Pabna University of Science and Technology

Pabna, Bangladesh

PUST

Faculty of Engineering and Technology

Department of

Information and Communication Engineering

ICE

Syllabus for B.Sc. (Engineering)

Session:2019-2020

Examinations

1st Year 1st Semester & 2nd Semester ⟹ 2020
2nd Year 1st Semester & 2nd Semester ⟹ 2021
3rd Year 1st Semester & 2nd Semester ⟹ 2022
4th Year 1st Semester & 2nd Semester ⟹ 2023

About the Department

The Department of Information and Communication Engineering (ICE) was founded in 2011. The goal of ICE Department is to cultivate highly-motivated and well-trained professionals who will lead the ICT arena. The Department of Information and Communication Engineering offers various specialized educational programs to create many competent engineers with profound knowledge of academic theories and practical approaches for the development of our country and all human society, in general.

The department offers both basic and advanced courses. In the Department of Information and Communications Engineering, students study basic and applied technologies related to IT as well as information processing, information systems, robotics and the diverse technologies upon which our IT society is based on. To become engineers with knowledge related to the construction and management of communication networks which serve as transmission media, software driven management, and the control of systems. They support these networks, and knowledge related to hardware design and manufacture.

The department has a number of well-constructed laboratories, namely Software Laboratory, Electrical & Electronics laboratory, Communication laboratory. Well-equipped computers are provided for the students, faculty members as well as the researchers. The department has a seminar library. Students are encouraged for academic excellence by awarding various prizes, medals and certificates in per year performances. The department also arranges co-curriculum activities among the students such as programming contests, software exhibitions, cultural events, games competitions, debates etc. in every year.

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Pabna University of Science and Technology
Academic Ordinance for Undergraduate Programmes

1. Definitions

(i) 'University' means the Pabna University of Science and Technology, abbreviated as PUST.
(ii) 'Regent Board' means the Regent Board of the University.
(iii) 'Academic Council' means the Academic Council of the University.
(iv) 'Committee of Courses' means the Committee of Courses for Undergraduate of a degree awarding Department of the University formed as per rules of the University.
(v) 'Faculty' means the Faculty of the University.
(vi) 'Academic Committee' means academic committee of the Department formed as per statute of the University.

2. Departments

The University shall have the following undergraduate degree awarding departments in the five Faculties:

(a) Faculty of Engineering and Technology

(i) Department of Computer Science and Engineering (abbreviated as CSE)
(ii) Department of Electrical and Electronic Engineering (abbreviated as EEE)
(iii) Department of Electronic and Telecommunication Engineering (abbreviated as ETE)
(iv) Department of Information and Communication Engineering (abbreviated as ICE)
(v) Department of Civil Engineering (abbreviated as CE)
(vi) Department of Architecture
(vii) Department of Urban and Regional Planning (abbreviated as URP)

(b) Faculty of Science

(i) Department of Mathematics
(ii) Department of Physics
(iii) Department of Pharmacy
(iv) Department of Chemistry
(v) Department of Statistics

(c) Faculty of Business Studies

(i) Department of Business Administration (abbreviated as B.Admin)
(ii) Department of Tourism and Hospitality Management (abbreviated as THM)

(d) Faculty of Humanities and Social Science

(i) Department of Economics
(ii) Department of Bengali
(iii) Department of Social Work (abbreviated as SW)
(iv) Department of English
(v) Department of Public Administration
(vi) Department of History and Bangladesh Studies (abbreviated as HBS)

(e) Faculty of Life and Earth Science

(i) Department of Geography and Environment

And any other Institute/Faculty/Department which may be approved by the University authority from time to time.

3. Degree Offered

The University shall offer courses leading to the award of the following undergraduate degrees in the five Faculties:

(a) Faculty of Engineering and Technology

(i) Bachelor of Science in Engineering, abbreviated as B. Sc. (Engineering)
(ii) Bachelor of Science in Architecture, abbreviated as B. Arch.
(iii) Bachelor of Science in Urban and Regional Planning, abbreviated as BURP

(b) Faculty of Science

(i) Bachelor of Science (Honours), abbreviated as B. Sc. (Honours)
(ii) Bachelor of Pharmacy (Professional), abbreviated as B. Pharm. (Professional)

(c) Faculty of Business Studies

(i) Bachelor of Business Administration, abbreviated as BBA

(ii) Bachelor of Business Administration in Tourism and Hospitality Management, abbreviated as BBA (THM)

(d) Faculty of Humanities and Social Science

(i) Bachelor of Social Science (Honours), abbreviated as BSS (Honours)
(ii) Bachelor of Arts (Honours), abbreviated as BA (Honours)

(e) Faculty of Life and Earth Science

Bachelor of Science (Honours), abbreviated as B. Sc. (Honours)

Any other degree that may be awarded by the Department on the approval of the Regent Board on the recommendation of the Faculty and the Academic Council.

