ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

M.TECH

WIRELESS AND MOBILE COMMUNICATIONS

(WMC)

(APPLICABLE FOR THE BATCHES ADMITTED FROM 2018-2019)

Department of Electronics & Telematics Engineering

G. Narayanamma Institute of Technology & Science (for Women)
(Autonomous)
Shaikpet, Hyderabad - 500104, Telangana State

G. NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE

(For Women)

(AUTONOMOUS)

Shaikpet, Hyderabad– 500104

ACADEMIC REGULATIONS 2018

for CBCS Based M.Tech. Degree Course (Regular/Full Time PG Programme)

(Effective for the students admitted into I year from the Academic Year **2018-19** and onwards)

1.0 Post-Graduate Degree Course (PGDC) in Engineering & Technology (E & T)

G. Narayanamma Institute of Technology & Science (GNITS) - for Women, Hyderabad, affiliated to Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, offers 2 Year (4 Semesters) Master of Technology (M. Tech.) Degree Course under Choice Based Credit System (CBCS), with effect from the Academic Year 2018 - 19 onwards in the following Branches of Engineering & Technology with the Specializations as listed below :

S.No.	***Branch/ Department***	***Specialization***
I.	Computer Science & Engineering	Computer Science & Engineering
II.	Electrical & Electronics Engineering	Power Electronics & Electric Drives
III.	Electronics & Communication Engineering	Digital Electronics & Communication Engineering
IV.	Electronics & Telematics Engineering	Wireless & Mobile Communications
V.	Information Technology	Computer Networks & Information Security

2.0 Eligibility for Admission

2.1 Admission to the **PGDC** shall be made either on the basis of - the Rank/Percentile earned by the candidate in the relevant qualifying GATE Examination, OR the Merit Rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (PGECET) for M.Tech. Programmes, OR an Entrance Test conducted by the Jawaharlal Nehru Technological University Hyderabad, OR on the basis of any other order of merit approved by the University, subject to the reservations as prescribed by the Government from time to time.

2.2 The medium of instruction for all the PG Programmes shall be ENGLISH only.

3.0 M.Tech. Degree Course Structure

3.1 All M.Tech. Programmes at GNITS are of the Semester Pattern with 4 Semesters constituting 2 Academic Years, and each Academic Year has TWO Semesters

(First/Odd and Second/Even Semesters). Each Semester shall be of 22 Weeks duration (inclusive of Examinations) with a minimum of 90 Instructional Days per Semester.

3.2 UGC/ AICTE specified Definitions/ Descriptions are adopted appropriately for the various terms and abbreviations used in this PGDC - Academic Regulations/Norms.

3.2.1 Semester Scheme:

Each M.Tech Degree Course is of 2 Academic Years (4 Semesters) with each academic year divided into two Semesters of ~ 22 weeks (≥ 90 working days) each, and each semester has - 'Continuous Internal Evaluation' (CIE) and 'End Semester Examination' or 'Semester End Examination' (SEE). Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted and suggested by UGC and AICTE are taken as 'references' for the present set of Regulations. The terms 'SUBJECT' or 'COURSE' imply the same meaning here, and refer to 'Theory Subject', or 'Lab/Practical Course', or 'Design/ Drawing Subject', or 'Elective (Program Specific Elective/ Open Elective)', or 'Mini-Project with Seminar', or 'Project', or 'Audit Course' as the case may be.

3.2.2 Credit Courses:

All the Subjects/Courses are to be registered by a student in a semester to earn Credits. Credits shall be assigned to each Subject/ Course in a **L: T: P: C** (**L**ecture Periods: **T**utorial Periods: **P**racticals Periods : **C**redits) Structure, based on the following general pattern:

- One Credit - for One hour/ Week/ Semester for Theory/ Lecture (L) Courses, and Tutorials (T); and,
- One Credit - for Two hours/ Week/ Semester for Laboratory/ Practical (P) Courses.
- Student activity courses like NCC, NSS, NSO, and other Courses identified as Audit Courses shall not carry Credits.

3.2.3 Subject/ Course Classification :

All Subjects/ Courses offered for the PGDC are broadly classified as:

(a) Core Courses (CoC), and
(b) Elective Courses (Elc)

- Core Courses (CoC) and Elective Courses (Elc) are categorized as PS (Professional Subjects), which are further subdivided as –
  (i) PC (Professional/ Departmental Core) Courses
  (ii) PE (Program Specific Elective) Courses
  (iii) OE (Open Elective) Courses; and
  (iv) Project Works (PW);
- Specific prescribed Course by AICTE Model Curriculum (on "Research Methodology & IPR").
- Audit Courses (as listed by AITCTE Model Curriculum).

3.2.4 Course Nomenclature :

The Curriculum Nomenclature and Course Structure grouping for GNITS M.Tech. Degree Programmes are as listed below:

S. No.	*Broad Course Classification*	*Course Group/ Category*	*Courses Description*	*Credits*
1)	**Core Courses (CoC)**	**PC - Professional Core**	Includes Core subjects related to the Parent Department/ Branch of Engg.	**20**
2)	**Elective Courses (EℓC)**	**PE – Program Specific Elective**	Includes Elective subjects related to the Parent Department/ Branch of Engg.	**15**
3)		**OE - Open Elective**	Elective Courses which include subjects from other technical and/or Emerging Areas	**3**
4)	**Project Related Courses**	**PW - Project Work**	M.Tech. Project or PG Project or PG Major Project (Phase-I and Phase-II)	**26**
		Mini-Project with Seminar (MPS)	Seminar based on core contents related to the Parent Department/ Branch of Engg. in identified specialization	**2**
5)	Prescribed Course	**AICTE Model Curriculum 2018**	Research Methodology & IPR	**2**
6)	Audit Courses	**AICTE Model Curriculum 2018**	Inclusive of AICTE Suggested List	**No Credits**
Total Credits for PGDC				**68**

4.0 Course Work

4.1 A student after securing admission, shall pursue and complete the M.Tech. Degree Course in a minimum period of 2 Academic Years (4 Semesters), and/or within a maximum period of 4 Academic Years (starting from the Date of Commencement of I Year).

4.2 Each student shall register for and secure the specified number of Credits required for the completion of the PG Degree Course and Award of the M.Tech. Degree in the respective Branch of Engineering with the chosen Specialization.

4.3 The I Year is structured to provide typically 18 Credits in each of the I and II Semesters, and II Year comprises of 16 Credits in each of the I and II semesters , totaling to 68 Credits for the entire M.Tech. Programme.

5.0 Course Registration

5.1 A 'Faculty Advisor' shall be assigned to each M.Tech. Degree Course student with respective Specialization, and the Faculty Advisor assigned shall advise/counsel the student about the M.Tech. Programme Specialization, its Course Structure and

Curriculum, Choice/ Option for Subjects/ Courses, based on the competence, progress, pre-requisites and interest of the student.

5.2 The Academic/Examination Section of the College invites 'Registration Forms' from the students apriori (before the beginning of the Semester) through 'ONLINE SUBMISSIONS' ensuring 'DATE and TIME Stamping'. The ONLINE Registration Requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

5.3 A student can apply for ONLINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from her assigned Faculty Advisor, which should be submitted to the College Academic/Examination Section through the Head of the Department (a copy of the same being retained with the Head, Faculty Advisor and the Student).

5.4 A student shall Register for Subjects/Courses of 'her CHOICE' with a total of 18 Credits per semester in the I Year as structured in the Course Curriculum, which will be treated as the Minimum Work Load; she may also seek registration for a maximum of 3 additional/extra credits from those specified for the II Year I Semester (Maximum Work Load thus limited to 21 C) based on her interest, competence, progress, and 'pre-requisites' as indicated for various Subjects/ Courses in the Department Course Structure (for the relevant Specialization) and the Syllabus contents for various Subjects/ Courses, as applicable. All the remaining Credits shall be registered in the II Year-I and II Semesters.

5.5 The choice for the 'Additional Subjects/ Courses' in the I Year (in any semester, above the typical 18 Credit norm, and within the Maximum Permissible Limit of 21 Credits, as applicable) must be indicated clearly in the ONLINE Registration, which needs the specific approval and the signature of the Faculty Advisor/Counsellor assigned and the Head of the Department on the hard-copy.

5.6 If the student submits ambiguous choices or multiple options or erroneous entries during ONLINE Registration for the Subject(s)/Course(s) under a given/specified Course Group/Category as listed in the Course Structure for that particular PGDC Specialization, ONLY the first mentioned Subject/Course in that Category will be taken into consideration, as applicable.

5.7 The Subject/Course Options exercised through ONLINE Registration are final and CANNOT be changed, and CANNOT be inter-changed; further, alternate choices shall also not be considered. However, if the Subject/Course that has already been listed for Registration (by the Head of Department) in a semester could not be offered due to any unforeseen or unexpected reasons, then the student may be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements shall be made by the Head of the Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that semester.

5.8 The Dropping of Subjects/ Courses in any semester of the I Year may be permitted, ONLY AFTER obtaining prior approval and signature from the Faculty Advisor (subject to retaining the minimum of specified 18 Credits) 'within 15 Days of Time' from the beginning of the current semester.

6.0 Class Strength

6.1 The typical student strength for each semester shall be 18 (or as per JNTUH / AICTE Approved Intake).

6.2 A Subject/Course may be offered to the students, ONLY IF a minimum of 50% of the students of a PG Specialization opt for the same.

6.3 In case of the options for Subjects/Courses coming from students of other Departments/Branches/Disciplines also, PRIORITY shall be given to the student of the 'Parent Department' first.

7.0 Attendance Requirements

7.1 A student shall be eligible to appear for the Semester End Examination (SEE) of any subject, if she acquires a minimum of 75% of attendance in that Subject for that semester.

7.2 The condoning of shortage of attendance up to 10% in each Subject (for 65% and above, and below 75% attendance cases) of a semester may be granted by the College Academic Committee (CAC) on genuine and valid grounds based on the student's representation with supporting evidence.

7.3 A stipulated fee per Subject/Course shall be payable towards condoning of shortage of attendance.

7.4 The Shortage of Attendance below 65% in any Subject shall in NO case be condoned.

7.5 A student, whose shortage of attendance is not condoned in any Subject(s) in any semester, is considered as 'Detained Student in that Subject(s)', and is not eligible to take End Examination(s) in the Subject(s) detained in that semester; and she has to seek Re-registration for those Subject(s) in subsequent semesters, and attend the same as and when offered.

7.6 Every student shall put in the minimum required attendance (as specified in Clauses 7.1-7.3) in at least 3 theory subjects and 2 lab courses – (i) in I Year I Semester, for promotion to I Year II Semester, and similarly - (ii) in I Year II Semester along with the 'Mini-Project with Seminar', for promotion to II Year I Semester.

7.7 A student shall not be promoted to the next semester unless she satisfies the attendance requirements of the present semester, as applicable. In such cases, she may seek readmission into that semester (and register for all semester subjects), as and when offered. When she fulfils the attendance requirements in the present semester, she shall not be eligible for readmission (or re-register) into the same class/semester again.

8.0 Academic Requirements

The following Academic Requirements have to be satisfied, in addition to the Attendance Requirements mentioned in Clause 7.0:

8.1 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if she secures not less than 40% marks (28 out of 70 marks) in the Semester End Examination (SEE), and a minimum of 50% of marks (50 out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing **'C'** Grade or above in that Subject.

8.2 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to - Mini-Project with Seminar (MPS), in I year II semester if she secures not less than 50% of the total marks allocated. The student would be

treated as failed, if she - (i) does not execute the Mini-Project (and prepare the report) as specified by the Supervisor, or (ii) does not present the Seminar as required, or (iii) secures less than 50% of Marks (< 50 marks) in evaluation. She may have to reappear for the 'Mini-Project with Seminar' evaluation, when it is re-scheduled again in that semester; if she fails in such 'one reappearance' evaluation also, she has to reappear for the same in the next subsequent semester(s), as and when scheduled, as supplementary candidate.

8.3 A student shall register for all Subjects covering 68 Credits as specified and listed in the Course Structure for the chosen M.Tech. Degree Specialization, put up all the Attendance and Academic requirements for securing 68 Credits obtaining a minimum of C Grade or above in each Subject, and 'earn all 68 Credits securing SGPA ≥ 5.0 (in each semester) and final CGPA (i.e., CGPA at the end of PGDC is to be ≥ 5.0), to successfully complete the PGDC.

8.4 The Marks and the Letter Grades obtained in all those Subjects covering the specified 68 Credits alone shall be considered for the calculation of final CGPA, which shall be indicated in the Grade Card of the II Year II Semester.

8.5 If a student registers for few more 'extra Subjects' (in the parent Department or other Departments/Branches of Engg.) other than those listed Subjects totalling to 68 Credits as specified in the Course Structure, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required 68 Credits) shall not be taken into account while calculating the SGPA and CGPA. For such 'extra Subjects' registered, the Letter Grade alone shall be indicated in the Grade Card as a performance measure, subject to the completion of the Attendance and Academic Requirements as stated in Clauses 7.0 and 8.1 – 8.4 above.

8.6 A student who fails to earn 68 Credits as per the specified Course Structure, and as indicated in Clauses 8.1- 8.5, within 4 Academic Years from the Date of Commencement of her I Year, shall forfeit her seat in M.Tech. Programme and her admission shall stand cancelled.

8.7 When a student is detained due to the shortage of attendance in any Subject(s) in any semester, no Grade Allotment shall be done for such Subject(s), and SGPA/ CGPA calculations of that semester shall not include the performance evaluations of such Subject(s) in which she gets detained. However, she becomes eligible for re-registration of such Subject(s) (in which she gets detained) in the subsequent semester(s), as and when offered next, with the Academic Regulations of the Batch into which she gets readmitted, by paying the stipulated fees per Subject to the College. In all these re-registration cases, the student shall have to secure a fresh set of Internal Marks (CIE) and Semester End Examination Marks (SEE) for performance evaluation in such Subject(s), and subsequent SGPA/ CGPA calculations.

8.8 A student eligible to appear for the Semester End Examination (SEE) in any Subject, but is absent at it or failed (failing to secure C Grade or above), may reappear for that Subject at the supplementary examination (Supplementary SEE) as and when conducted. In such cases, her Internal Marks (CIE) assessed earlier for that Subject/ Course shall be retained and added to the marks to be obtained in the supplementary examination (Supplementary SEE) for the evaluation of her performance in that Subject.

9.0 Evaluation - Distribution and Weightage of Marks

9.1 The performance of a student in each semester shall be evaluated Subject-wise (irrespective of the Credits assigned) with a maximum of 100 marks for the Theory or Practicals or Mini-Project with Seminar or Drawing/Design etc; further, Phase-I and Phase-II of the M.Tech. Project Work (in II Year I and II semesters) shall also be evaluated for 100 marks each. These evaluations shall be based on 30% CIE and 70% SEE, and a Letter Grade corresponding to the % of marks obtained shall be given.

9.2 For all the Subjects/ Courses as mentioned in 9.1**,** the distribution shall be: 30 marks for CIE (Continuous Internal Evaluation), and 70 marks for the SEE (Semester End Examination).

9.3 **a)** For the Theory Subjects, the CIE marks shall comprise of - Mid-Term Examination marks (for 30 Marks).

b)During the semester, there shall be 2 Mid-Term examinations. Each Mid-Term examination shall be for 30 marks (with 120 minutes duration), and the question paper shall contain 2 parts, Part-A is for 06 Marks and shall contain 3 short answer questions of 02 marks each and Part-B is for 24 Marks and shall contain 5 questions of 8 Marks each out of which 3 questions are to be answered. The first Mid-Term examination shall be conducted at the middle of the semester for the first 50% of the syllabus and the second Mid-Term examination shall be conducted at the end of the semester, immediately after the completion of the class work, for the remaining 50% of the syllabus; each shall be evaluated for 30 marks.

c) The first mid-term examination marks, shall make the first set of CIE marks, and the second mid-term examination marks shall make the second set of CIE marks; and the AVERAGE of the two sets of mid-term examination marks shall be taken as the final marks secured by the student towards Continuous Internal Evaluation (CIE) in that Theory Subject.

9.4 For the Lab./Practical Subjects, there shall be a Continuous Internal Evaluation (CIE) during the semester for 30 marks, and Semester End Examination (SEE) at the end of the semester for 70 marks. Out of the 30 marks for Internals, day-to-day work assessment in the laboratory shall be evaluated for 20 marks; and the performance in an internal Lab./Practical Test shall be evaluated for 10 marks. The Semester End Examination (SEE) for Lab./ Practicals shall be conducted at the end of the semester by the Lab. Teacher concerned and another faculty member of the same Department as assigned by the Head of the Department.

9.5 **a)** There shall be a Mini-Project, preferably in collaboration with an Industry with the relevant specialization to be registered and executed during the I Year II Semester, for about sixteen weeks duration. It shall also carry 100 marks, out of which CIE shall be for 30 marks, and SEE shall be for 70 marks. Marks earned under CIE for the 'Mini-Project with Seminar' shall be awarded by the Mini-Project Guide/Supervisor (based on the continuous evaluation of student's performance during the Mini-Project execution period).

b) The Mini-Project work shall be submitted in a Technical Report form, and a presentation of the same shall be made before a Committee as a Seminar, and the 'Mini-Project with Seminar' shall be evaluated by the committee for 70 Marks (SEE). The Committee shall consist of the Head of the Department, the Supervisor of Mini-Project, and a Senior Faculty Member of the Department. Performance evaluation of the 'Mini-Project with Seminar' shall be included in the I Year II Semester Grade Card.

9.6 **Electives:** 5 Program Specific Elective Courses and 1 Open Elective Course are offered in the 4 Semester PG Degree Course at GNITS, as per AICTE Model Curriculum. Students are to choose each Elective Course from the corresponding Set of Electives given, and the evaluation of the Elective Course shall be the same as that for the Theory Course/Subject.

9.7 Every student shall be required to execute her M.Tech. Project under the guidance of the Supervisor assigned to her by the Head of the Department, and shall submit her dissertation on a topic relevant to her PG specialization.

a) The M.Tech. Project shall start immediately after the completion of the I Year II Semester, and shall be divided and carried out in 2 phases : Phase–I during II Year I Semester, and Phase–II during II Year II Semester. The student shall prepare and submit two independent Project Work Reports - Project Work Report-I shall include the Project Work carried out under Phase–I, and the Project Work Report-II (Final Report) shall include the Project Work carried out under Phase–I and Phase–II put together.

b) In Phase-I of the Project Work, the student shall carry out the literature survey, select an appropriate topic and submit a Project Proposal within 6 weeks (immediately after her I Year II Semester End Examinations), for approval by the Project Review Committee (PRC). The PRC shall be constituted by the Head of the Department, and shall consist of the Head of the Department, Project Supervisor, and a Senior Faculty Member of the Department. The student shall present her Project Work Proposal to the PRC (PRC-I Presentation), on whose approval she can 'REGISTER for the M.Tech Project'. Every student shall compulsorily register for her M.Tech. Project Work, preferably within the 6 weeks of time-frame as specified.

c) After the Registration, the student shall carry out the work, and periodically submit 'a periodic progress report' to her Supervisor throughout the Project period. The PRC shall monitor the progress of the Project Work and review, based on the PRC-II and PRC-III presentations and performance evaluations – the first one at the middle of the II Year I Semester, and the second one at the end of the II Year I Semester (before the I Semester End Examinations). The student shall also submit the Project Work Report-I to the PRC at PRC-III, for the PRC-III considerations and evaluations.

d) 100 marks are allocated for each Phase (Phase-I and Phase-II) of the Project Work, out of which 30 marks shall be for CIE (Continuous Internal Evaluation/CIE), and 70 Marks will be for SEE (Semester End viva-voce Examination).

e) The marks earned under CIE for the Phase-I of the Project shall be awarded by the Project Guide/Supervisor (based on the continuous evaluation of student's performance, all her PRC presentations during the Project Work Phase-I period and Project Work Report-I). For SEE marks of Project Phase-I, the Project Work Report-I shall be examined, and viva-voce shall be conducted at the end of the II Year I Semester (along with PRC-III) by the PRC, and the corresponding SEE marks shall be awarded.

f) The Phase-II of the Project shall be carried out in the II Year II Semester, and the student's progress and performance evaluation shall be carried out through PRC-IV (at the middle of the II semester), and PRC-V (at the end of the II semester) presentations. The student shall submit the Project Work Report-II (Final Project Report or Dissertation Draft Copy) to the PRC at PRC-V, for the PRC-V considerations and evaluations. Marks earned under CIE for Phase-II of the Project shall be awarded by the Project Guide/Supervisor (based on the continuous evaluation of student's performance, all her PRC presentations during the Project Work Phase-II period and

Project Work Report-II). Marks earned under SEE for Phase-II Work shall be awarded by the External Examiner, after the evaluation of the M.Tech. dissertation and the final viva-voce examination of the M.Tech. Project work.

g) After the PRC-V presentation, the PRC shall evaluate the entire performance of the student and declare the Project Work as 'Satisfactory' or 'Unsatisfactory'. Every Final Project Work Report (that has been declared 'satisfactory') shall undergo 'Plagiarism Check' as per the University/ College norms to ensure the content plagiarism below a specified level of 30%, and to be acceptable for submission. In case of the unacceptable plagiarism levels, the student shall resubmit the Modified Project Work Report/Dissertation after carrying out the necessary modifications/additions to her Project Work/Report as suggested by the PRC within the specified time.

h) If any student could not be present for any PRC at the scheduled time (after approval and registration of her Project Work at the PRC-I), or her progress is considered as 'not satisfactory' at any scheduled PRC, she will have to reappear (within one month period) for the same PRC presentation and evaluation at a later date/time as suggested by the PRC.

i) A student is allowed to submit her M.Tech. Project Dissertation 'only after the completion of 40 weeks from the date of approval/registration' of her Project, and after obtaining all the approvals from the PRC. The Extension of time, within the total permissible limits of completion of the PGDC may be considered by the PRC on sufficient valid, genuine grounds.

j) The student shall be allowed to submit her M.Tech. Project Dissertation, only on the successful completion of all the prescribed PG Subjects (Theory and Labs.), Mini-Project with Seminar, etc. (securing C Grade or above), and after obtaining all approvals from PRC. In such cases, the M.Tech. dissertation will be sent to an External Examiner nominated by the Principal of the College, from the panel of 3 names of external faculty members (Professors or Associate Professors, outside the college) suggested by the Head of Department, on whose approval, the student can appear for the M.Tech. Project viva-voce Examination, which shall be conducted by a Board, consisting of the PG Project Supervisor, Head of the Department, and the External Examiner who adjudicated the M.Tech. Project Work and Dissertation. The Board shall jointly declare the Project Work Performance as 'satisfactory', or 'unsatisfactory'; and in successful cases, the External Examiner shall evaluate the Student's Project Work presentation and performance for 70 Marks (SEE).

k) If the adjudication report of the External Examiner is 'not favourable' , then the student shall revise and resubmit her M.Tech Dissertation after one semester, or as per the time specified by the External Examiner and/ or the PRC. If the resubmitted report is again evaluated by the External Examiner as 'not favourable', then that Dissertation will be summarily rejected. Subsequent actions for such rejected dissertations may be considered, only on the specific recommendations of the External Examiner and/ or PRC.

l) In cases, where the Board declared the Project Work Performance as 'unsatisfactory', the student is deemed to have failed in the Project viva-voce Examination, and she may reappear for the viva-voce Examination as per the Board's recommendations. If she fails in the second viva-voce Examination also, she shall not be considered eligible for the Award of the Degree, unless she is asked to revise and resubmit her Project Work by the Board within a specified time period (within 4 years from the date of commencement of her I Year I Semester).

10.0 Re-Admission / Re-Registration

10.1 Re-Admission for Discontinued Students :

The student who has discontinued the M.Tech. Degree Programme on account of any reasons whatsoever, may be considered for 'Readmission' into the same Degree Programme (with same specialization) with the Academic Regulations of the Batch into which she get readmitted, with prior permission from the authorities concerned, subject to Clause 4.1.

10.2 Re-Registration for Detained Students :

When any student is detained in a Subject(s) on account of the shortage of attendance in any semester, she may be permitted to re-register for the same Subject(s) in the 'same category' (Core or Elective Group) or equivalent Subject(s) if the same Subject is not available, as suggested by the BoS Chair of that Department, as and when offered in the sub-sequent semester(s), with the Academic Regulations of the Batch into which she seeks re-registration , with prior permission from the authorities concerned, subject to Clause 4.1.

11.0 Grading Procedure

11.1 The marks shall be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Mini-Project with Seminar, or Project etc., and based on the % of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Clause 9.0, a corresponding Letter Grade shall be given.

11.2 A Letter Grade does not imply any specific % of marks.

11.3 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured (Class Intervals)	*Letter Grade (UGC Guidelines)*	*Grade Points (GP)*
90% and above (≥ 90% , ≤ 100%)	**O (Outstanding)**	**10**
Below 90% but not less than 80% (≥ 80% , < 90%)	**A^+ (Excellent)**	**9**
Below 80% but not less than 70% (≥ 70% , < 80%)	**A (Very Good)**	**8**
Below 70% but not less than 60% (≥ 60% , < 70%)	**B^+ (Good)**	**7**
Below 60% but not less than 55% (≥ 55% , < 60%)	**B (above Average)**	**6**
Below 55% but not less than 50% (≥ 50% , < 55%)	**C (Average)**	**5**
Below 50% (< 50%)	**F (FAIL)**	**0**

11.4 A student obtaining F Grade in any Subject shall be considered 'failed', and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination

(SEE), in the subsequent semesters, as and when offered. In such cases, her Internal marks (CIE marks) in those Subject(s) will remain same as those she obtained earlier.

11.5 In general, a student shall not be permitted to repeat any Subject(s) with the sole intention of 'Grade Improvement' or 'SGPA/ CGPA Improvement'. However, she has to repeat all those Subject(s), in which she gets 'detained due to lack of required attendance' (as listed in Clauses 8.7 and 10.2), through Re-Registration at a later date.

11.6 A student earns Grade Points (GP) in each Subject on the basis of the Letter Grade obtained by her in that Subject. Then, the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Points with Credits for that particular Subject/Project.

Credit Points (CP) = Grade Points (GP) x Credits

11.7 The student passes the Subject/Project only when she gets GP ≥ 5 (C Grade or above).

11.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from ALL the Subjects/ Seminar/ Comprehensive Viva-voce/Project registered in a Semester by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as:

SGPA $= \{ \sum_{i=1}^{N} C_i G_i \} / \{ \sum_{i=1}^{N} C_i \}$ **.... For each semester,**

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the no. of Subjects 'REGISTERED' for the Semester, C_i is the no. of Credits allotted to the ith Subject, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that ith Subject.

11.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the Second Semester onwards, at the end of each Semester, as per the formula:

CGPA $= \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \}$ **.... For all S Semesters registered**

(ie., upto and inclusive of S semesters, S ≥ 2),

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of that PGDC Specialization) the student has 'REGISTERED' from the 1st Semester onwards up to and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_j is the no. of Credits allotted to the jth Subject, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Subject. After Registration and completion of the I Year I Semester however, the SGPA of that Semester itself may be taken as CGPA, as there are no cumulative effects.

11.10 For the Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs shall be used.

11.11 For the calculations listed in Clauses 11.6 – 11.10, performance in the failed Subjects/ Courses (securing F Grade) shall also be taken into account, and the Credits of such Subjects/Courses shall also be included in the multiplications and summations.

11.12 Passing Standards :

a) A Student shall be declared successful or 'passed' in a semester, only when she gets a SGPA ≥ 5.00 (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire PGDC, only when she gets a CGPA ≥ 5.00; subject to the condition that she secures a GP ≥ 5 (C Grade or above) in every registered Subject/ Course in each semester (during the entire PGDC), for the Award of the Degree, as required.

b) After the completion of each semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the registered students of that semester, indicating the Letter Grades and the Credits earned. The Grade Card/Grade Sheet shall show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned), Credits earned, SGPA, and CGPA etc.

12.0 Declaration of Results

12.1 The Computation of SGPA and CGPA are done using the procedure listed in Clauses 11.6 – 11.11.

12.2 For the Final % of Marks equivalent to the computed CGPA, the following formula may be used

% of Marks = CGPA x 10

13.0 Award of Degree

13.1 A student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes all the examinations prescribed in the entire M.Tech. Programme (PGDC), and secures the required number of 68 Credits (with CGPA ≥ 5.0), within the 4 Academic Years from the Date of Commencement of the First Academic Year, shall be declared to have 'QUALIFIED' for the Award of the M.Tech. Degree in the chosen Branch of Engineering, with the Specialization considered at the time of Admission.

13.2 A student who qualifies for the Award of the M.Tech. Degree (in her chosen Branch/ Specialization) as listed in Clause 13.1, shall be placed in the following Class Divisions:

13.3 **a)** A student with CGPA (at the end of the PG Degree Course) ≥ 8.00, and fulfilling the following conditions -

(i) should have passed all the Subjects/Courses in 'FIRST APPEARANCE' within the first 2 Academic Years (or 4 Sequential Semesters) from the Date of Commencement of her First Academic Year,

(ii) should have secured a CGPA ≥ 8.00, at the end of each of the first 4 sequential semesters, starting from the I Year I Semester onwards,

(iii) should not have been detained or prevented from writing the End Semester Examinations in any Semester due to the shortage of attendance or any other reason

shall be placed in 'FIRST CLASS with DISTINCTION'.

b) A student with CGPA ≥ 8.00 , but has not fulfilled the conditions under Clause 13.3 (a) shall be placed in 'FIRST CLASS'.

13.4 A student with CGPA (at the end of the PG Degree Course) ≥ 6.50 but < 8.00, shall be placed in 'FIRST CLASS'.

13.5 A student with CGPA (at the end of the PG Degree Course) ≥ 5.00 but < 6.50, shall be placed in 'SECOND CLASS'.

13.6 A student with CGPA (at the end of the PG Degree Course) < 5.00 will not be eligible for the Award of the Degree.

13.7 A student fulfilling the conditions listed under Clause 13.3 (a) alone, shall be the eligible candidate for the 'University Rank' and 'Gold Medal' considerations.

14.0 Withholding of Results

14.1 If a student has not paid fees to the University/ College at any stage, or has pending dues against her name on account of any reason whatsoever, or if any case of indiscipline is pending against her, the result of such student may be withheld, and she shall not be allowed to into the next higher semester. The Award or issue of the Degree may also be withheld in such cases.

15.0 Transitory Regulations

15.1 A student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed in her M.Tech. Degree Course after the PGDC period of 2 years, may be considered eligible for readmission - to the same PGDC with same set of Subjects/ Courses (or equivalent Subjects/ Courses as the case may be), and/or to the same Program Specific Electives (or from same set/category of Electives or equivalents as suggested), as and when they are offered (within the time-frame of 4 years from the Date of Commencement of her I Year I Semester), along with the Academic Regulations of the Batch into which she gets readmitted.

16.0 Student Transfers

16.1 There shall be no Branch/ Specialization transfers after the completion of the Admission Process.

17.0 Scope

i) Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".

ii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.

iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

iv) The College may change or amend the Academic Regulations, Course Structure or Syllabi at any time, and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the College Authorities.

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MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled and sent to the university.

3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/assistant superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to police and, a police case will be registered against them.

10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Principal for further action to award suitable punishment.	

G.NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE (FOR WOMEN)
(AUTONOMOUS)
SHAIKPET, HYDERABAD-500104
M. TECH 2 YEAR (4 SEMESTERS) REGULAR PROGRAMME IN
WIRELESS AND MOBILE COMMUNICATIONS
COURSE STRUCTURE
(APPLICABLE FOR THE BATCH ADMITTED FROM THE ACADEMIC YEAR 2018-2019 ONWARDS)

I Year **I Semester**

S.No	Group	Name of the Subject	L	T	P	C
1.	PC 1	Wireless and Mobile Communications	3	-	-	3
2.	PC 2	Adhoc Wireless Networks	3	-	-	3
3.	PSE 1	Internetworking with TCP/IP Detection & Estimation Theory Antenna Theory & Design	3	-	-	3
4.	PSE 2	Coding Theory and Techniques Mobile Computing Wireless LANS & PANS	3	-	-	3
5.	PCL 1	Wireless and Mobile Communications Lab	-	-	4	2
6.	PCL 2	Adhoc Wireless Networks Lab	-	-	4	2
7.	PW	Research Methodology and IPR	2	-	-	2
8.	AC 1	Audit Course - 1	2	-	-	0
		Total	**16**	**-**	**8**	**18**

I Year **II Semester**

S.No	Group	Name of the Subject	L	T	P	C
1.	PC 3	Advanced Communications Systems	3	-	-	3
2.	PC 4	Wireless Sensor Networks	3	-	-	3
3.	PSE 3	Digital Image & Video Processing Network Security & Cryptography MIMO Systems	3	-	-	3
4.	PSE 4	Cognitive Radio 4G Technologies Advanced Digital Signal Processing	3	-	-	3
5.	PCL 3	Advanced Communications Systems Lab	-	-	4	2
6.	PCL 4	Wireless Sensor Networks Lab	-	-	4	2
7.	PW	Mini Project	-	-	4	2
8.	AC 2	Audit Course - 2	2	-	-	-
		Total	**14**	**-**	**12**	**18**

G.NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE (FOR WOMEN)
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SHAIKPET, HYDERABAD-500104
M. TECH 2 YEAR (4 SEMESTERS) REGULAR PROGRAMME IN
WIRELESS AND MOBILE COMMUNICATIONS (ETE)
COURSE STRUCTURE
(APPLICABLE FOR THE BATCH ADMITTED FROM THE ACADEMIC YEAR 2018-2019 ONWARDS)

II Year **I Semester**

S.No	Group	Name of the Subject	L	T	P	C
1.	PSE 5	Voice over Internet Protocol Multimedia Communications Microcontroller & Embedded System Design	3	-	-	3
2.	OE	Open Elective	3	-	-	3
3	PW	Project/ Dissertation Phase – I	-	-	20	10
		Total	**6**	**-**	**20**	**16**

II Year **II Semester**

S.No	Group	Name of the Subject	L	T	P	C
1.	PW	Project/ Dissertation Phase - II	-	-	32	16
		Total	**-**	**-**	**32**	**16**

Total 68 Credits

Audit Courses:

S.No	Group	Name of the Subject	L	T	P	C
1	AC 1	English for Research paper Writing	2	-	-	-
2	AC 1	Disaster management	2	-	-	-
3	AC 1	Personality Development through Life Enlightenment Skills	2	-	-	-
4	AC 1	Pedagogy Studies	2	-	-	-
5	AC 2	Sanskrit for Technical Knowledge	2	-	-	-
6	AC 2	Value Education	2	-	-	-
7	AC 2	Constitution of India	2	-	-	-
8	AC 2	Stress Management by YOGA	2	-	-	-

Open Electives:

S.No	Group	Name of the Subject	L	T	P	C
1	OE	Business Analytics	3	-	-	3
2	OE	Industrial Safety	3	-	-	3
3	OE	Operations Research	3	-	-	3
4	OE	Cost Management of Engg. Projects	3	-	-	3
5	OE	Composite Materials	3	-	-	3
6	OE	Energy from Waste	3	-	-	3
7	OE	Power from Renewable Energy sources	3	-	-	3

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WIRELESS AND MOBILE COMMUNICATIONS (Under ETE)

M. Tech. I Year, I Sem.	**L**	**T**	**P**	**C**
	3	**-**	**-**	**3**

WIRELESS AND MOBILE COMMUNICATIONS (PC 1)
(Common to DECE, WMC)

Prerequisite: 1. Wireless Communication 2. Cellular Mobile Communication.

Course objectives:

1. To analyze wireless and mobile Cellular Communication systems over a stochastic fading channel.
2. To impart the concepts of Multiple Access Techniques.
3. To analyze the concepts of Mobile Radio Propagation, fading and diversity reception techniques.
4. To provide the knowledge on digital cellular systems.

Syllabus Contents:

UNIT – 1(~11 Lecture Hours)
Cellular Communication Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and system capacity, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems–cell splitting, sectoring, Comparison of 1G, 2G, 3G & 4G.

UNIT– 2 (~10 Lecture Hours)
Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Outdoor Propagation Models-Okumura model, HATA model, Indoor Propagation Models-partition losses (same floor),partition losses between floors, Log distance path loss model, Ericsson multiple break point model, Attenuation factor model , Signal Penetration into Buildings.

UNIT – 3(~8 Lecture Hours)
Small Scale Fading and Multipath: Small scale multipath propagation, Impulse Response Model, small scale Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading.

UNIT– 4(~8 Lecture Hours)
Equalization: Fundamentals of Equalization, Training a Generic Adaptive Equalizer, Equalizers in a communications receiver, classification of equalization techniques. Linear Equalizers, Nonlinear Equalization, Algorithms for adaptive equalization.
Diversity: Diversity techniques, space, frequency diversity, Time Diversity, RAKE Receiver.

UNIT– 5 (~8 Lecture Hours)
Multiple Access Techniques: Introduction to multiple access, FDMA, TDMA and CDMA, and their comparison.

OFDM: Basic principles, Block diagram and Mathematical representation.
CDMA: CDMA Digital Cellular Standard (IS-95), Forward CDMA Channel, Reverse CDMA Channel.

TEXT BOOKS:

1. T. S. Rappaport, "Wireless Communications, Principles and Practice", 2nd Edition, PHI, 2010.
2. William C. Y. Lee ,"Mobile Cellular Telecommunications Analog and Digital Systems", 2ndEdition, TMH, 2006.
3. Upena Dalal, "Wireless Communication", Oxford University Press, 8th Impression, 2015.