4. Admission and Re-admission

Students shall be enrolled into the first year first semester of the B. Sc. (Engineering), B. Arch., BURP, B. Sc. (Honours), B. Pharm. (Professional), BBA, BSS (Honours), and BA (Honours) Degree programmes as per the University Rules and Act.

a) Eligibility

Students passing the Secondary School Certificate (SSC) examination and Higher Secondary Certificate (HSC) examination or a recognized equivalent examination in Bangladesh or abroad may be admitted to the B. Sc. (Engineering), B. Arch., BURP, B. Sc. (Honours), B. Pharm. (Professional), BBA, BSS (Honours), and BA (Honours) programmes of this University on such terms and conditions as may be determined by the University admission committee constituted by the competent authority.

b) Admission Cancellation

(i) If a newly admitted student remains totally absent without prior permission of the Registrar through the Chairman of the Department from all classes for first 02 (two) consecutive weeks after the start of first year first semester classes, his/her admission shall be cancelled on the recommendation of the Chairman of the concerned Department.

(ii) A student shall never take admission simultaneously in more than one subject of this University or in any other higher institution with an exception of Certificate/Diploma course. If the stated clause is violated, studentship, examination, and examinations' results of the reported student shall be cancelled.

c) Re-admission

(i) A student who fails to earn YGPA (including 1st and 2nd semester) less than 2.00, unless otherwise the section 4.b (i) is applicable, may be allowed to get re-admission with the 1st/2nd semester of the immediate next batch. Readmitted students, however, shall always be assigned the original registration number.

(ii) If a student fails to appear (not allowed to fill the examination entry form) at any semester final examination (other than first year first semester) due to shortage of required percentage of attendance, or failure of paying the dues of the University or for any other reason s/he shall have to get herself/himself re-admitted to the same semester of the subsequently available batch.

(iii) If a student fails to get the requisite grade points for promotion (according to clause 16) from one year to the next, may seek re-admission with the 1st/2nd semester of the subsequent available batch.

(iv) On re-admission, grades earned earlier by a student in any semester shall be cancelled automatically and the student shall have to retake all the course-works (such as class test/quiz test, internship, Viva-voce, final examination etc.) of that semester. Percentage of class attendance of such students shall be counted from the date of her/his re-admission. Class test(s) if completed before her/his re-admission, the concerned course teacher shall arrange make-up examination(s).

(v) A student shall not get chance for re-admission more than three times during the entire program.

(vi) For re-admission, a student shall have to apply within 02 (two) consecutive weeks after announcement of the result of the concerned semester.

5. Registration

A student shall attain her/his studentship for the University to an academic programme as per the University rules. S/he shall be required to register with the University through the University registration process on payment of required fees as determined by the University authority from time to time.

6. Medium of Instruction

The medium of instruction and answer in the examination script for the programmes mentioned in the section 2 shall be in English. For BA (Honours) and BSS (Honours), the medium of instruction and answer in the examination script for the programme shall be in Bangla/English.

7. Programme Duration

Each academic year is divided into two semesters to be called as first semester and second semester. Distribution of weeks in each semester shall be as follows:

(i)	Class Teaching	14 weeks
(ii)	Sessional/Laboratory Examination	01 week
(iii)	Preparation Time for Semester Final Examination	02 weeks
(iv)	Semester Final Examination	03 weeks
	Total=	**20weeks**

Normally 01 (one) week break is provided after semester final examination.

8. Syllabus

There shall be a syllabus of the programme for each batch prepared by the committee of courses as constituted by the University. The syllabus should clearly indicate the courses, and detail course contents, credit points and total number of credits in each semester and year. The syllabus shall be updated by the concerned committee of courses as and when needed by the academic committee of the concerned Department.

9. Structure of Courses

Syllabus of each Department in the five Faculties of this University shall consist theoretical, sessional/laboratory, project and or thesis works, internship and Viva-voce etc.

Course Identification

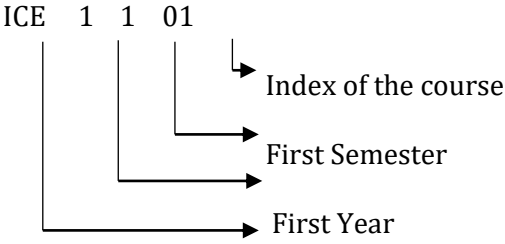
Each course is designed by three to four letter words identifying the subject followed by a four digit number as follows:

(i) The first digit corresponds to the 'year' indicated in which the course is taken by the student;

(ii) The second digit corresponds to the 'semester' in which the course is taken by the student;

(iii) The third and fourth digits shall be used to identify a 'course' within the Department.