REFERENCE BOOKS:

1. Kaveh Pahlaven and P. Krishna Murthy, "Principles of Wireless Networks", Pearson Education, 2006.
2. V. K. Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th Edition, 2008.
3. V. K. Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th Edition, 2009.
4. Asha Mehrotra, "A GSM system Engineering", Artech House Publishers Bosten, London,1997.
5. Mischa Schwartz, "Mobile Wireless Communications", Cambridge university press, 2013.

ONLINE RESORCES:

1. http://nptel.ac.in/courses/117104099/
2. http://nptel.ac.in/courses/117102062/

Course Outcomes:
At the end of this course, students will be able to
1. Design appropriate mobile communication systems.
2. Apply frequency-reuse concept in mobile communications.
3. Distinguish various multiple-access techniques of mobile communications.
4. Analyze path loss, interference for wireless telephony in mobile communication system.
5. Analyze CDMA system concepts.
6. Comprehend the concepts on fading, diversity and equalization.

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M. Tech. I Year, I Sem.	**L**	**T**	**P**	**C**
	3	**-**	**-**	**3**

ADHOC WIRELESS NETWORKS (PC 2)

Prerequisites: Computer Networks.

Course Objectives:

1. To provide the knowledge on various concepts related to WLANS and PANS
2. To give an overview of the designing issues of MAC, Routing and Transport protocols of Adhoc Networks
3. To provide in depth analysis of various MAC, Routing and Transport protocols and their performance evaluation.
4. To inculcate regarding the security issues in Adhoc networks.
5. To enable the students to understand regarding Quality of Service in Adhoc networks.

Syllabus

UNIT –1:(~10 Lecture Hours)
Wireless LANs and PANs :Wireless Local Area Networks : Introduction, wireless LAN Topologies, Wireless LAN Requirements, Physical Layer- Infrared Physical Layer, Microwave based Physical Layer Alternatives, Medium Access Control Layer- HIPERLAN 1 Sublayer, IEEE 802.11 MAC Sublayer and Latest Developments-802.11a, 802.11b, 802.11g.
Personal Area Networks: Introduction to PAN technology and Applications, Bluetooth - specifications, Radio Channel, Piconets and Scatternets, Inquiry, Paging and Link Establishment, Packet Format, Link Types, Power Management, Security, Home RF - Physical and MAC Layer.

UNIT – 2: (~10 Lecture Hours)
Medium Access Control Protocols: Introduction; Issues in Designing a MAC protocol: Design goals of a MAC protocol; Classification of MAC protocols; Contention-based protocols: Contention-based protocols with reservation mechanisms; Contention-based MAC protocols with scheduling mechanisms; MAC protocols that use directional antennas, Other MAC protocols.

UNIT – 3: (~10 Lecture Hours)
Routing Protocols: Introduction, issues in designing a routing protocol for adhoc wireless networks, Classification of routing protocols, Table-driven protocols, On-demand routing protocols, Hybrid routing protocols, Routing protocols with efficient flooding mechanisms, Hierarchical routing protocols, Power-aware routing protocols.

UNIT – 4 : (~8 Lecture Hours)
Transport Layer and security protocols : Introduction to transport layer protocols, issues in designing a transport layer protocol for adhoc wireless networks, design goals

of transport layer protocol for adhoc wireless networks, Classification of transport layer solutions, TCP over adhoc wireless networks, other transport layer protocols for adhoc wireless networks. Security in adhoc wireless networks, network security requirements, issues and challenges in security provisioning, network security attacks.

UNIT -5:(~8 Lecture Hours)

Qos in Adhoc Wireless networks: Introduction, real time traffic support in adhoc wireless networks, quality of service parameters in adhoc wireless networks, issue and challenges in providing QoS in adhoc wireless networks,

Classification of QoS solutions: MAC layer solutions, Network layer solutions, QoS frameworks for adhoc wireless networks.

TEXT BOOKS:

1. C. Siva Ram Murthy, "Ad Hoc Wireless Networks", Pearson Education, 2004.
2. P Nicopolitidis and M. S. Obaidat, "Wireless Networks",Wiley India Edition , 2003.

REFERENCE BOOKS:

1. C. K. Toh, "Ad-Hoc Mobile Wireless Networks: Protocols and Systems", Pearson Education, 1st. Edn.
2. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks", World Scientific, 2011.
3. Kazen Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks", Wiley Student Edition, 1991.
4. C.S. Raghavendra, Krishna M. Siva Lingam, "Wireless Sensor Networks", Springer, 2004.
5. Jagannathan Sarangapani, "Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control", CRC Press.

ONLINE RESOURCES:

1. http://nptel.ac.in/syllabus/106105160/
2. http://www.cse.wustl.edu/~jain/

Course Outcomes:

At the end of the course, the students will be able to

1. Demonstrate knowledge on various concepts related to WLANs.
2. Acquaintance of knowledge regarding PANs.
3. Understand the designing issues of MAC, Routing and Transport protocols of Adhoc Networks.
4. Analyze various MAC, Routing and Transport protocols and their performance evaluation.
5. Familiarity with the security issues in Adhoc networks.
6. Understand regarding Quality of Service in Adhoc networks.

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WIRELESS AND MOBILE COMMUNICATIONS (Under ETE)

M. Tech. I Year, I Sem.	**L**	**T**	**P**	**C**
	3	**-**	**-**	**3**

INTERNETWORKING WITH TCP/IP (PSE1)

Prerequisites: Computer Networks.

Course Objectives:

1. Build an understanding of the fundamental concepts of computer networking.
2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
3. Introduce the student to advanced networking concepts
4. Allow the student to gain expertise in some specific areas of networking such as the messages getting exchanged at several layers of network.

Syllabus

UNIT – 1: (~8 Lecture Hours)
Overview of the Internet: Introduction, The OSI model and TCP/IP Protocol suite.
Physical Layer: Guided transmission media, Wireless transmission media.
Underlying Technologies: Wired LANS, Wireless LANs.
Multiple access protocols: ALOHA, CSMA.
Data Link layer Switching: Use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways.

UNIT – 2: (~12 Lecture Hours)
Internetworking: How networks differ, How networks can be connected, Tunneling, internetwork routing, packet fragmentation.
Network Layer: Classful addressing**:** Introduction, Classful Addressing, Other Issues, Sub-netting and Super-netting, Classless Addressing: - Variable length Blocks, Sub-netting, Address Allocation.
Delivery, Forwarding, and Routing of IP Packets: Delivery, Forwarding, Routing, Structure of Router.
Internet Protocol (IP): Datagram, Fragmentation, Options, Checksum.
ARP and RARP: ARP, ARP Package, RARP.
IPv6: Introduction, Address space allocation, Packet format, transmission from IPv4 to IPv6.

UNIT – 3:(~10 Lecture Hours)
Transmission Control Protocol (TCP): TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Flow Control, Error Control, Congestion Control, TCP Times.
Stream Control Transmission Protocol (SCTP): SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control, Congestion Control.

UNIT – 4: (~8 Lecture Hours)
Unicast Routing Protocols (RIP, OSPF, AND BGP): Intra and Inter-domain Routing, Distance Vector Routing, RIP, Link State Routing, OSPF, Path Vector Routing, BGP.

Multicasting and Multicast Routing Protocols: Unicast - Multicast- Broadcast, Multicast Applications, Multicast Routing, Multicast Link State Routing: MOSPF, Multicast Distance Vector: DVMRP.

UNIT – 5: (~10 Lecture Hours)
Application Layer:
Domain Name System (DNS): Name Space, Domain Name Space, Distribution of Name Space, and DNS in the internet.
Remote Login Telnet:- Concept, Network Virtual Terminal (NVT).
File Transfer FTP and TFTP: File Transfer Protocol (FTP).
Electronic Mail: SMTP and POP.
Network Management-SNMP: Concept, Management Components.
World Wide Web- HTTP Architecture.

TEXT BOOKS:

1. Behrouz A. Forouzan, "TCP/IP Protocol Suite", TMH, 4th Edition.
2. Andrew S. Tanenbaum, "Computer Networks", Pearson Education, 4th Edition.

REFERENCE BOOKS:

1. Comer, "Internetworking with TCP/IP", PHI, 3rd Edition
2. Mahbub Hassan, Raj Jain, "High performance TCP/IP Networking", PHI, 2005.
3. B. A. Forouzan, "Data Communications & Networking", TMH, 2nd Edition.
4. William Stallings, "High Speed Networks and Internets", Pearson Education, 2002.
5. William Stallings, "Data and Computer Communications", PEI, 7th Edition.

ONLINE RESOURCES:

1. http://nptel.ac.in/syllabus/106105081/
2. https://in.udacity.com/course/computer-networking--ud436
3. http://nptel.ac.in/syllabus/106105082/
4. http://www.cse.wustl.edu/~jain/

Course Outcomes:

At the end of the course, the students will be able to

1. Independently understand basic computer network technology, different types of network topologies and protocols.
2. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
3. Identify the different types of network devices and their functions within a network
4. Understand and building the skills of subnetting and routing mechanisms.
5. Acquaint with the knowledge of various routing protocols.
6. Familiarity with various types of messages being exchanged at different layers of an Internet

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M. Tech. I Year, I Sem.	**L**	**T**	**P**	**C**
	3	**-**	**-**	**3**

DETECTION AND ESTIMATION THEORY (PSE 2)
(Common to DECE, WMC)

Prerequisite: Basic Mathematics.

Course Objectives:

1. To build the mathematical background of Signal Detection and Estimation.
2. To understand the spectral and temporal characteristics of random signal.
3. To apply Classical and Bayesian approaches to formulate and solve problems for parameter estimation from noisy signals.
4. To design and analyze Optimum Detection schemes.

Syllabus:

UNIT 1: (~8 Lecture Hours)
Review of Vector Spaces : Vector Spaces and Subspaces, Linear Independence, Basis and Dimension, Linear Transformations, Orthogonality – Orthogonal Vectors and Subspaces, Orthogonal Bases and Gram-Schmidt Orthogonalization.

UNIT 2:(~8 Lecture Hours)
Stochastic Process : Temporal Characteristics –The Stochastic Process Concept, Stationarity and Independence, Time Averages and Ergodicity, Correlation Functions, Gaussian Random Processes, Poisson Random Process, Random Signal Response of Linear System.

UNIT – 3:(~8 Lecture Hours)
Introduction to Estimation Theory: Minimum variance Unbiased Estimation, Cramer-Rao lower bound – Estimator Accuracy Consideration, Bound, General CRLB for signals in White Gaussian Noise, Transformation of Parameters, Linear.

UNIT – 4: (~10 Lecture Hours)
Estimators : Best linear unbiased estimator (BLUE)**,** Maximum Likelihood Estimator (MLE) –Finding the MLE, Properties, MLE for Transformed Parameters, Extension to Vector Parameters, General Bayesian Estimator – Risk Functions, MMSE Estimator, MAP Estimator, Performance description.

UNIT – 5:(~11 Lecture Hours)
Detection Theory: Neyman Pearson Theorem, Receiver Operating Characteristics, MPE, Baye's Risk, Multiple Hypotheses Testing, Minimum Baye's Risk Detector – Binary and Multiple Hypotheses, Deterministic Signals – Matched Filters, Generalized

Matched Filters, Multiple Signals (Only Binary Case), Random Signals – Estimator Correlator.

TEXT BOOKS:

1. Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory", Pearson, 2010
2. Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume II: Detection Theory", Pearson, 2010
3. Peyton Z. Peebles ,"Probability, Random Variables & Random Signal Principles ", 4th Edition, TMH, 2010.
4. Gilbert Strang, "Linear Algebra and its Applications", 5th Edition, Brooks/Cole Thomson Learning, 2016.

REFERENCE BOOKS:

1. Thomas Kailath, Babak Hassibi, Ali H. Sayed, "Linear Estimation", Prentice Hall,2000.
2. H. Vincent Poor, "An Introduction to Signal Detection and Estimation", 2nd Edition, springer 1998.

ONLINE RESOURCES:

1. https://www.youtube.com/playlist?list=PL48UwQJyfW3SmrjLgl5LrVciqfWz9XazY
2. https://www.youtube.com/watch?v=09eXRHf6glA

Course Outcomes:

At the end of this course, students will be able to

1. Comprehend with the mathematical background of Signal Detection and Estimation.
2. Acquire basics of statistical decision theory used for Signal Detection and Estimation.
3. Examine the detection of deterministic and random signals using statistical models.
4. Test the performance of signal parameters using optimal estimators.
5. Analyze signal estimation in discrete-time domain using filters.
6. Choose the appropriate detection and estimation methods to solve the real time problems.

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M. Tech. I Year, I Sem.

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ANTENNA THEORY & DESIGN (PSE 1)

Course Objectives:

1. To know the various basic parameters of antenna and its working in wireless communication.
2. To study the Maxwell's equation and apply them to find the far field pattern of electric dipole & array antenna.
3. To design VHF, UHF and microwave antennas, which are used in various applications like mobile, satellite, RADAR, SONAR etc.
4. To study special antennas for special applications.

Syllabus:

UNIT –1: (~9 Lecture Hours)

Fundamental Parameters of Antennas: Introduction to antenna, Radiation Mechanism, Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, radiation efficiency, Antenna Vector effective length, Friss Transmission equation, Antenna Temperature, problems.

UNIT –2: (~10 Lecture Hours)

Types of Antennas: Wire antennas, Aperture antennas, Micro strip antennas, Array antennas Reflector antennas, Lens antennas.

Linear Wire Antennas: Infinitesimal dipole, Small dipole, Finite length dipole, Half-wave dipole-Radiated fields (Derivation for **A**, **E**, **H)**, Power density and radiation resistance, Region separation. Current distribution on thin wire antenna. Loop Antennas: Small Circular loop, problems.

UNIT –3: (~10 Lecture Hours)

Linear Arrays: Two element array, n-Element array: Uniform Amplitude and spacing, Broadside array, End fire array, Phased array and Hansen-Woodyard End-fire array and their directivities (derivation), problems.

UNIT–4: (~10 Lecture Hours)

VHF, UHF &Microwave Antennas:

Helical Antenna: Helical geometry, practical design consideration of monofilar axial mode & normal helical antenna, applications, design problems.

Dipole Array Antenna: Dipole array with parasitic elements, Yagi-Uda antenna: Construction, operation and design problems.

Horn Antenna: E-plane and H-plane sectoral horns, pyramidal (design) and conical horns, design problems.

Reflector Antenna: plane reflector, parabolic reflector- parabola general properties, paraboloidal reflector, reflector types, cassegrain antenna, F/D ratio, feed methods, design problems.

UNIT –5: (~10 Lecture Hours)

Lens Antenna: Non dielectric lens antenna & Fermats principal.

Micro Strip Antennas: Introduction, Features, Advantages, limitations, Rectangular Micro strip antenna, Feeding mechanisms, Characteristics, applications.

Antennas for Special Applications: Antenna design consideration for satellite communication- receiving Vs transmitting consideration, bandwidth consideration, Antennas for terrestrial mobile communication systems- base station antenna, mobile station antenna.

TEXT BOOKS:

1. Constantine A. Balanis, "Antenna Theory Analysis and Design", John Wiley & Sons, 2nd Edition, 2002. (Unit **1, 2 & 3** are covered from this text book)
2. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas and Wave Propagation", Tata Mc-Graw-Hill, 4th Edition, 2010.(Unit **4&5** are covered from this text book)

REFERENCE BOOKS:

1. Saunders, Simon R, Aragon-Zavala, "Antennas and Propagation for Wireless Communication Systems", Asian Publisher, 2008.
2. Christodoulou. Christos G, Wahid. Parveen F, "Fundamentals of Antennas: Concepts and Applications", PHI, 1st Edition, 2005.
3. A.R.Harish, M.Sachidananda, "Antennas and Wave Propagation", Oxford Higher Education, 2007.
4. K.D. Prasad, Satya Prakashan, "Antennas and Wave Propagation", Tech Publications, 3rd Edition, 2001.

ONLINE RESOURCES:

1. http://www.radio-electronics.com/info/antennas
2. http://www.pctel.com/antennas-products/
3. http://electronicsforu.com/resources/learn-electronics/learn-design-ebooks-antenna-design
4. http://nptel.ac.in/courses/117107035/

Course Outcomes:

At the end of this course, students will be able to

1. Learn the various parameters of antenna and same is used for further analysis of antennas.
2. Compute the far field distance, radiation pattern and gain of an antenna for given current distribution.
3. Determination of the input impedance & efficiency for different antennas.
4. Compute the array factor for an array of identical antennas.
5. Design antennas and antenna arrays for various desired radiation pattern characteristics.
6. Design antennas for particular applications.

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CODING THEORY AND TECHNIQUES (PSE 2)
(Common to DECE, WMC)

Prerequisite: Digital Communications.

Course Objectives:

1. To expose the students to the principles of Error- correcting codes, and their applications to communication systems with noise.
2. To understand the methods for speedy/ compact Error Detection and Correction.
3. To analyze latest Channel Coding Techniques.

Syllabus:

UNIT – 1: (~9 Lecture Hours)
Coding for Reliable Digital Transmission and Storage: Types of Errors, Error Control Strategies.
Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system-Error Control for Computer main processor and control storages, Error Control for Magnetic tapes.

UNIT – 2: (~10 Lecture Hours)
Cyclic Codes: Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, Shortened Cyclic Codes, Error-Trapping decoding for Cyclic Codes- Error Trapping decoding, Improved Error-Trapping decoding, One Step Majority logic decoding for Cyclic Codes, Introduction to Galois field, Description of BCH codes, Decoding procedure for BCH codes.

UNIT – 3: (~8 Lecture Hours)
Convolutional Codes: Encoding of Convolutional Codes, Structural and Distance Properties, Viterbi Decoding, Sequential decoding-The Stack Algorithm, The Fano Algorithm, Majority- Logic Decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ System

UNIT – 4:(~10 Lecture Hours)
Turbo Codes: Turbo Codes Concepts, Log-Likelihood Algebra, Product Code Example, Encoding with Recursive Systematic Codes, A Feedback Decoder, The MAP Algorithm, MAP Decoding Example.

UNIT – 5: (~8 Lecture Hours)

LDPC Codes: LDPC Codes- Codes based on sparse graphs, Decoding for Binary Erasure Channel, Log-Likelihood Algebra, Belief Propagation, Product Codes, Iterative Decoding of Product Codes, Concatenated Convolutional Codes- Parallel Concatenation, The UMTS Turbo Code, Serial Concatenation, Parallel Concatenation.

TEXT BOOKS:

1. Shu Lin, Daniel J.Costello, Jr, "Error Control Coding- Fundamentals and Applications", 1st and 2nd Editions, Prentice Hall, 2011, 2013.
2. Bernard Sklar, "Digital Communications-Fundamentals and Applications", 2nd Edition, PEA, 2013.
3. Andre Neubauer, Jurgen Freadenberger, Volker Kuhn, "Coding Theory- Algorithms, Architectures and Applications", 1st Edition, John Wiley & Sons Ltd, 2007

REFERENCE BOOKS:

1. J. Das, "Review of Digital communications", 2nd Edition, New age international publishers, 2013.
2. Man Young Rhee, "Error Correcting Coding Theory", McGraw-Hill Publishing, 1989.
3. John G. Proakis, "Digital Communications", 5th Edition, Tata McGraw-Hill, 2008.
4. Todd K.Moon, "Error Correction Coding-Mathematical Methods and Algorithms", Wiley India, 2006.
5. Ranjan Bose, "Information Theory, Coding and Cryptography", 2nd Edition, Tata McGraw-Hill, 2009.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc17_ee07
2. http://www.nptelvideos.in/2012/12/coding-theory.html

Course Outcomes:

At the end of this course, students will be able to

1. Relate the capabilities, Probability of Error Detection and Correction using various methods.
2. Estimate the apriori Probabilities for better Error Detection and Correction.
3. Develop the Optimal paths of Detecting and Correcting Errors.
4. Use Majority Logic Decoding in different Error Correcting Codes.
5. Implement Iterative techniques to simplify Error Detection and Correlation.
6. Apply these Error Correcting Codes in various practical applications.

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MOBILE COMPUTING (PSE 2)

Prerequisite: Computer Networks, Computer Organization and architecture.

Course Objectives:

The objectives of the course Mobile Computing are

1. To learn the fundamental technologies that help in the networking of wireless devices.
2. To study the cellular architectures of GSM, GPRS, SMS.
3. To have an exposure about emerging technologies like Blue tooth, WiMAX etc.
4. To know the Network, Transport functionalities of Mobile Communication.
5. To impart knowledge about Mobile Application Development using Palm OS, Symbian OS, J2ME etc.

UNIT – 1: (~9 Lecture Hours)
Introduction to Mobile Computing Architecture: Mobile Computing, dialog control, networks, middleware and gateways, application and services, developing mobile computing applications, security in mobile computing, architecture for mobile computing, three tier architecture, design considerations for mobile computing, mobile computing through internet, making existing applications mobile-enabled.

UNIT – 2: (~9 Lecture Hours)
Cellular Technologies – GSM, GPRS, CDMA AND 3G : Bluetooth, Radio frequency identification, Wireless Broadband, mobile IP, Internet protocol version 6 (IPv6), Java card, PLNM interfaces, GSM addresses and identifiers, network aspects in GSM, Mobile computing over SMS, Short Message Services (SMS), GPRS network architecture, GPRS network operations, data services in GPRS, applications for GPRS, limitations of GPRS, CDMA versus GSM, third generation networks, applications on 3G.

UNIT – 3: (~8 Lecture Hours)
Wireless Application Protocol (WAP) and Wireless LAN: WAP, MMS, wireless LAN advantages, IEEE 802.11 standards, wireless LAN architecture, mobility in wireless LAN.
Intelligent and Internetworking: Introduction, fundamentals of call processing, intelligence in the networks, SS#7 signaling, IN Conceptual Model (INCM), Softswitch, programmable networks, technologies and interfaces for IN.

UNIT – 4: (~10 Lecture Hours)
Client Programming, PLAM OS, SYMBIAN OS, WIN CE Architecture: Introduction, moving beyond the desktop, a peek under the hood: hardware overview, mobile phones,

PDA, design constraints in applications for handheld devices, palm OS architecture, application development, Symbian OS architecture, Applications for Symbian, different flavors of windows CE, windows CE architecture.
J2ME: Java in the handset, the three prong approach to JAVA everywhere, JAVA 2 micro edition (J2ME) technology, programming for CLDC, MIDLet, Optional packages.

UNIT – 5: (~9 Lecture Hours)
Voice Over Internet Protocol and Convergence: Voice over IP, H.323 Framework for voice over IP, Session Initiation Protocol, Comparison between H.323 and SIP, Real Time protocols, Convergence Technologies, Call Routing, IP multimedia subsystem (IMS), Mobile VoIP.
Security Issues in Mobile Computing: Introduction, information security, security techniques and algorithms, security protocols, trust, security models, security frameworks for mobile environment.

TEXT BOOKS:
1. Asoke K. Talukder, Roopa R Yavagal, "Mobile Computing- Technology, Applications and Service Creation", 2nd edition, Tata McGraw Hill, New Delhi, 2009.
2. Jochen Schiller,"Mobile Communications, 2nd Edition, Pearson Education, New Delhi, 2008.

REFERENCE BOOKS:
1. Vieri Vanghi, Aleksander Damnjanovic, "The cdma 2000 system for Mobile Communications", Pearson Education, New Delhi, 2007.
2. Frank Adelstein, "Fundamentals of Mobile and Pervasive Computing", McGraw Hill, New Delhi, 2008.

ONLINE RESOURCES:
1.https://www.tutorialspoint.com/mobile_computing/mobile_computing_overview.htm
2. http://uberthings.com/mobile/#intro
3. http://www.ittoday.info/Articles/Introduction_to_Mobile.htm

Course Outcomes:
At the end of this course, students will be able to
1. Articulate the basics of mobile computing and its standards.
2. Describe Cellular Network architectures, operations of GSM, GPRS etc.
3. Demonstrate the knowledge of various platforms like Palm OS, Symbian OS and Windows CE used for mobile devices.
4. Develop mobile applications using JAVA 2 micro edition (J2ME) technology.
5. Differentiate H.323, SIP and other protocols, frameworks for VoIP.
6. Analyze various security protocols and able to deal with security attacks in mobile environment.

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WIRELESS LANS AND PANS (PSE 2)

Prerequisites: Computer Networks.

Course Objectives:

1. Build an understanding of the fundamental concepts of various random access protocols.
2. Familiarize the student with wired and wireless LANs.
3. Introduce the student to Wireless PANs and IEEE 802.15 working group.

Syllabus:

UNIT –1: (~8 Lecture Hours)

Wireless System & Random Access Protocols: Introduction, First and Second Generation Cellular Systems, Cellular Communications from 1G to 3G, Wireless 4G systems, Random Access Methods: Pure ALOHA, Slotted ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA).

UNIT –2: (~10 Lecture Hours)

Wireless LANs: Introduction, importance of Wireless LANs, WLAN Topologies, Transmission Techniques: Wired Networks, Wireless Networks, comparison of wired and Wireless LANs; WLAN Technologies: Infrared technology, UHF narrowband technology, Spread Spectrum technology.

UNIT –3: (~10 Lecture Hours)

The IEEE 802.11 Standard for Wireless LANs: Network Architecture, Physical layer, The Medium Access Control Layer; MAC Layer issues: Hidden Terminal Problem, Reliability, Collision avoidance, Congestion avoidance, Congestion control, Security, The IEEE 802.11e MAC protocol.

UNIT –4: (~8 Lecture Hours)

Wireless PANs: Introduction, importance of Wireless PANs, The Bluetooth technology: history and applications, technical overview, the Bluetooth specifications, piconet synchronization and Bluetooth clocks, Master-Slave Switch; Bluetooth security; Enhancements to Bluetooth: Bluetooth interference issues, Intra and Inter Piconet scheduling, Bridge selection, Traffic Engineering, QoS and Dynamics Slot Assignment, Scatternet formation.

UNIT –5: (~10 Lecture Hours)

The IEEE 802.15 working Group for WPANs: The IEEE 802.15.3, The IEEE 802.15.4, Zig-Bee Technology, Zig-Bee components and network topologies, The IEEE 802.15.4 LR-WPAN Device architecture: Physical Layer, Data Link Layer, The Network Layer, Applications; IEEE 802.15.3a Ultra wideband.

TEXT BOOKS:

1. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, “Ad Hoc and Sensor Networks”, World Scientific, 2011.
2. Vijay K.Garg, Morgan Kaufmann, “Wireless Communications and Networking”, Publishers, 2009.

REFERENCE BOOKS:

1. Kaveh Pahlaram, Prashant Krishnamurthy, “Wireless Networks”, PHI, 2002.
2. Marks Ciampor, Jeorge Olenewa, “Wireless Communication”, Cengage Learning, 2007.

ONLINE REFERENCES:

1. http://nptel.ac.in/courses/106105082/31
2. https://www.youtube.com/watch?v=vjhp0zTXEsc

Course Outcomes:

At the end of the course, the students will be able to

1. Independently understand basic random access control protocols.
2. Enumerate the wireless and wired networks.
3. Understand the architecture of IEEE 802.11
4. Acquaint knowledge on MAC protocol of IEEE 802.11
5. Familiarity with wireless personal area networks
6. Identify different PANs and familiarize with working group of IEEE 802.15

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WIRELESS AND MOBILE COMMUNICATIONS LABORATORY (PCL 1)
(Common to DECE , WMC)

Course Objectives:
1. To analyze Cellular concepts, GSM and CDMA networks.
2. Analyze the digital carrier modulation and demodulation techniques.
3. To describe GSM handset by experimentation and fault insertion techniques.
4. Analyze CDMA concept using DSSS kit.

Experiments:
Note: Experiments 1 to 5 need to be simulated using MATLAB and tested on hardware**.**
1. FSK Modulation and Demodulation technique.
2. QPSK Modulation and Demodulation technique.
3. DQPSK Modulation and Demodulation technique
4. 8-QAM Modulation and Demodulation technique.
5. Implementation of Convolutional Encoder and Decoder.
6. Simulation of the following Outdoor Path loss propagation models using MATLAB.
   a. Free Space Propagation model b. Okumura model
   c. Hata model
7. Simulation of Adaptive Linear Equalizer using MAT LAB software.
8. Measurement of call blocking probability for GSM &CDMA networks using Netsim software.
9. Study of GSM handset for various signalling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).
10. Study of transmitter and receiver section in mobile handset and measure frequency
    band signal and GMSK modulating signal.
11. Simulation of RAKE Receiver for CDMA communication using MAT LAB software.
12. Simulate and test various types of PN codes, chip rate, spreading factor and processing gain on performance of DSSS in CDMA.
13. Simulate and test the 3G Network system features using GSM AT Commands. (Features of 3G Communication system: Transmission of voice, video calls, SMS, MMS,TCP/IP,HTTP,GPS)
14. Modelling of communication system using Simulink.

Course Outcomes:
At the end of this course, students will be able to
1. Implement the advanced digital modulation techniques.
2. Design Convolutional encoder and decoder for error control coding techniques.
3. Calculate path loss for Free space, Okumura and Hata models for outdoor propagation.
4. Comprehend Cellular concepts of GSM and CDMA networks.
5. Simulate RAKE receiver for CDMA with MATLAB.
6. Analyze GSM architecture.

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ADHOC WIRELESS NETWORKS LAB (PCL 2)

Lab Objectives:

1. To simulate various LAN topologies.
2. To simulate various queue management schemes and scheduling mechanisms in wireless scenarios.
3. To simulate different transport and routing protocols in MANETs.
4. To compare the performance of IEEE 802.11 and IEEE 802.15.4
5. To analyze various Internet packets and protocols.
6. To analyze OFDM spectrum and CDMA system.

Prerequisite: Students should have knowledge on basics of computer networks, Adhoc wireless networks.

Experiments:

NOTE:

A. All the experiments may be conducted using Network Simulation Software like NS-2/NSG-2.1, Wireshark, SDR, Matlab.

B. Experiments 1 to 7 may be evaluated through simulation by using the parameters Throughput, Packet Delivery Ratio, End to end Delay.

1. Evaluate the performance of various wired LAN Topologies
2. Evaluate the performance of Drop Tail and RED queue management schemes in wired networks.
3. Evaluate the performance of CBQ and FQ Scheduling Mechanisms in wired networks.
4. Evaluate the performance of TCP and UDP Protocols in wireless networks
5. Evaluate the performance of TCP, New Reno and Vegas in wireless networks
6. Evaluate the performance of AODV, DSR and DSDV routing protocols in wireless networks
7. Evaluate the performance of IEEE 802.11 and IEEE 802.15.4 in wireless networks
8. Capturing and Analysis of TCP and IP Packets
9. Capturing and Analysis of ICMP and IGMP Packets
10. Analyze the Protocols SCTP , ARP, NetBIOS, IPX VINES
11. Analysis of HTTP ,DNS and DHCP Protocols
12. Design OFDM System using SDR and observe its spectrum.
13. Performance evaluation of CDMA system in multiuser environment.

Course Outcomes:

At the end of the course, the students will be able to

1. Carry out simulation of various LAN topologies using network simulators.
2. Distinguish between various queue management schemes and scheduling mechanisms in wireless environment.
3. Evaluate the performance of various transport and routing protocols in MANETs.
4. Compare the performance of IEEE 802.11 and IEEE 802.15.4
5. Analyze various Internet packets and protocols using Wireshark.
6. Analyze OFDM spectrum and CDMA system.

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RESEARCH METHODOLOGY AND IPR
(Common to DECE, WMC)

Prerequisite: -

Course Objectives:
1. To develop an understanding of IPR/ research methodology in the process of creation of patents through research.
2. To develop further research capabilities.

Syllabus Contents

UNIT 1: (~7 Lecture Hours)
Research Methodology: Objectives and Motivation of Research, Types of Research, Research Approaches, Significance of Research, Research Methods verses Methodology, Research and Scientific Method, Important of Research Methodology, Research Process, Criteria of Good Research.

UNIT 2 :(~6 Lecture Hours)
Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Design of Experimental Set-up, Use of Standards and Codes, Data collection methods, Collection of primary data, Secondary data, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data.

UNIT 3(~6 Lecture Hours)
Research Report Writing: Format of the Research report, Synopsis, Dissertation, References/Bibliography/Webliography, Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

UNIT 4:(~6 Lecture Hours)
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

UNIT 5: (~6 Lecture Hours)
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. New Developments in IPR: Administration of Patent System.

TEXT BOOKS :
1. C.R Kothari, “Research Methodology, Methods & Technique”. New Age International Publishers, 2004.

2. R. Ganesan, “Research Methodology for Engineers”, MJP Publishers, 2011.
3. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
4. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008.
5. Satarkar, S.V, “Intellectual property rights and copy right”. ESS Publications, 2000.

REFERENCE BOOKS :

1. Ranjit Kumar, “Research Methodology: A Step by Step Guide for beginners, 2nd Edition, 2012.
2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc18 ge12

Course Outcomes:

At the end of the course, the students will be able to

1. Describe research problem formulation.
2. Analyze research related information.
3. Follow research ethics.
4. Understand the new developments in Intellectual Property Right.
5. Develop patent grants.
6. Create new and better products, and in turn brings about, economic growth and social benefits.

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ENGLISH FOR RESEARCH PAPER WRITING
(Common to all streams)
AUDIT COURSE –1

Prerequisites: ---

Course Objectives:

1. To understand the nuances of language and vocabulary in writing a Research Paper.
2. To develop the content, structure and format of writing a research paper.
3. To give the practice of writing a Research Paper.
4. To enable the students to evolve original research papers without subjected to plagiarism.

UNIT 1 : (~7 lecture hours)
Academic Writing : What is Research? - Meaning & Definition of a research paper?– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT 2 : (~7 lecture hours)
Research Format : Title – Abstract – Introduction – Discussion - Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT 3 : (~6 lecture hours)
Research Methodology: Methods (Qualitative – Quantitative) – Literature Review – Who did what – Criticizing, Paraphrasing & Plagiarism.

UNIT 4 : (~6 lecture hours)
Process of Writing a research paper : Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - Typing the final draft.

UNIT 5 : (~6 lecture hours)
How to & where to get published: Reputed Journals – National/International – ISSN No, No. of volumes, Scopes Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits.

REFERENCE BOOKS:

1. "MLA Hand book for writers of Research Papers", East West Press Pv1t. Ltd, New Delhi, 7thEdn,
2. C. R Kothari, Gaurav, Garg, "Research Methodology Methods and Techniques", New Age International Publishers, 4thEdn.
3. Lauri Rozakis, Schaum's, "Quick Guide to Writing Great Research Papers", Tata McGraw Hills Pvt. Ltd, New Delhi.
4. N. Gurumani, "Scientific Thesis Writing and Paper Presentation", MJP Publishers.

ONLINE RESOURCES:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

Course Outcomes:

At the end of the course, the students will be able to

1. Understand the nuances of research writing
2. Write a research paper with required writing skills and be confident to share their writing with others
3. Publish a paper using the requisite standard in a journal
4. Review the research papers and articles in a scientific manner.
5. Work on citations and ably place them in her research paper.
6. Avoid plagiarism and be able to develop her own writing skills in presenting the research work.

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SHAIKPET, HYDERABAD-500104
WIRELESS AND MOBILE COMMUNICATIONS (Under ETE)

M. Tech. I Year, I Sem.

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DISASTER MANAGEMENT
(Common to all streams)
AUDIT COURSE –1

Prerequisites:
Awareness about Various Planetary & Extra Planetary Hazards, their Impacts & Mitigation measures

Course Objectives:
1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.
5. Students will get the overview on the roles of government and non-government agencies in disaster management.
6. Describe the basic concepts of the emergency management cycle (mitigation, preparedness, response and recovery) and their application on various types of disasters.

UNIT 1 : (~8 Lecture Hours)
Introduction and Repercussions of Disasters and Hazards: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT 2 : (~5 Lecture Hours)
Disaster Prone Areas in India Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with special reference to Tsunami; Post-Disaster Diseases and Epidemics.

UNIT 3 : (~5 Lecture Hours)
Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing,

Data From Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT 4 : (~5 Lecture Hours)
Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation In Risk Assessment, Strategies for Survival.

UNIT 5 : (~5 Lecture Hours)
Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation - Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOKS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.), "Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L.,"Disaster Administration And Management Text And Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009-2012).
2. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.
3. Satapathy S, "Psychosocial care in Disaster management, A training of trainers manual (ToT)", NIDM publication 2009.
4. Guerisse P, "Basic Principles of Disaster Medical Management. Act Anaesth. Belg;56:395-401",2005.
5. Study Guide prepared by Sharman and Hansen, "Aim and Scope of Disaster Management", UW-DMC, University of Washington.

Online Resources:
1. https://www.mooc-list.com/tags/earthquake
2. https://freevideolectures.com/course/3581/earthquakes-in-your-backyard
3. https://summer.uci.edu/online/
4. http://www.open.edu/openlearn/free-courses/full-catalogue
5. https://www.edx.org
6. https://www.disasterready.org/courses

Course Outcomes:
At the end of the course, the students will be able to
1. Learn different disasters and measures to reduce the risk due to these disasters.
2. Learn institutional frame work for disaster management at national as well as global level.
3. Develop the capacity to integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.

4. Demonstrate , describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.
5. Understand the emergency/disaster management cycle for various types of disasters.
6. Develop a basic understanding of prevention, mitigation, preparedness, response and recovery on various types of disasters.