For Example:



Subject identification (Information and Communication Engineering)

10. Credit Requirements and Contact Hours

(a) B.Sc. (Engineering), BURP, and B. Sc. (Honours) Degrees

The total credits for the 04 (four) yearsB. Sc. (Engineering), BURP,and B. Sc. (Honours) degrees and their distribution will be decided by the individual Departments. However, the following constraints are operative.

(i) Total Credits: 150-165

(ii) Maximum number of credits for sessional courses/projects/field study: 48

(iii) Maximum credits for Viva-voce: 16

(iv) There shall be at least 18 credits including Viva-voce in each semester.

(b) B. Acrh. and B. Pharm (Professional) Degrees

The total credits for the 05 (five) years B. Arch. and B. Pharm. (Professional) degrees and their distribution will be decided by the Department. However, the following constraints are operative.

(i) Total Credits: 190-230
(ii) Maximum number of credits for sessional courses/projects/field study: 60
(iii) Maximum credits for Viva-voce: 18
(iv) There shall be at least 18 credits including Viva-voce in each semester.

(c) BBA, BSS (Honours), and B. A. (Honours) Degrees

The total credits for the 04 (four) years, BBA, BSS (Honours), and B. A. (Honours)degrees and their distribution will be decided by the Department. However, the following constraints are operative.

(i) Total Credits: 140-150
(ii) Maximum number of credits for practical courses/projects/field study: 10
(iii) Maximum credits for Viva-voce: 18
(iv) There shall be at least 16.50 credits including Viva-voce in each semester.

(d) Contact Hours

There shall be at least 01 (one) lecture-hour for each credit in a week for each theoretical course and 02 (two) practical-hour for each credit in a week for each sessional/laboratory course.

11. Entry Requirements for Examination

(i) Astudent shall be allowed to appear at the semester final examination as a regular student if her/his class attendance is at least 70% of the total courses held in a semester.
(ii) Student having 60-69% attendance are considered to be non-collegiate and will be eligible to sit for the final examination on payment of fine Tk. 1000/- (One thousand) to the respective department.
(iii) A student shall not be allowed to appear at the examination if her/his class attendance is below 60% of the total courses held in a Semester.
(iv) A student is required to fill the examination entry form and pay the University dues within the time specified by the concerned authority for taking each semester final

examination. The Chairman of the Department shall send these examination entry forms to the Controller of Examinations.

12. Duration of Final Examination

(i) The semester final examination for each theory course shall be of 03 (three) hours duration. There shall be two examiners for each course in the semester final examination.

(ii) Duration of each sessional/laboratory examination will be between 4-6 hours irrespective of credits.

13. Examination Procedures

(a) Examination Schedule: At the end of each Semester, the Department shall prepare the semester final examination schedule and send it to the Controller of Examination for necessary arrangements.

(b) Formation of the Examination Committee: The Academic Committee of the Department shall recommend an examination committee for each academic year consisting of two Semester. The examination committee shall be composed of 05 (five) members (one chairman, three internal members, and an external member appointed from any other public University). In case of any vacancy, absence or inability on the part of any of the members of the examination committee, the examination work shall not be invalidated. The Chairman of the last year (last two semesters) examination committee would be the Chairman of the Department or any senior teacher of the Department.

(c) Function of the Examination Committee

(i) The examination committee shall send the names of the question setters and examiners to the Controller of Examinations who shall issue appointment letters subject to the approval of the Vice-Chancellor.

(ii) The examination committee shall arrange moderation and print the question papers.

(iii) The examination committee shall arrange the semester final examination, sessional/laboratory examination, project, thesis and Viva-voce in cooperation of the Controller of Examinations.

(d) Distribution of Answer Scripts: The Controller of Examinations shall be responsible for safe custody of answer scripts that will be distributed to the first and second examiners along with necessary supporting question, top sheet, detailed and integrated mark sheet etc. The first examiner shall receive the answer scripts with

acknowledgement from the Controller of Examinations along with necessary supporting documents (question papers, top sheet, instructions, blank mark sheets, envelops, etc.) on the date of examination. After examining the scripts, the first examiner will seal the packet of the answer scripts and send to the second examiner. After examining the answer scripts, the second examiner shall send the answer scripts back to the Controller of Examinations.

e) Tabulation: The concerned examination committee shall arrange tabulation works. The tabulation works shall not begin until marks of all courses are received. Modification of the submitted marks shall not be accepted.

f) Preservation of examination documents: After finalizing the results, the Chairman of the examination committee, shall hand over the tabulation books and the relevant answer scripts to the Controller of Examinations. All other documents related to the examination should be submitted to the Chairman of the Department.

14. Evaluation System

(a) Each course offered by the Department should be composed of 100 marks. The marking and student evaluation system will be as follows:

(i) Distribution ofmarks for each theoretical course

Thirty percent (30%) of marks of a theoretical course shall be allotted for continuous assessment, i.e. quizzes, class test, home assignments, class evaluation and class performance. The rest of the marks (seventy) will be allotted to the semester final Examination that is conducted centrally by the University. Distribution of marks for a given course is asfollows.