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PEDAGOGY STUDIES
(Common to all streams)
AUDIT COURSE - 1

Prerequisites:-

Course Objectives:
To enable the students
1. To understand the programme design and policies of pedagogy studies.
2. To develop knowledge, abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. Analyze various theories of learning and their connection to teaching practice.
4. To familiarize the student with various research designs and research methods.
5. To create an awareness about the practices followed by DfID, other agencies and other researchers.
6. To identify critical evidence gaps to guide the development.

UNIT 1 :(~08 Lecture Hours)
Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT 2 :(~06 Lecture Hours)
Thematic overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT 3 :(~06 Lecture Hours)
Evidence on the effectiveness of pedagogical practices - Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT 4 :(~06 Lecture Hours)
Professional development: alignment with classroom practices and follow up support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT 5 :(~08 Lecture Hours)
Research gaps and future directions - Research design - Contexts - Pedagogy
Teacher education - Curriculum and assessment - Dissemination and research impact.

SUGGESTED READING:

1. Ackers J, Hardman F, "Classroom Interaction in Kenyan Primary Schools, Compare, 31 (2): 245 – 261", 2001.
2. Agarwal M, "Curricular Reform in Schools: The importance of evaluation, Journal of Curriculum Studies", 36 (3) : 361 – 379, 2004.
3. AkyeampongK, "Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER) Country Report 1.London: DFID",2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?", International Journal Educational Development, 33 (3): 272- 282, 2013.
5. Alexander R J, " Culture and Pedagogy : International Comparisons in Primary Education",Oxford and Boston : Blackwell, 2001.
6. Chavan M, "Read India: A mass scale, rapid, 'learning to read' campaign", 2003.
7. www.pratham.org/images/resources%20working%20paper%202.pdf.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview

Course Outcomes:

At the end of the course, the students will be able to

1. The pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. To examine the effectiveness of pedagogical practices.
3. To understand the concept, characteristics and types of educational research and perspectives of research.
4. The role of teacher education, school curriculum and guidance materials for effective pedagogy

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PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Common to all streams)
AUDIT COURSE - 1

Prerequisites: -

Course Objectives:

1. To learn to achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination.
3. To awaken wisdom in students.

UNIT 1 :(~05 lecture hours)

- Neetisatakam – Holistic development of personality.
- Verses 19,20,21,22 (Wisdom)
- Verses 29,31,32 (Pride and Heroism)
- Verses 26,28,63,65 (Virtue)

UNIT 2 :(~05 lecture hours)

- Neetisatakam – Holistic development of personality (cont'd)
- Verses 52,53,59 (dont's)
- Verses 71,73,75 & 78 (do's)
- Approach to day to day works and duties.

UNIT 3 :(~05 lecture hours)

- Introduction to Bhagavadgeetha for Personality Development
- Shrimad BhagawadGeeta: Chapter 2 – Verses 41, 47, 48
- Chapter 3 – Verses 13,21,27,35
- Chapter 6 – Verses 5,13,17,23,35
- Chapter 18 – Verses 45, 46, 48

UNIT 4 :(~05 lecture hours)

- Statements of basic knowledge
- Shrimad BhagawadGeeta: Chapter 2- Verses 56, 62,68
- Chapter 12 – Verses 13, 14, 15, 16, 17, 18
- Personality of Role model from Shrimad BhagawatGeeta.

UNIT 5 :(~05 lecture hours)

- Role of Bahgavadgeeta in the present scenario
- Chapter 2 – Verses 17
- Chapter 3 – Verses 36, 37, 42
- Chapter 4 – Verses 18, 38, 39
- Chapter 18 – Verses 37, 38, 63.

SUGGESTED READING:

1. Swami Swarupananda Advaita Ashram, "Srimad Bhagavad Gita", (Publication Department), Kolkata.
2. P. Gopinath, Rashtriya , "Bhartrihari's ThriSatakam (Niti – Sringar- Vairagya) Sanskrit Sansthanam", New Delhi.

Course Outcomes:

At the end of this course , students will be able to

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. Develop versatile personality.

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ADVANCED COMMUNICATIONS SYSTEMS (PC 3)

Prerequisite: Wireless & Mobile Communications

Course Objectives:

1. To expose the students to the principles of spread spectrum and their applications to communication systems.
2. To understand basic requirements of MIMO system.
3. To analyse OFDM signal Bandwidth, channel estimation techniques.
4. To familiarize SONET,ATM frame formats.

Syllabus Contents:

UNIT – 1:(~8 Lecture Hours)

Spread Spectrum Communications: Fundamental Concepts of Spread Spectrum Systems, Properties of Spreading Sequences, Pseudo- noise sequences, Walsh Sequences, Orthogonal Variable Spreading Factor Sequences, Barker Sequence, Complementary Codes. Direct Sequence Spread Spectrum, Frequency Hop Spread Spectrum, Hybrid Direct Sequence Frequency Hop Spread Spectrum, Code Division Multiple Access, Synchronization in CDMA, Power Control, Soft handoff, Multiuser detection – Optimum multiuser detector, Liner multiuser detection.

UNIT – 2: (~9 Lecture Hours)

Orthogonal Frequency Division Multiplexing: Basic Principles of Orthogonality, Single vs Multicarrier Systems, OFDM Block Diagram and Its Explanation, OFDM Signal Mathematical Representation, Selection parameter for Modulation, Pulse shaping in OFDM Signal and Spectral Efficiency, Window in OFDM Signal and Spectrum, Synchronization in OFDM, Pilot Insert in OFDM Transmission and Channel Estimation, Amplitude Limitations in OFDM, FFT Point Selection Constraints in OFDM, CDMA vs OFDM, Hybrid OFDM.

UNIT – 3:(~10Lecture Hours)

MIMO Systems: Introduction, Space Diversity and System Based on Space Diversity, Smart Antenna
system and MIMO, MIMO Based System Architecture, MIMO Exploits Multipath, Space – Time Processing, Antenna Consideration for MIMO, MIMO Channel Modelling, MIMO Channel Measurement, MIMO Channel Capacity, Cyclic Delay Diversity (CDD), Space Time Coding, Advantages and Applications of MIMO in Present Context, MIMO Applications in 3G Wireless System and Beyond, MIMO-OFDM

UNIT – 4: (~8Lecture Hours)

SONET/SDH: Architecture, SONET Layers, SONET Frames, STS Multiplexing, SONET Networks, Virtual Tributaries.

ATM: Overview, Virtual channels, Virtual paths, VP and VC switching, ATM cells, Header format, Generic flow control, Header error control, Transmission of ATM cells, Adaptation layer, AAL servicesand protocols.

UNIT – 5 (~10 Lecture Hours)

ATM Traffic and congestion Control: Requirements for ATM Traffic and Congestion Control, Cell-Delay Variation, ATM Service Categories, Traffic and Congestion Control Framework, Traffic Control, Congestion Control

TEXT BOOKS:

1. Gary J. Mullett, "Introduction to Wireless Telecommunications Systems and Networks", CENGAGE
2. Upena Dalal, "Wireless Communication", Oxford University Press, 2009
3. William Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM" Prentice Hall, 4th edition
4. Rodger E Ziemer, Roger L. Peterson and David E Borth - "Introduction to Spread Spectrum Communication- Pearson, 1st Edition, 1995.
5. Rainer Handel, Manfred N Huber, Stefan Schroder, "ATM Networks, Concepts, Protocols and Applications", Addison - Wesley, 3rd Edition, 1999.

REFERENCE BOOKS:

1. Ke-Lin Du & M N S Swamy, "Wireless Communication System", Cambridge University Press, 2010
2. Behrouz A Forouzan, "Data Communications and Networking", 4th Edition, McGraw Hill.
3. Gottapu Sasibhusan Rao, "Mobile Cellular Communication", PEARSON

ONLINE RESOURCES:

1. nptel.ac.in/courses/117101050/6
2. nptel.ac.in/courses/106105081/24
3. http://nptel.ac.in/courses/117104099/

Course Outcomes:

At the end of this course, students will be able to

1. Gain the fundamental concepts of spread spectrum concepts in wireless communication system
2. Apply space time coding in MIMO system.
3. Develop channel modelling of a MIMO system.
4. Analyze mathematical representation of OFDM system.
5. Estimate channel in OFDM environment.
6. Comprehend ATM traffic and congestion control.

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WIRELESS SENSOR NETWORKS (PC 4)

(Common to DECE, WMC)

Prerequisite: 1.Computer Networks 2.Adhoc Wireless Networks.

Course Objectives:

1. To analyze various sensor nodes, sensor network programming.
2. To get acquaintance with medium access control protocols and address physical layer issues.
3. To inculcate key routing and transport layer protocols for sensor networks and main design issues.
4. To provide analysis of the power management aspects, time synchronization, localization and security issues.

Syllabus:

UNIT 1: (~10 Lecture Hours)

Introduction: Components of a wireless sensor node, Motivation for a Network of Wireless Sensor Nodes, Classification of sensor networks, Characteristics of wireless sensor networks, Challenges of wireless sensor networks, Comparison between wireless sensor networks and wireless mesh networks, Limitations in wireless sensor networks, Design challenges, Hardware architecture, Applications.

Node Architecture: The Sensing Subsystem, the Processor Subsystem, Communication Interfaces, Prototypes.

Operating Systems: Functional and Non-functional Aspects, Prototypes, Evaluation.

UNIT –2: (~10 Lecture Hours)

Popular sensor nodes-The "Mica Mote" family, EYES nodes, BTnodes, Scatterweb, Commercial solutions

Sensor Network Programming: Challenges in sensor network programming, Node-Centric programming, Microprogramming, dynamic reprogramming, Sensor network simulators.

Basic Architectural Framework: Physical Layer, Basic Components, Source Encoding, Channel Encoding, Modulation.

UNIT – 3: (~10 Lecture Hours)

Medium Access Control: Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Hybrid MAC Protocols.

Network Layer: Routing Metrics, Flooding and Gossiping, Data-Centric Routing, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location-Based Routing, QoS-Based Routing Protocols.

UNIT – 4: (~8 Lecture Hours)

Node and Network Management: Power Management, Local Power Management aspects, Dynamic Power Management, Conceptual Architecture.

Time Synchronization: Clocks and the Synchronization Problem, Time Synchronization in Wireless Sensor Networks, Basics of Time Synchronization, Time Synchronization Protocols.

UNIT – 5: (~8 Lecture Hours)

Localization: Ranging Techniques, Range-Based Localization, Range-Free Localization, Event- Driven Localization.

Security: Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and Zig Bee Security.

TEXT BOOKS:

1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley 2010.
2. Mohammad S. Obaidat, Sudip Misra, "Principles of Wireless Sensor Networks", Cambridge, 2014.
3. Holger Karl, Andreas Willig, "Protocols and Architectures for wireless sensor networks" Wiley, 2005.

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran , "Wireless Sensor Networks", Wiley, 2010.
2. C.S. Raghavendra, K.M. Sivalingam, Taieb Znati, "Wireless Sensor Networks", Springer, 2010
3. C. Sivarammurthy & B.S. Manoj, "Adhoc Wireless Networks",1st Edition, PHI,2004.
4. Fei Hu., Xiaojun Cao, "Wireless Sensor Networks",1st Edition, CRC Press, 2013.
5. Carlos de Morais Cordeiro & Dharmaprakash Agarwal," Adhoc& wireless sensor, 2nd edition, World Scientific & Imperial college press, 2006.
6. Sunil Kumar, S. Manvi, Mahabalaseshwar, "Wireless & sensor mobile networks concepts and protocols" Wiley, 2010.

ONLINE RESOURCES:

1. http://nptel.ac.in/syllabus/106105160/

Course Outcomes:

At the end of this course, students will be able to

1. Analyze various issues in sensor networks.
2. Identify various sensor platforms and supporting protocols.
3. Acquaint with various sensor network simulators and sensor network programming.
4. Identify different operating systems for the implementation and deployment of wireless sensor networks.
5. Design MAC, routing and transport protocols for wireless sensor networks.
6. Comprehend Security mechanisms attacks sensor network.

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DIGITAL IMAGE & VIDEO PROCESSING (PSE 3)

(Common to DECE, WMC)

Prerequisite: Digital Signal Processing

Course Objectives:

1. Provide fundamentals of Digital Image Processing.
2. Give the students a taste of applications of the theories taught in the subject.
3. Introduce few advanced topics in Image and Video Processing.
4. Give the students a useful skill base in the area of Image & Video Processing that creates interest in related applications.

Syllabus:

UNIT – 1: (~8Lecture Hours)

Fundamentals of Image Processing: Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Basic relationships between Pixels.

Image Transforms: Introduction to DFT, DCT, Walsh Transform, Hadamard Transform, Haar Transform & Wavelet Transform – Basics of CWT & DWT.

UNIT - 2: (~10 Lecture Hours)

Image Enhancement: Basic gray level transformations, Histogram processing, Basics of Spatial filtering, Smoothening Spatial filters, Sharpening Spatial filters, Filtering in frequency domain, Smoothening frequency domain filters, Sharpening frequency domain filters, Homomorphic filtering.

UNIT – 3: (~12 Lecture Hours)

Image Restoration: Model of Image degradation/restoration process, Periodic noise reduction by Frequency domain filtering, Linear position Invariant degradations, Estimating the Degradation function, Inverse filtering, Minimum mean square error filtering.

Color Image Processing: Color fundamentals, Color models, Pseudocolor Image Processing, Basics of full Color Image Processing.

UNIT- 4: (~6 Lecture Hours)

Introduction to Video Processing: Digital Video, Sampled Video, Time varying Image formation models – Three-dimensional motion models, Geometric Image formation, Photometric Image formation, Sampling of Video signals, Filtering operations.

UNIT- 5: (~10 Lecture Hours)

Image Compression: Lossless Coding – Introduction, Basics of Lossless Image Coding, Lossless Symbol Coding, Lossless Coding standards, Fundamentals of Vector Quantization – Introduction, Theory of Vector Quantization, Design of Vector quantizers, VQ implementations, JPEG Lossy Image Compression – Introduction, Lossy JPEG Codec structure (Encoder & Decoder).

Video Compression: Introduction to Video Compression, Video compression application requirements, Video Compression techniques – Entropy & Predictive

coding, Block transform coding, Discrete Cosine Transform, Quantization, Motion compensation & estimation, Video Encoding Standards and H.261.

TEXT BOOKS:

1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", 3rd Edition, Pearson.
2. Al Bovik, "Handbook of Image and Video Processing", Academic Press.
3. Yao Wang, Joem Ostermann and Ya–quin Zhang, "Video Processing and Communications", 1st Edition, PHI.

REFERENCE BOOKS:

1. A Murat Tekalp, "Digital Video Processing", Pearson, 2010.
2. A K Jain, "Fundamentals of Digital Image Processing", PHI, 1989.
3. S Jayaraman, S Esakkirajan, T Veerakumar, "Digital Image Processing", TMH, 2010.
4. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing using MATLAB", 2nd Edition, McGraw Hill Education, 2010

ONLINE RESOURCES:

1. http://nptel.ac.in/courses/117105079/
2. http://nptel.ac.in/courses/117104069/
3. http://nptel.ac.in/courses/117104020/

Course Outcomes:

At the end of the course the student should be able to

1. Analyze various advanced Image transforms.
2. Understand different techniques employed for the Enhancement of images both in Spatial & Frequency domain.
3. Explore image degradation and various restoration techniques.
4. Study the concepts of Colour Image Processing.
5. Demonstrate the basic concepts in Video Processing.
6. Compare the various Image and Video Compression Techniques.

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NETWORK SECURITY AND CRYPTOGRAPHY (PSE 3)

Prerequisites: Computer Networks.

Course Objectives:

1. To understand the fundamentals of Cryptography
2. To acquire knowledge on standard security services and mechanisms used to provide confidentiality, integrity and authenticity.
3. To understand the various key distribution and management schemes.
4. To understand how to deploy encryption techniques to secure data in transit across data networks.

Syllabus:

UNIT – 1: (~8 Lecture Hours)

Introduction: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security.

Classical Encryption Techniques: Symmetric cipher model, Substitution Techniques, Transposition techniques, Rotor machines, Steganography

Modern Techniques: Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis.

UNIT – 2: (~8 Lecture Hours)

Advanced Encryption Standard: The origin of AES, AES structure, AES Key expansion

Block Cipher Operation: Triple DES, Modes of operation: ECM, CBC, CFB, OFM, Counter mode

Conventional Encryption: Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

UNIT – 3: (~10 Lecture Hours)

Number Theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for Primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

UNIT – 4: (~10 Lecture Hours)

Hash functions: Applications, two simples Hash functions, requirements and security, hash functions based on cipher block chaining, SHA, SHA-3

Message Authentication and Hash Functions: Authentication requirements and functions, Message Authentication codes, Security of MACs , HMAC

Digital signatures and Authentication protocols: Digital signatures, Digital signature standards

Key management & Distribution: Symmetric key distribution, Distribution of public keys, X.509 Certificates.

UNIT – 5: (~10 Lecture Hours)
User Authentication Applications: Kerberos **Web Security**: Web Security requirements, Secure sockets layer and Transport layer security
Electronic Mail Security: Pretty Good Privacy, S/MIME.
IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management.

TEXT BOOKS:
1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education, 5th Edition.
2. Network Security Essentials (Applications and Standards) - William Stallings Pearson Education.

REFERENCE BOOKS:
1. Eric Maiwald, "Fundamentals of Network Security", Dreamtech press.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security - Private Communication in a Public World", Pearson/PHI.
3. Whitman, Thomson, "Principles of Information Security".
4. Robert Bragg, Mark Rhodes, "Network Security: The complete reference", TMH
5. Buchmann, Springer, "Introduction to Cryptography".

ONLINE REFRENCES:
1. http://www.cse.wustl.edu/~jain/
2. http://nptel.ac.in/syllabus/106105031/
3. https://onlinecourses.nptel.ac.in/noc18_cs07/preview

Course Outcomes:
At the end of the course, the students will be able to-
1. Identify some of the factors driving the need for network security.
2. Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
3. Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.
4. Effectively apply relevant standards, ethical considerations, and an understanding of privacy issues to designing secure networks.
5. Understand the standard security services and mechanisms used to provide confidentiality, integrity and authenticity.
6. Apply the knowledge and abide by the legal framework that governs computer and information systems.

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MIMO SYSTEMS (PSE 3)
(Common to DECE, WMC)

Prerequisite: Detection and Estimation Theory.

Course Objectives:
1. To understand basic requirement of MIMO systems.
2. To develop channel modeling for MIMO.
3. To calculate capacity of wireless channels.
4. To multiplexing capabilities and architectures of MIMO channel.

Syllabus

UNIT-1: (~9 Lecture Hours)
Point-to-Point Communication: Detection, Diversity and Channel Uncertainty: Detection in a Rayleigh fading channel – non-coherent detection coherent detection, from BPSK to QPSK: exploiting the degrees of freedom, diversity. Time diversity – repetition coding, beyond repetition coding, time diversity in GSM. Antenna diversity – receive diversity, transmit diversity: space-time codes, MIMO: a 2 × 2 example. Frequency diversity – basic concept, single-carrier with ISI equalization, direct sequence spread spectrum, orthogonal frequency division multiplexing.

UNIT -2: (~9 Lecture Hours)
Capacity of Wireless Channels: AWGN channel capacity - repetition coding, packing spheres, Capacity. Resources of the AWGN channel - continuous-time AWGN channel, power and bandwidth, bandwidth reuse in cellular systems. Linear time-invariant Gaussian channels, single input multiple output (SIMO) channel, multiple input single output (MISO) channel, frequency-selective channel. Capacity of fading channels – slow fading channel, receive diversity, transmit diversity, time and frequency diversity, fast fading channel, transmitter side information, frequency-selective fading channels.

UNIT -3: (~9 Lecture Hours)
Spatial Multiplexing and Channel Modeling: Multiplexing capability of deterministic MIMO channels – capacity via singular value decomposition, rank and condition number. Physical modeling of MIMO channels, line-of-sight SIMO channel, line-of-sight MISO channel, antenna arrays with only a line-of-sight path, geographically separated antennas, line-of-sight plus one reflected path. Modeling of MIMO fading channels – Basic approach, MIMO multipath channel, angular domain representation of signals, angular domain representation of MIMO channels, statistical modeling in the angular domain, degrees of freedom and diversity, dependency on antenna spacing, IID Rayleigh fading model.

UNIT-4: (~9 Lecture Hours)
Capacity and Multiplexing Architectures: The V-BLAST architecture. Fast fading MIMO channel – capacity with CSI at receiver, performance gains, full CSI. Receiver

architectures – linear decorrelator, successive cancellation, linear MMSE receiver, information theoretic optimality. Slow fading MIMO channel. D-BLAST: an outage-optimal architecture – Sub-optimality of V-BLAST, coding across transmit antennas: D-BLAST.

UNIT - 5: **(~9 Lecture Hours)**

Multiuser Communication: Uplink with multiple receive antennas – space-division multiple access, SDMA capacity region, system implications, slow fading, fast fading, multiuser diversity revisited. MIMO uplink – SDMA with multiple transmit antennas, system implications, fast fading. Downlink with multiple transmit antennas, degrees of freedom in the downlink, upink-downlink duality and transmit beamforming, precoding for interference known at transmitter, precoding for the downlink, fast fading. MIMO Downlink.

TEXT BOOKS:

1. David TsePramodViswanath, "Fundamentals of Wireless Communication", 1st Edition, Cambridge University Press, 2014.
2. MohinderJanakiraman, "Space - Time Codes and MIMO Systems", Artech House Publishers, 2004.

REFERENCE BOOKS:

1. Claude Oestges, Bruno Clerckx, "MIMO Wireless Communications: From Real-world Propagation to Space-time Code Design",Academic Press, 1stedition, 2010.
2. Togla M. Duman, Ali Ghrayeb, "Coding for MIMO Communication Systems", John Wiley & Sons Ltd, 2007.
3. Hamid Jafarkhani, "Space Time coding –Theory and Practice", Cambridge University press, 2005.

ONLINE REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc16_ec11/course
2. http://nptel.ac.in/courses/117104115/34
3. http://nptel.ac.in/courses/117104099/

Course Outcomes:

At the end of this course, students will be able to

1. Perform Mathematical modeling of a MIMO systems.
2. Analyze the performance of different diversity techniques.
3. Derive channel capacity of a MIMO system.
4. Apply the Space-Time coding in MIMO system.
5. Comprehend multi-user communication in MIMO.
6. Identify the appropriate multiplexing architecture for the given environment.

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COGNITIVE RADIO (PSE 4)

Prerequisite: Detection and Estimation Theory

Course Objectives:

1. To explore the principle of cognitive radio.
2. To develop techniques for spectrum hole detection.
3. To study the models and techniques for efficient utilization of spectrum

Syllabus:

UNIT –1: (~7 Lecture Hours)
Introduction to Cognitive Radios: cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.
Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross layer design for cognitive radio networks.

UNIT – 2:(~7 Lecture Hours)
Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).

UNIT – 3: (~10 Lecture Hours)
Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

UNIT – 4: (~12 Lecture Hours)
Dynamic Spectrum Access and Management: cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

UNIT – 5: (~10 Lecture Hours)
Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory) and classification of auctions (single auctions, double auctions, concurrent, sequential)

TEXTBOOKS:
1. Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.

2. Kwang-Cheng Chen, Ramjee Prasad, “Cognitive radio networks”, John Wiley & Sons Ltd., 2009.
3. Bruce Fette, “Cognitive radio technology”, Elsevier, 2nd edition, 2009.

REFERENCE BOOKS:

1. HuseyinArslan, “Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems”, Springer, 2007.
2. Francisco Rodrigo Porto Cavalcanti, Soren Anderson, “Optimizing Wireless Communication Systems” Springer, 2009.
3. Linda Doyle, “Essentials of Cognitive Radio”, Cambridge University Press, 2009.

ONLINE REFERENCES:

1. https://www.youtube.com/playlist?list=PL48UwQJyfW3SmrjLgl5LrVciqfWz9XazY
2. https://www.youtube.com/watch?v=09eXRHf6glA

Course Outcomes:

At the end of this course, students will be able to

1. Gain the fundamental concepts of cognitive radio networks.
2. Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
3. Identify technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.
4. Identify the fundamental issues regarding dynamic spectrum access.
5. Analyze the radio-resource management and trading in cognitive radio network.
6. Investigate optimization techniques for better spectrum exploitation.

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4G TECHNOLOGIES (PSE 4)

Prerequisite: Wireless and Mobile Communications.

Course Objectives:
The objectives of the course 4G Technologies are
1. To know about Second Generation, Third Generation Cellular technologies.
2. To study the Evolution Generation (2.5G) technology platforms.
3. To study various 4G technologies like OFDM, MC-CDMA etc.
4. To understand UWB wireless channels, channel modelling for micro, pico cells.

UNIT – 1: (~10 Lecture Hours)
2G technology: Second Generation (2G): Overview, Enhancements over 1G Systems, Integration with Existing 1G Systems, GSM, IS-136 System Description, IS-95 System Description, iDEN (Integrated Dispatch Enhanced Network), CDPD.
Third Generation (3G): Overview, Introduction, Universal Mobile Telecommunications Service (UMTS), UMTS Services, The UMTS Air Interface, Overview of the 3GPP Release 1999 Network Architecture, Overview of the 3GPP Release 4 Network Architecture, Overview of the 3GPP Release 5 All-IP Network Architecture, Overview CDMA2000, TD-CDMA, TD-SCDMA, Commonality Between WCDMA, CDMA2000, TD-CDMA and TD-SCDMA.

UNIT – 2: (~7 Lecture Hours)
The Evolution Generation (2.5G): What Is 2.5G?, Enhancements over 2G, Technology Platforms, General Packet Radio Service, (GPRS), Enhanced Data Rates for Global Evolution (EDGE),High-Speed Circuit Switched Data (HSCSD), CDMA2000 (1XRTT), WAP, SMS, Migration Path from 2G to 2.5G to 3G.

UNIT – 3: (~9 Lecture Hours)
4G Technology: Fundamentals of 4G, Advantages and Applications of 4G, Technology path, IMS, Convergent Devices, Advanced Broadband Wireless Access, Multimedia (Mobile TV), Business Requirements.
OFDM: Timing and frequency offset in OFDM, Fading channel estimation for OFDM signals, Space-Time coding with OFDM signals, Layered Space-Time coding for MIMO OFDM, PAPR Reduction of OFDM signals.
UNIT – 4: (~10 Lecture Hours)
MC-CDMA : Signal Structure, Downlink Signal, Uplink Signal, Spreading Techniques, Detection Techniques, Pre- Equalization, Combined Equalization , Soft Channel Decoding Flexibility in System design, Performance Analysis, MC-DS-CDMA, Signal Structure, Downlink Signal, Uplink Signal, Spreading, Detection Techniques, Performance Analysis.
Hybrid Multiple Access Schemes: Orthogonal Frequency Division Multiple Access (OFDMA), Single - Carrier FDMA (SC-FDMA), OFDMA with Code Division Multiplexing (SS-MC-MA).

UNIT – 5: (~10 Lecture Hours)

UWB: Ultra Wide Band Radio, The UWB channel, Coded UWB schemes, Multiuser detection in UWB radio, UWB with space–time processing.

Channel Modelling and Measurements for 4G: Macrocellular environments (1.8 GHz), urban spatial radio channels in macro/microcell (2.154 GHz), MIMO channels in microcell and picocell environments (1.71/2.05 GHz), Outdoor mobile channel (5.3 GHz), Microcell channel (8.45 GHz), Wireless MIMO LAN environments (5.2 GHz).

TEXT BOOKS:

1. Clint Smith, P.E., Daniel Collins, "3G Wireless Networks", 2nd ed., McGraw-Hill, 2007.
2. Savo G. Glisic, "Advanced Wireless Communications: 4G Cognitive and Cooperative Broadband Technology", 2nd ed., University of Oulu, Finland, John Wiley & Sons, Ltd, 2007.
3. K.Fazel, S.Kaiser, "Multi-Carrier and Spread Spectrum Systems: From OFDM and MC-CDMA to LTE and WiMAX", 2nd ed., John Wiley & Sons, Ltd, 2008.

REFERENCE BOOKS:

1. UpenaDalal, "Wireless Communication", Oxford University Press, 2009.
2. Simon R. Saunders, Alejandro Aragon-Zavala, "Antennas and Propagation for Wireless Communication Systems", 2nded.,2008.

ONLINE RESOURCES:

1. http://www.3glteinfo.com/lte-tutorial-free-online-lte-training-courses/
2. https://www.gta.ufrj.br/ensino/eel879/trabalhos_vf_2014_2/rafaelreis/introduction.html
3. http://www.radio-electronics.com/info/rf-technology-design/ofdm/ofdma-cdma.php

Course Outcomes:

At the end of the course, the students will be able to

1. Explain and compare Second and Third Generation technologies, their architectures.
2. Describe improved version of 2G technology i.e., evolution Generation (2.5G).
3. Define 4G technologies, their applications in modern wireless communication systems.
4. Evaluate the performance of OFDM system in fading environment.
5. Differentiate various hybrid multiple access schemes used in 4G systems.
6. Demonstrate the knowledge about UWB wireless channels.

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ADVANCED DIGITAL SIGNAL PROCESSING (PSE 4)
(Common to DECE, WMC)

Prerequisite: Digital Signal Processing.

Course Objectives:

1. To implement Digital filter Structures.
2. To analyze the effects of finite word length effects in Filter implementation..
3. To understand Multirate digital signal processing and Applications.
4. To have in-depth knowledge of Linear Prediction and power spectral estimation methods.

Syllabus

UNIT – 1: (~10 Lecture Hours)
Digital filters: Theory of FIR, IIR digital filters and their differences, Structures for FIR Systems-Lattice Structure, Structures for IIR Systems-Lattice and Lattice-ladder.

Finite word length effects in digital Filters: Analysis of direct form IIR structures, scaling in fixed point implementation of IIR systems, analysis of direct form FIR systems, limit cycles due to round off & truncations, limit cycles due to overflow, avoiding limit cycles.

UNIT – 2:(~10 Lecture Hours)
Multirate Digital Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter design and Implementation for Sampling – Rate conversion- Direct –Form FIR Filter Structures, Polyphase filter structures. Multistage Implementation of Sampling Rate Conversion.
Applications of Multi Rate Signal Processing: Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Digital Filter Banks, Sub-band Coding of Speech Signals, Quadrature Mirror Filters, Trans-multiplexers, Over Sampling A/D and D/A Conversion.

UNIT – 3: (~8 Lecture Hours)
Linear Prediction and Optimum Linear filters: Representation of Stationary Random Process-Rational Power Spectra, Relationships between the filter parameters and Autocorrelation Sequence. Forward and Backward linear Prediction, Solution of Normal Equations-Shur Algorithm, AR Lattice and ARMA lattice ladder filters, Wiener filters for filtering and prediction.

UNIT – 4: (~10 Lecture Hours)
Non-Parametric Methods of Power Spectral Estimation: Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch &

Blackman-Tukey methods, Performance Characteristics of Nonparametric Power Spectrum Estimators. Computational Requirements of Non-Parametric Power Spectrum Estimates.

UNIT – 5: (~8 Lecture Hours)

Parametric Methods of Power Spectrum Estimation: Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA Model for Power Spectrum Estimation, ARMA Model for Power Spectrum Estimation.

TEXT BOOKS:

1. John G. Proakis and Dimitris C. Manolakis, "Digital Signal Processing Principles, Algorithm and Application", Prentice Hall of India, Pvt. Limited, 1996.
2. Alan V. Oppenheim, Ronald W. Schaffer, John R. Buck, "Discrete Time Signal Processing", Pearson, 2rd Ed.
3. Emmanuel C. Ifeachor, Barrie W. Jervis. Addison-Wesley, "Digital Signal Processing: A Practical Approach", 1993.

REFERENCE BOOKS:

1. S. M .Kay, "Modern spectral Estimation techniques", PHI, 1997.
2. P.P. Vaidyanathan "Multi Rate Systems and Filter Banks", Pearson Education.
3. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, "Digital Signal Processing", 2000, TMH.

ONLINE REFERENCES:

1. http://nptel.ac.in/courses/117102060/
2. http://nptel.ac.in/courses/117101123/

Course Outcomes:

At the end of this course, students will be able to

1. Design and Analyse the digital filters.
2. Acquire the basics of Multi rate digital signal processing and applications.
3. Understand the concepts of Linear Prediction.
4. Analyse the different Power Spectrum Estimation methods.
5. Comprehend the Finite word length effects in DSP Systems.

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ADVANCED COMMUNICATIONS SYSTEMS LABORATORY (PCL 3)

Course Objectives:
1. Understand the Spread Spectrum Systems concepts.
2. To study ATM technology in B-ISDN.
3. To understand basic requirements of MIMO systems.
4. To implement MIMO-OFDM system in modern wireless communications.

Experiments:
1. To study the operation of Direct - Sequence Spread Spectrum Modulation and Demodulation technique.
2. To study the operation of Frequency - Hopping Spread Spectrum Modulation and Demodulation technique.
3. To study the operation of CDMA in multi-user channel.
4. Implementation of matched filter.
5. OFDM Transceiver design using SDR
6. **ATM: A connection oriented cell switching technology**: Study the effect of Peak Cell Rate (per Sec) and Cell Delay Variation Tolerance on the performance of an ATM Networks.(Netsim)
7. **Applications: Network Applications, Performance and Analysis** Analyze the effect of different applications as data, CBR and VBR on network Performance (Netsim)
8. Measurement of effect of Inter Symbol Interference
9. To find MIMO Channel Capacity using Matlab.
10. Simulation of Alamouti coding using Matlab
11. Simulation of Pilot based channel estimation using Matlab.
12. Implementation of Linear multi user detection techniques using Matlab.
13. Measurement of PAPR in OFDM using Matlab.
14. Implementation of MIMO-OFDM using Matlab.

Course Outcomes:
At the end of this course, students will be able to
1. Implement CDMA Technique in multi-user environment.
2. Measure Peak Cell Rate (per Sec) and Cell Delay Variation Tolerance (CVDT) for ATM networks.
3. Analyze the effect of different class of services such as CBR and VBR on network Performance.
4. Measure channel capacity of MIMO system.
5. Design OFDM Transceiver using Software Radio.
6. Develop solutions to PAPR issue in OFDM systems

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WIRELESS SENSOR NETWORKS LAB (PCL 4)

Prerequisite: Adhoc Wireless networks, Sensor networks, basics of programming.

Lab Objectives:
1. Familiarize to get an exposure on working with real time sensor motes
2. Expertise to work with arduino and raspberry pi.
3. Introduce the students to upload sensor data to the internet.
4. Understand working with real time signals using LABView.

Experiments
1. a. Program to turn LED0 ON and OFF at 4MHz.
   b. Program to turn LED1 ON and OFF at 1MHz.
   c. Program to turn LED2 ON and OFF at 2MHz.
2. Program to broadcast a string “Hello”.
3. Program to broadcast a string “Hello” and get the acknowledgement.
4. Experimentation on sensor boards.
5. Experimentation on Data aggregation of sensor data.
6. Experimentation to analyse packet loss with varying distance Indoor and outdoor.
7. Implementation of any clustering algorithm.
8. Program to acquire temperature, humidity of room and display on LCD using arduino.
9. Program to implement automatic plant watering system.
10. Program to transfer sensor data wirelessly using arduino and Xbee.
11. Program to connect arduino to Thingspeak.
12. Program to acquire data on raspberry pi.
13. Program to connect raspberry pi to Thingspeak.
14. Acquire real time data to LABView using NI myDAQ.
15. Generating a control signal in LABView to operate a device using NI my DAQ.

Instructions:
A. Minimum of 10 Experiments have to be conducted.
B. 1 to 7 are to be conducted on sensor motes.
C. 8 to 11 are to be conducted on Arduino boards.
D. 12 & 13 are to be conducted on raspberry pi.
E. 14 & 15 are to be conducted using LABView and NI myDAQ.

Text Books:

1. Tiny OS Programming by Philip Levis, David Gay Cambridge University Press.

Online References:

1. https://www.youtube.com/watch?v=CoJgQfRkqa4
2. http://tinyos.stanford.edu/tinyos-wiki/index.php/TinyOS_Tutorials

Course Outcomes:

At the end of the course, the students will be able to

1. Acquaint with the knowledge of programming in nesC.
2. Understand programming of sensor motes.
3. Familiarity with the programming of arduino and raspberry pi.
4. Understand and build the skills require to upload sensor data to the Internet.
5. Demonstrate knowledge on working with real-time signals using LABView.

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SANSKRIT FOR TECHNICAL KNOWLEDGE
(Common to all streams)
AUDIT COURSE -2

Prerequisites:-

Course Objectives:

1. To get a working knowledge in Illustrious SANSKRIT, the scientific language in the world.
2. To improve brain functioning.
3. To enhance the memory power to develop logic in Mathematics, Science and other subjects.
4. To explore the huge treasure of knowledge that is hidden in the ancient literature.

UNIT 1 : (~6 Lecture Hours)

Alphabets in SANSKRIT: Varnamala–Vowels (Swaraaha) and consonants (Vyanjanaani) – samyuktavarnaaha (compound letters) – Varna vishleshanam (Disjoining of letters) – Varna samshleshanam(Joining of letters) - Practise of simple words – Three genders – Pumlingam (MasculineGender) – Streelingam (FeminineGender) – Napumsaka lingam (Neutral Gender) – The forms of Nouns – Singular & Plural

UNIT 2 : (~6 Lecture Hours)

Pronouns & Demonstrative pronouns (Sarvanaamashabdaaha) Eshaha, Yeshaa&Yetat– Question words – Five Ws & one H (Kim, kadaa, kutra, Kaha, Kimartham&Katham) Different forms of verbs – Tenses – Present – Past & Future Tenses.

UNIT 3 : (~6 Lecture Hours)

Propositions (Vibhaktis) – Prathama – Dwitiya – Truteeya – Chaturthee – Panchami – Shashtee – Saptami – Sambodhana Prathama
The Three Purushas – Prathama (RamahaRaamouRaamaaha) – Madhyama (twamYuvaamYooyam) – Uttama(AhamAawaamVayam)

UNIT 4 : (~6 Lecture Hours)

Order (Subject – Verb – Object) karta – Kriya – karma.
Introduction of Roots – Ancient literature on Science & Technology in SANSKRIT language - Scope of SANSKRIT in India – Technical information about SANSKRIT Literature.- Technical concepts of Engineering.

UNIT 5 : (~6 Lecture Hours)

Technical concepts of Engineering – Electrical, Mechanical, Architecture and Mathematics - Role of SANSKRIT in the field of Science & Technology. Scope of SANSKRIT as a powerful & alternative tool in the field of Computer Science.

SUGGESTED READING:

1. Dr. Vishwas, “ABHYAAS PUSTAKAM”, Samskrutha Bharati Publications, New Delhi.
2. Vempati Kutumba Shastri, “Teach Yourself SANSKRIT, Prathama Deeksha”, Rashtriya Sanskrit Sansthan, NewDelhi Publications.
3. Suresh Soni, “India’s glorious Scientific Tradition”, Ocean Books Pvt. Ltd., NewDelhi.

Course Outcomes:

At the end of the course, students will be able to

1. Gain knowledge in basic SANSKRIT language.
2. Understand the ancient SANSKRIT literature about Science & Technology.
3. Develop logical and analytical skills.

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VALUE EDUCATION
(Common to all streams)
AUDIT COURSE -2

Prerequisites: -

Course Objectives:
1. Understand value of Education and self-development.
2. Imbibe good values in students
3. Know the importance of character

UNIT 1 : (~5 Lecture Hours)
Values and self – development – Social values and Individual attitudes. Work ethics, Indian vision of humanism.
- Moral and non – moral Valuation. Standards and principles.
- Value judgements
- Importance of cultivation of values.

UNIT 2 : (~6 Lecture Hours)
- Sense of duty, Devotion, Self – reliance. Confidence, Concentration, Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism, Love for nature, Discipline

UNIT 3 : (~5 Lecture Hours)
Personality and Behaviour Development – Soul and Scientific attitude. Positive thinking. Integrity and Discipline.
- Punctuality, Love and Kindness.
- Avoid Fault Thinking.
- Free from anger, Dignity of labour

UNIT 4 : (~5 Lecture Hours)
Universal brotherhood and religious tolerance.
- True friendship
- Happiness Vs suffering, love for truth.
- Aware of self - destructive habits.
- Association and Cooperation.
- Doing best for saving nature.

UNIT 5 : (~6 Lecture Hours)
- Character and Competence – Holy books Vs Blind faith.
- Self-management and Good Health.
- Science of Reincarnation.
- Equality, Nonviolence, Humility, Role of Women.
- All religions and same message.

- Mind your Mind, Self- control.
- Honesty, Studying effectively.

SUGGESTED READING:

1. Chakroborty, SK. "Values and Ethics for Organizations – Theory and Practice", - Oxford University Press, New Delhi.

ONLINE RESOURCES:

1. http://nptel.ac.in/courses/109104068/36
2. http://nptel.ac.in/courses/109104068/37

Course outcomes:

At the end of the course, Students will be able to

1. Gain knowledge on self-development.
2. Learn the importance of Human Values.
3. Develop overall personality.

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CONSTITUTION OF INDIA
(Common to all streams)
AUDIT COURSE -2

Prerequisites: -

Course Objectives:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT 1 :(~8 Lecture Hours)
History of making of the Indian Constitution & Philosophy of the Indian Constitution.
History of making of the Indian Constitution: History, Drafting Committee (Composition & Working).
Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT 2 :(~6 Lecture Hours)
Contours of Constitutional Rights and Duties : Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT 3 :(~6 Lecture Hours)
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions- Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT 4 :(~6 Lecture Hours)
Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati Raj : Introduction, PRI : ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role, Block Level : Organizational Hierarchy (Different departments), Village level : Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT 5 :(~6 Lecture Hours)
Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

SUGGESTED READING:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr.S.N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1st edition, 2015.
3. M.P. Jain, "Indian Constitution Law", 7th Edition, Lexis Nexis, 2014.

ONLINE RESOURCES:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

Course Outcomes:

At the end of the course, the students will be able to

1. Get the clarity and idea about function of Indian constitution.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Grab the knowledge of union government & their powers and function.
4. Understand state and central policies, fundamental duties.
5. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
6. Understand Electoral Process, special provisions.

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STRESS MANAGEMENT BY YOGA
(Common to all streams)
AUDIT COURSE -2

Prerequisites:-

Course Objectives:
1. Creating awareness about different types of Stress and role of Yoga in the management of Stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by Yoga practice.

UNIT 1 :(~4 Lecture Hours)
- Meaning and definition of Yoga.
- Historical perspective of Yoga.
- Principles of Astanga Yoga by Patanjali.

UNIT 2 :(~4 Lecture Hours)
- Meaning and definition of Stress.
- Types of Stress-Eustress and Distress.
- Anticipatory Anxiety and Intense Anxiety and depression.
- Meaning of Management- Stress Management.

UNIT 3 :(~8 Lecture Hours)
- Concept of Stress according to Yoga.
- Stress assessment methods.
- Role of Asana, Pranayama and Meditation in the management of stress.

UNIT 4 :(~8 Lecture Hours)
Asanas:: (5 Asanas in ach posture)
- Warm up.
- Standing Asanas.
- Sitting Asanas.
- Prone Asanas.
- Supine asanas.
- Surya Namaskar.

UNIT 5 : (~8 Lecture Hours)
Pranayama:
- Anulom and Vilom Pranayama.
- Nadishudhi Pranayama.
- Kapalabhati Pranayama.
- BhramariPranayama.
- Nadanusandhana Pranayama.

Meditation techniques:

- Om Meditation.
- Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT).

SUGGESTED READING:

1. Andrews, Linda Washer , "Stress control for peace of mind, London: Greenwich Editions", 2005.
2. Author's Guide -Yoga- The science of Holistic Living, Chennai: The Vivekananda Kendra Prakashan trust.
3. Iyengar BKS, "The art of Yoga, New Delhi: Harper Collins Publishers", 2003.
4. Lalvani, Vimla , "Yoga for Stress, London: Hamlyn",1998.
5. Maguire,Imelda, "Yoga for a healthy body, London: Greenwich editions", 2005.
6. Nagendra H.R. and Nagaratna.R , "Yoga prespective in stress management", Bangalore: Swami Vivekananda Yoga prakashan, 2004.
7. Nagendra H.R. and Nagaratna.R , "Yoga practices for Anxiety and Depression", Bangalore: Swami Sukhabhogananda Yoga prakashan, 2004.
8. Sukhabhogananda, Swami , "Stress management", Bangalore: Prakashan trust, 2002.
9. Udupa, "Stress management by Yoga", New Delhi: Motilal Bandaridas Publishers pvt. Ltd., 1998.
10. Ravi Shankar N.S. , "Yoga for Health", New Delhi: Pustak Mahal, 2001.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

Course Outcomes:

At the end of the course, the students will be able to

1. Enhancement of Physical strength and flexibility.
2. Learn to relax and focus.
3. Relieves physical and mental tension
4. Improved work performance/ efficiency.

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VOICE OVER INTERNET PROTOCOL (PSE 5)

Prerequisites: Computer Networks

Course Objectives:

1. To provide detailed description regarding IPV4,IPV6 and RTP protocols.
2. To inculcate knowledge about the challenges in the implementation of VOIP and new protocols developed for its implementation.
3. To give an insight into QOS issues in VOIP and also its internetworking with other existing internet protocols.

Syllabus

UNIT –1: (~10 Lecture Hours)
Overview of IP Protocol Suite: The Internet Protocol, The Transmission Control Protocol (TCP), The User Datagram Protocol (UDP), The Real-time Transport Protocol (RTP), IP multicast, IP version 6 (IP v6), Interworking IPv4 and IPv6, The VoIP Market, VoIP Challenges.

UNIT –2: (~9 Lecture Hours)
H.323 and H.245 Standards: The H.323 Architecture, Call Signaling-Call Scenarios, H.245 Control Signaling Conference calls- The Decomposed Gateway.

UNIT –3:(~8 Lecture Hours)
The Session Initiation Protocol (SIP): SIP architecture- Overview of SIP Messaging Syntax-Examples of SIP Message sequences- Redirect Servers- Proxy Servers. The Session Description Protocol (SDP)- Usage of SDP With SIP.

UNIT –4: (~9 Lecture Hours)
VoIP and SS7: The SS7 Protocol Suite- The Message Transfer Part (MTP), ISDN User Part (ISUP) and Signaling Connection Control Part (SCCP), SS7 Network Architecture- Signaling Points(SPs)- Single Transfer Point (STP), - Service Control Point(SCP)- Message Signal Units (MSUs)- SS7 Addressing, ISUP, Performance Requirements for SS7, Sigtran- Sigtran Architecture- SCTP- M3UA Operation- M2UA Operation- M2PA Operation- Interworking SS7 and VoIP Architectures- Interworking Soft switch and SS7- Interworking H.323 and SS7.

UNIT –5:(~10 Lecture Hours)
Quality of Service (QoS): Need for QOS – End-to-end QoS, Overview of QOS solutions- The Resource reservation Protocol (RSVP)-Diffserv- The Diffserv Architecture- Multi-protocol Label Switching (MPLS)- The MPLS Architecture- MPLS Traffic Engineering- Label Distribution Protocols and Constraint- Based Routing.

TEXT BOOKS:

1. Daniel Collins, "Carrier Grade Voice over IP", 2nd ed., TMH.
2. TCP/IP Protocol Suite- Behrouz A. Forouzan, Fourth Edition, TMH.

REFERENCE BOOKS:

1. Nicholas Wittenberg ,"Understanding Voice over IP Technology", Cengage, 1st Ed., 2010.
2. Michael, F. Finnevan, "Voice Over WLANS – The Complete Guide", Elsevier, 2008.
3. Thiagarajan Vishwanathan, "Telecommunication switching systems and networks" PHI publications, 2006.

ONLINE REFERENCES:

1. http://nptel.ac.in/courses/117105081/32
2. http://nptel.ac.in/courses/117101050/29

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

1. Understand various concepts related to IPV4, IPV6 and RTP.
2. Illustrate various challenges in the implementation of VOIP and modifications required to meet these challenges.
3. Demonstrate knowledge about various protocols developed for the implementation of VOIP.
4. Analyze the message formats used in H.323 and SIP Protocols.
5. Handle the QOS requirements in VOIP and various protocols developed to ensure QOS.
6. Implement internetworking of VOIP with already existing networks.

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MULTIMEDIA COMMUNICATIONS (PSE 5)

Prerequisites: Students should have knowledge on basic source of information, digital transmission.

Course Objectives:

1. Familiarize student, the history, applications of multimedia and introduce different tools related to multimedia.
2. Build an Understanding of core multimedia technologies and standards (Digital Audio, Graphics, Video, data transmission/compression).
3. Make the student be aware of factors involved in multimedia systems performance, integration and evaluation.

Syllabus

UNIT- 1: (~10 Lecture Hours)

Introduction to Multimedia : Definition of Multimedia, components of components, research trends in multimedia, multimedia & hypermedia, World Wide Web, Overview of multimedia tools, Multimedia authoring, Graphics/ image data types, and file formats.

UNIT -2: (~8 Lecture Hours)

Color in Image and Video : Color Science – Image Formation, Camera Systems, Gamma Correction, Color Matching Functions, CIE Chromaticity Diagram, Color Monitor Specifications, Out-of-Gamut colors, White point correction, XYZ to RGB transform, Transform with Gamma Correction, L*a*b* Color model.

Color models in images – RGB color model for CRT displays, Subtractive Color : CMY Color model, Transformation from RGB to CMY, Under color removal : CMYK System, printer Gamuts.

Color models in video – Video Color Transforms, YUV color model, YIQ color model, YCbCr Color Model.

UNIT -3: (~8 Lecture Hours)

Fundamentals Concepts in Video & Audio : Basics of Video: Types of video signals, Analog video, Digital Video, HDTV.

Basics of digital audio: Digitization of sound, Nyquist Theorem, SNR, SQNR, Linear & nonlinear quantization, audio filtering, audio quality Vs data rate, synthetic sounds, quantization and transmission of audio.

UNIT- 4: (~10 Lecture Hours)

Compression Algorithms: Lossless Compression Algorithms: Run length coding, Variable length coding, Arithmetic coding, Lossless JPEG, Image Compression.

Lossy Image Compression Algorithms: Transform Coding:- KLT and DCT Coding, Wavelet based coding.

Image Compression Standards: JPEG and JPEG2000

UNIT -5: (~10 Lecture Hours)

Video Compression Techniques: Introduction to Video Compression, Video Compression based on Motion Compensation, Search for motion vectors, H.261- Intra-frame and Inter-frame coding, Quantization, Encoder and Decoder, Overview of MPEG1.

Audio Compression Techniques: ADPCM in Speech Coding, G.726 ADPCM, Vocoders – Phase Insensitivity, Channel Vocoder, Formant Vocoder, Linear Predictive Coding**.**

TEXT BOOKS:

1. Fundamentals of Multimedia – Ze- Nian Li, Mark S. Drew, PHI, 2010.
2. Multimedia Signals & Systems – Mrinal Kr. Mandal Springer International Edition 1st edition, 2009.

REFERENCE BOOKS:

1. K.R. Rao, Zorans. Bojkoric, Dragorad A.Milovanovic, "Multimedia Communication Systems – Techniques, Stds & Networks", 1st Edition, 2002.
2. John F. Koegel Bufond, "Multimedia Systems", Pearson Education (LPE), 1st Edition, 2003.
3. A. Murat Tekalp, "Digital Video Processing", PHI, 1996.
4. Yaowang, Jorn Ostermann, Ya-Qin Zhang, "Video Processing and Communications",Pearson,2002

ONLINE REFERENCES:

1. http://nptel.ac.in/courses/117105079/
2. http://nptel.ac.in/syllabus/117105083/

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

1. Get an idea of the history, applications of multimedia.
2. Get aware of tools related to multimedia, computer and multimedia networks.
3. Understand the formation of an image and various models of color in images, video.
4. Exposure to the types of video signals and digitization of audio signals and corresponding compression techniques.
5. Independently know core multimedia technologies and standards for image compressions.
6. Gain the knowledge of various video compression standards.

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MICROCONTROLLER & EMBEDDED SYSTEM DESIGN (PSE 5)

Course Objectives:

1. To conceptualize the basics of embedded systems.
2. To conceptualize the basics of organizational and architectural issues of a Microcontroller.
3. To learn programming techniques used in microcontroller.
4. To realize the interfacing of ADC, DAC, Sensors, 8255 etc. with 8051.
5. To understand fundamentals of Real time operating system(RTOS).

Syllabus:

UNIT -1: (~10 Lecture Hours)

Understanding Basic Concepts of Embedded Systems: Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems.

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off- The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators.

UNIT -2:(~9 Lecture Hours)

Designing Embedded Systems with 8 bit Microcontroller : Factor to be considered in selecting microcontroller, why 8051 controller, designing with 8051, memory organisation, registers, oscillator unit, ports, interrupts, 8051 interrupts systems, timer units, serial port, reset circuitry, power saving modes.

UNIT -3:(~10 Lecture Hours)

Programming the 8051 Microcontroller: Addressing supported by 8051 with examples, instruction sets-data transfer, arithmetic, logical, Boolean, control transfer with programs.

Embedded Systems- Applications and domain specific- Washing Machine & Automotive.

Communication Interface: On-board and External Communication Interfaces.

UNIT -4:(~10 Lecture Hours)

Real World Interfacing: Interfacing an LCD to 8051, Interfacing ADC to 8051, Interfacing sensor to 8051, Interfacing a Stepper motor, 8051 interfacing to Keyboard, Interfacing DAC, Interfacing external memory to 8051, Interfacing 8051 with 8255.

UNIT -5: (~10 Lecture Hours)

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking,

Task Scheduling, Task Communication- Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization- Task Communication/ Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

TEXT BOOKS:

1. Shibu K. V., " Introduction to Embedded Systems by McGraw Hill Education, Second Edition, 2009. (Chapters **I, II, III & V** are covered from this text book).
2. Muhammad Ali Mazidi, Janice GillispieMazidi , "The 8051 Microcontroller and Embedded Systems", Pearson Education, 2003. (Chapter **IV** is covered from this text book).

REFERENCE BOOKS:

1. Dr. K.V. K. K. Prasad, "Embedded / Real – Time Systems: concepts, design & programming", Black Book, Dreamtech press, 2011.
2. Frank Vahid & Tony Givargis, "Embedded System Design", Wiley India Edition, 2002.

ONLINE REFERENCES:

1. http://nptel.ac.in/courses/117104072/
2. https://www.coursera.org/learn/introduction-embedded-systems/lecture/5z2IZ/2-introduction-to-embedded-systems

Course Outcomes:

At the end of the course, the students will be able to

1. Understand basic structure and concepts used in embedded systems.
2. Apply the knowledge of microcontroller in embedded systems.
3. Interface microcontroller with peripherals.
4. Introduces concepts of Real – Time Operating Systems (RTOS).
5. Design, and implement an embedded system using RTOS.

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BUSINESS ANALYTICS
(Open Elective)

Prerequisites: -

Course Objectives:

1. To understand the role of business analytics within an organization.
2. To gain an understanding in usage of business analytics in formulating and solving problems using analytical and management tools in managerial decision making.
3. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization and across various sectors.

UNIT 1: (~9 Lecture Hours)
Introduction to Business Analytics: Introduction to Business Analytics Overview of Business Analytics Evolution of Business Analytics, classification of Business Analytics, Trends of Business Analytics, frame work of Business Analytics, Data for Business Analytics, Decision models, Problem solving & decision making. Business analytics process and organization. Competitive and advantages.

UNIT 2: (~8 Lecture Hours)
Statistics for Business Analytics: Organization structure of Business Analytics; Team management issues, designing information policy, outsourcing, ensuing data quality, Introduction to Data mining Descriptive Analytic tools – Statistical notation. Data Summarization methods.

UNIT 3: (~9 Lecture Hours)
Descriptive Tools: Descriptive Statistical Tools – Tables, graphs, charts, histograms, frequency distribution, relative frequency. Measures of central tendency & dispersion. Introduction to Probability theory & distributions (Binomial, Poisson & Normal) Sampling & estimation methods.

UNIT 4: (~10 Lecture Hours)
Forecasting Techniques: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting models, Forecasting Models for stationary Time series. Forecasting Models for Time series with a linear trend, Forecasting Time series for seasonality, Regression Forecasting with casual variables, selecting Appropriate Forecasting Models. Monte Carlo simulation and Risk Analysis: Monte Carlo simulation using Analytic solver platform, Newsvendor Model, Overbooking Model.

UNIT 5: (~12 Lecture Hours)
Decision Analysis: Decision Analysis: Formulating Decision problems, Decision strategies, Decision trees, value of information utility & decision making, data story

telling & Data Journalism, Recent Trends in: Embedded & collaborative business intelligence. Data warehousing & Data mining.

TEXT BOOKS:

1. Gert H.N.Laursen, Jesper Thorlund, Business Analytics for Managers: Taking Business Intelligence Beyond Reporting, Publication, Wiley Publication, 2nd Edition.
2. Al bright/Winston, Business Analytics: Data Analysis & Decision Making, Cengage Learning Publication, 5th Edition.

REFERENCE BOOKS:

1. Marc I. Schniederjans, Dara G. Schniederjans, Christopher M. Sarkey, "Business analytics Principles, Concepts, and Applications", Pearson FT Press, 1st Edition.
2. James Evans, "Business Analytics", Pearson Education, 2nd Edition.

ONLINE RESOURCES:

1. NPTEL: Business Analytics for Management Decision
   http://nptel.ac.in/courses/110105089/

Course Outcomes:

At the end of the course, the students will be able to

1. Have a knowledge of data analytics.
2. Think critically in making decisions based on data analytics.
3. Identify the befitting descriptive tool required for the business problem.
4. Identify appropriate prescriptive modeling technique for decision making.
5. Apply suitable predicative method that supports business decision making.
6. Translate data into clear, actionable insights in the decision making process

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INDUSTRIAL SAFETY
(Open Elective)

Course Objectives:

The purpose of this course is to teach the students.

1. Concepts of industrial safety and provide useful knowledge for work place safety.
2. Helps in identification, evaluation and control of the hazards.
3. Mitigate harm to people, property and the environment.

Unit- 1: (~10 Lecture Hours)

Industrial safety-Importance and objectives of safety, safety programs – components and realisation. Evolution of modern safety concept, safety policy, safety organisation. implementation of safety procedures-periodic inspection and replacement.

Unit- 2:(~8 Lecture Hours)

Accidents causes, types, results and control, mechanical and electrical hazards types, causes and preventive steps , describe salient points and factories act 1948 for health and safety ,wash rooms, drinking water layout, lights, cleanliness fire guarding etc. safety colour code, fire prevention and fire fighting equipments and methods.

Unit –3: (~10 Lecture Hours)

Fundamentals of maintenance engineering. Definition aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, types of maintenance, types of applications of tools used for maintenance, maintenance cost and its relations with replacement economy, service life of equipment.

Unit-4: (~9 Lecture Hours)

Quality and safety in maintenance: needs for quality maintenance process, maintenance work quality, use of quality control, charts in maintenance work sampling, post maintenance testing, reasons for safety problems in maintenance, guidelines to safety in maintenance work, safety officers' role in maintenance work, Protection of maintenance workers.

Unit –5: (~8 Lecture Hours)

Periodic and preventive maintenance:- Periodic inspection – concept and need, degreasing, cleaning and repairing schemes, over hauling of mechanical components, overhauling of electrical motors, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.

TEXTBOOKS:-

1. Krishnan N.N, "Safety management in industries", Jaico publishing house, Bombay, 1997.
2. H.P. Garg, S., "Maintenance Engineering", S. Chand and company.

REFERENCE BOOKS :

1. Handley.W, "Industrial safety Hand book", McGraw-Hill Book Company, 2nd Edn, 1969.
2. Higgins & Morrow , "Maintenance Engineering Handbook", Da Information Services.
3. Mc Cornick E.J, "Human Factors in Engineering and design", Tata McGraw-Hill, 1982.

Online websites/ Materials :

1. https://www.spplimited.co.in/industrial-safety-certificate-course-training-in-chennai/
2. https://onlinecourses.nptel.ac.in/noc18_mg42/preview

Course Outcomes:

At the end of the course, the students will be able to

1. Know the need for safety in industries.
2. Know about factory acts and industrial safety regulations.
3. Analyse causes and types of different hazards on their preventions .
4. Assess quality maintenance processes and maintenance work quality.
5. Assess safety practices and programs.
6. Know about periodic and preventive maintenance activities in industries.

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OPERATIONS RESEARCH
(Open Elective)

Course objectives:
The course will enable the students to:
1. Study the linear programming and non linear programming techniques used for business and engineering applications.
2. Understand the importance of dynamic programming concept in operations research
3. Know about the inventory, Game theory and waiting line model applications in real world.

UNIT 1: (~10 Lecture Hours)
Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem-Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M methods, Special cases in LP-Degeneracy, unbounded, infeasibility & alternative optima.

UNIT 2:(~8 Lecture Hours)
Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions-Northwest corner rule, least cost method and Vogel's approximation method. Optimality test by MODI method & stepping stone method.
Assignment problem: Formulation. Hungarian method for optimal solution. Solving unbalanced Assignment problem.

UNIT 3: (~8 Lecture hours)
Non-linear Programming: Introduction to non-linear programming (NLP), Convex and concave functions, NLP with one variable, Line search algorithms, Multivariable unconstrained problems, constrained problems, Lagrange Multiplier, The Karush-Kuhn-Tucker (KKT) conditions, the method of steepest ascent, convex combination method, penalty function, Quadratic programming.

UNIT 4: (~8 Lecture Hours)
a)**Dynamic programming**. Characteristics of dynamic programming. Dynamic programming approach for Coach/Shortest Path and cargo loading problems.
b) **Inventory models**. Inventory costs. Models with deterministic demand-model (a) demand rate uniform and production rate infinite, model (b) demand rate uniform and production rate finite.

UNIT 5: (~10 Lecture Hours)
a) **Games Theory**. Competitive games rectangular game saddle point, minimax (maximin) method of optimal strategies, and value of the game. Solution of games with

saddle points, dominance principle. Rectangular games without saddle point-mixed strategy for 2*2 games.

b) **Waiting lines:** Single channel –poison arrivals and exponential service times with infinite population and finite population models. Multi channel- poisson arrivals and exponential service times with infinite population

TEXT BOOKS

1. J K Sharma,"Operations Research,theory and applications", 5th edition, Macmillan India Ltd ,2013.
2. S S Rao, "Engineering optimisation – Theory and Practice", 4th Edition, John Wiley & Sons Inc., 2009.

REFERENCE TEXT BOOKS

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008.
2. F.H. Hillier and G.J. Lieberman, "Introduction to Operations Research", Tata-McGraw-Hill, 2010.
3. S.D. Sharma, "Operations Research", Kedarnnath, Ramnath & Co., Meerut, 2009.
4. V.K. Kapoor, "Operations Research", S. Chand Publishers, New Delhi, 2004.

ONLINE RESOURCES: IOR Tutorials (Interactive Operations Research Tutorial)
ONLINE COURSES: onlinecourses.nptel.ac.in

Course outcomes:

At the end of the course, the students will be able to

1. Apply linear programming models to several Engineering Applications.
2. Able to apply the concept of non linear programming.
3. In Dynamic Programming selected models were taught.
4. Apply simple mathematical models in Inventory into the real Engineering Applications.
5. Solve Game theory problems related to business applications.
6. To minimize waiting time of the customer and optimization of number of servers.

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COST MANAGEMENT OF ENGINEERING PROJECTS
(Open Elective)

Prerequisites:-

Course Objectives:
1. Give inputs in handling the cost associated with engineering projects.
2. Acquaint the practical aspects of cost management.
3. Orient the quantitative techniques applicable to cost management.

UNIT 1 :(~10Lecture Hours)
Cost Management - Introduction and importance of Cost Management, Cost Classification on the basis of behaviour (as variable, fixed and semi variable), traceability (as direct and indirect), functions (as production cost, administration cost, selling cost and distribution cost), Various cost concepts. Objectives of costing system, Traditional Costing system, Activity Based Costing (ABC), and Cost Audit.

UNIT 2 :(~07Lecture Hours)
Project Management – Project Planning,Types of Project, Stages of Project execution importance of PERT and CPM, Project crashing – Problems.

UNIT 3 :(~10 Lecture Hours)
Budgetary Control –Introduction to Budget, Concepts advantages, types of Functional budgets: Fixed and Flexible budget, Performance budget, Cash Budget and Production Budget. Introduction to Zero based budgeting, (Simple Problems on Functional based budget).

UNIT 4 :(~10Lecture Hours)
Inventory Management - Valuing the Inventory using LIFO, FIFO and Weighted Average Methods, Economic Order Quantity (EOQ), Just-in-time, Material Requirements Planning (MRP), ABC Analysis, VED Analysis and Value Chain Analysis.

UNIT 5 :(~10 Lecture Hours)
Costing for Managerial Decision Making - Factors governing pricing policy, objectives of Pricing policy, concept of transfer pricing, objectives and methods. Choosing the right Pricing method with simple problems. International Transfer Pricing. Relevant costing for make or buy and evaluation of special order.

TEXT BOOKS:

1. T. Horngren and George Foster, "Cost Accounting: A Managerial Emphasis", Charles PHI, 1st edition.
2. Anthony A.Atkinson, Robert S Kalpan "Management Accounting", et al., Pearson, 6th edition
3. N. D. Vohra, "Quantitative Techniques in Management", Tata Mc. Graw Hill, 4th edition.

REFERENCE BOOKS:

1. Blocher, Chen, Cokins, and Lin, “Cost Management: A Strategic Emphasis”
2. John K. Shank and Vijay Govindarajan , “Strategic Cost Management” .

ONLINE RESOURCES:

NPTEL

1. Managerial Accounting: http://nptel.ac.in/courses/110101004/24

Course Outcomes:

At the end of the course, the students will be able to

1. Perceive the cost associated in managing engineering projects.
2. Prepare budgets for engineering projects.
3. Enumerate and effectively handle the inventory management in reducing the project management cost.
4. Envelope the cost associated in price fixation of the projects.
5. Orient the cost management decision-making using quantitative methodology in minimizing the cost associated with the projects.
6. Furnish effective cost management practices for better handling of engineering projects.

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COMPOSITE MATERIALS

(Open Elective)

Prerequisites: Basic understanding of materials and mechanical properties

Course Objectives:

1. Learn to demonstrate a critical understanding of composite materials of their nature and application.
2. Critically evaluate the types of reinforcements and their advantages in application.
3. Develop an understanding of different types of metal matrix composites and their preparation.
4. Develop an understanding of different types of ceramic matrix composites and their preparation.
5. Develop an understanding of different types of polymer matrix composites and their preparation.
6. Critically evaluate strength of the composite materials through Laminar study.

UNIT–1: (~9 Lecture Hours)
INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – 2: (~9 Lecture Hours)
REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – 3:(~9 Lecture Hours)
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique,Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving, properties and applications.

UNIT–4:(~8 lecture Hours)
Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding, properties and applications.

UNIT – 5:(~9 Lecture Hours)
Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygro-thermal failure. Laminate first play

failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots, stress concentrations.

TEXT BOOKS (SUGGESTED READINGS):

1. R.W.Cahn –, "Material Science and Technology", Vol 13 – Composites by VCH, West Germany.
2. WD Callister, Jr., Adapted by R.Balasubramaniam, "Materials Science and Engineering An introduction", John Wiley & Sons, NY, Indian edition, 2007.

REFERENCES:

1. Ed-Lubin, "Hand Book of Composite Materials".
2. K.K.Chawla, "Composite Materials".
3. Deborah D.L. Chung, "Composite Materials Science and Applications".
4. Danial Gay, Suong V. Hoa,and Stephen W, "Composite Materials Design and Applications".

ONLINE RESOURCES:

1. http://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Composite%20Materials/pdf/Lecture_Notes/LNm1.pdf
2. https://www.asminternational.org/documents/10192/1849770/05287G_Sample_Chapter.pdf
3. http://home.iitk.ac.in/~mohite/Composite_introduction.pdf

ONLINE COURSES:

1. https://onlinecourses.nptel.ac.in/noc18_me03/preview
2. https://www.online.colostate.edu/courses/MECH/MECH530.dot

Course Outcomes:

At the end of the course, the students will be able to

1. Students will learn different composite materials and their applications
2. Students will have capacity to integrate knowledge and to analyse, evaluate and manage the different the types of reinforcements.
3. Develop different types of metal matrix composites and prepare the same for their specific needs as engineers.
4. Develop different types of ceramic matrix composites and prepare the same for their specific needs as engineers.
5. Develop different types of polymer matrix composites and prepare the same for their specific needs as engineers.
6. Critically enhance strength of the composite materials through Laminar usage.

G.NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE (FOR WOMEN)
(AUTONOMOUS)
SHAIKPET, HYDERABAD-500104
WIRELESS AND MOBILE COMMUNICATIONS (Under ETE)

M. Tech. II Year, I Sem.

L	T	P	C
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ENERGY FROM WASTE
(Open Elective)

Course Objectives:

1. To classify various waste resources.
2. To identify various methods of waste disposal.
3. To study various energy generation methods from waste.
4. To analyze various processes of recycling of waste and environmental benefits.
5. To know the significance of managing of waste.

Unit 1: (~8 Lecture Hours)

Introduction: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW, recycling of municipal waste , Segregation of waste , Managing waste, Medical waste /Pharmaceutical waste treatment , Environmental impacts.
Solid waste: Land fill method of Solid waste disposal, Land fill classification, Types.

Unit 2: (~10 Lecture Hours)

Biomass: Pyrolysis – Types, Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications. Biomass Gasification: 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.

Unit 3: (~8 Lecture Hours)

Biomass 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 4: (~10 Lecture Hours)

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technologyand status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes.

Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Unit 5: (~8 Lecture Hours)

E-waste: e-waste in the global context- Environmental concerns and health hazards Recycling e-waste, Global trade in hazardous waste, e-waste legislation, Government regulations on e-waste management.

TEXT BOOKS:

1. Desai, Ashok V, “Non Conventional Energy” Wiley Eastern Ltd., 1990.

2. Khandelwal, K.C. and Mahdi S.S, “Biogas Technology-A Practical Hand Book Vol.I& II,” Tata McGraw Hill Publishing Co.Ltd.’ 1983.
3. Challal,D.S, “Food, Feed and Fuel from Biomass”, IBH Publishing Co.Pvt.Ltd.,1991.
4. Nicholas P.Cheremisinoff, “Handbook of Solid Waste Management and Waste Minimization Technologies”, An Imprint of Elsevier, New Delhi,2003.

REFERENCE BOOKS:

1. C.Y.WereKo-Brobby and E.B.Hagan, “Biomass Conversion and Technology” John Wiley & Sons,1996.
2. M.Dutta,B.P.Parida,B.K.Guha and T.R.Surkrishnan, “Industrial Solid Waste Management and Landfilling practice”, Narosa Publishing House, New Delhi, 1999.
3. P.Aarne Vesilind, William A.Worrell and Debra R.Reinhart, “ Solid Waste Engineering” ,Thomson Asia Pte Ltd. Singapore 2002

Course Outcomes:

At the end of the course, the students will be able to

1. Understand the methods of recycling of waste.
2. Compare the methods of waste disposal.
3. Identify different sources of energy from waste.
4. Analyze methods for management of waste.
5. Understand the global trade in hazardous waste.

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POWER FROM RENEWABLE ENERGY SOURCES

(Open Elective)

Course Objectives:

1. To introduce various types of renewable energy technologies
2. To understand the technologies of energy conversion from the resources and their quantitative analysis

UNIT 1: (~10 Lecture Hours)
Fundamentals of Solar Energy-Solar spectrum- Solar Radiation on Earth's surface- Solar radiation geometry-Solar radiation measurements- Solar radiation data- Solar radiation on horizontal and tilted surfaces. Solar Thermal conversion- Flat plate collectors- concentrated collectors- construction and thermal analysis- Solar applications- Solar ponds- Heliostat systems-water heater-air heater-solar still

UNIT 2: (~8 Lecture Hours)
Solar-Electric Power generation- Photovoltaic cells- Equivalent circuit- V-I Characteristics- Photovoltaic modules – constructional details- design considerations- Tracking- Maximum power point tracking - Solar Thermo electric conversion.

UNIT 3: (~8 Lecture Hours)
Wind Energy- Fundamentals of wind energy-power available in wind- Betz Limit Aerodynamics of wind turbine- Wind turbines- Horizontal and vertical axis turbines – their configurations- Wind Energy conversion systems

UNIT 4: (~9 Lecture Hours)
Energy from Bio Mass- Various fuels- Sources-Conversion technologies-Wet Processes – Dry Processes- Bio Gas generation – Aerobic and anaerobic digestion - Factors affecting generation of bio gas - Classification of bio gas plants-Different Indian digesters- Digester design considerations - Gasification process - Gasifiers – Applications. Geothermal Energy - sources- Hydrothermal convective - Geo-pressure resources - Petro-thermal systems (HDR) - Magma Resources-Prime Movers.

UNIT 5: (~9 Lecture Hours)
Ocean Thermal Energy Conversion Systems- Principle of operation - Open and closed cycles, Energy from Tides - Principle of Tidal Power - Components of tidal Power plants - Operation Methods - Estimation of Energy in Single and double basin systems - Energy and Power from Waves Wave energy conversion devices - Fuel Cells - Design and Principle of operation - Types of Fuel Cells - Types of Electrodes – Applications - Basics of Batteries - Constructional details of Lead acid batteries - Ni-Cd Batteries.

TEXT BOOKS:

1. John Twidell & Wier, "Renewable Energy Resources", CRC Press, 2009
2. G. D. Rai, "Non Conventional Energy sources", Khanna publishers, 2004

REFERENCE BOOKS:

1. D. P .Kothari, Singal, Rakesh and Ranjan, “Renewable Energy sources and Emerging Technologies”, PHI, 2009.
2. F. C. Treble, “Generating Electricity from Sun”, Pergamon Press, 1st Edition 1991
3. C. S. Solanki, “Solar Photovoltaics - Fundamentals- Principles and Applications”, PHI, 2009
4. S. P. Sukhatme, “Solar Energy Principles and Application”, TMH, 2009.

Course Outcomes:

After completion of this course, the student will be able to

1. Analyse solar thermal and photovoltaic systems and related technologies for energy conversion
2. Understand Wind energy conversion and devices available for it
3. Understand Biomass conversion technologies, Geo thermal resources and energy conversion principles and technologies
4. Realize Power from oceans (thermal, wave, tidal) and conversion devices
5. Understand fundamentals of fuel cells and commercial batteries.