ClassAttendance	10%
Class Tests/Assignments/Quizzes	20%
Final Examination (3hours)	70%
Total	**100**

The number of class tests/ assignments/quizzes of a course shall be three. Evaluation of performance in the class tests/ assignments/quizzes will be on the basis of the best two class tests/ assignments/quizzes of the three class tests/assignments/quizzes. The class test, assignment, quiz etc. will be conducted and evaluated by the

course teacher and the semester final scripts will be evaluated by two (three, if needed) examiners.

(ii) Distribution of marks for sessional/laboratory course

Forty percent (40%) of marks of a sessional/laboratory course shall be allotted for continuous assessment, i.e. lab test, quizzes, home assignments, lab evaluation and lab performance. The rest of the marks (sixty) will be allotted to the semester final sessional/laboratory examination. Distribution of marks for the sessional/laboratory courses is asfollows:

Sessional/LaboratoryAttendance	10%
Lab Test/Lab Performance and Lab Report	30%
Final Sessional/Laboratory Examination	60%
Total=	**100%**

Each department shall have one external examiner (not below the rank of Assistant Professor) for any one of the sessional/laboratory examinations in each semester.

(iii) Project/Thesis: Project/Thesis marks to be evaluated as follows:

Presentation and Viva-voce (Conducted by the Examination Committee)	20%
Assessment of Supervisor	30%
Project/Thesis Examined by Two Examiners* (Average of the marks given by the two examiners shall be taken as final)	50%
Total=	**100%**

*****Two examiners to evaluate the project/thesis shall be selected by the concerned examination committee of the Department.

(iv) Class Attendance: The distribution of marks for class attendance (theoretical and sessional/laboratory) shall be as follows:

Attendance	Marks
90% andabove	10
85% to less than90%	9
80% to less than85%	8
75% to less than80%	7
70% to less than75%	6

60% to less than70%	5
Below60%	0

b) Continuous Assessment Report:

(i) At the end of the course, the course teacher shall calculate total marks of the continuous assessment (including class attendance) and prepare a marks sheet. S/he shall notify it to the students and submit the same to the Chairman of the examination committee as well as to the Controller of Examinations before start of the semester final examination.

(ii) The course teacher shall also submit the class attendance report with the register/ documents to the Chairman of the Department for percentage calculation before sending the examination entry forms to the Controller of Examinations.

c) First and Second Examiners: There shall be two question setters and examiners (first and second) for each course of the semester final examination. The course teacher shall act as first examiner. The examination committee shall select the second examiner from the "Panel of Examiners" as approved by the Academic Council.

d) Final Marks: The average of the marks given by the two examiners shall be taken as final. If the marks of two examiners are differed by 20% or more, the relevant answer script (s) will go for third examination. In that case, the average of nearest two marks will be taken as final marks. If two marks are equidistant from the other, then average of three marks will be taken as the final.

e) Submission of Mark Sheets: All examiners including teachers involved in continuous assessment, Viva-voce, etc., shall prepare 04 (four) copies of mark sheets and submit 03 (three) copies to the Chairman of the respective examination committee and 01 (one) copy to the Controller of Examinations.Total marks in each course (final examination/tutorial assignment/attendance) should be rounded-up and awarded only one grade.

f) Letter Grade and Grade Point: Total marks obtained in each course, oral (viva-voce) examination, internship etc. shall be converted into letter grade (LG)and grade point (GP) as follows:

Numerical Grade	Letter Grade		Grade point	Interpretation
80% and above	A+	(A plus)	4.00	Outstanding
75% to less than 80%	A	(A regular)	3.75	Excellent
70% to less than 75%	A-	(A minus)	3.50	Very Good
65% to less than 70%	B+	(B plus)	3.25	Good
60% to less than 65%	B	(B regular)	3.00	Satisfactory
55% to less than 60%	B-	(B minus)	2.75	Below Satisfactory
50% to less than 55%	C+	(C plus)	2.50	Average
45% to less than 50%	C	(C regular)	2.25	Pass
40% to less than 45%	D	....	2.00	Poor
less than 40%	F	...	0.00	Fail

g) Re-examination: Re-examination of any script shall not be allowed.

15. Result Publication

a) The following information shall be shown in the tabulation sheet.

(i) **Semester final result preparation**: Continuous assessment marks, semester final marks, total marks, LG and GP in each course and earned credit points secured, total credits, Grade Point Average (GPA), Yearly Grade Point Average (YGPA), Cumulative Grade Point Average (CGPA) till the semester will be calculated and placed in the tabulation book.

(ii) **Retake/Improvement result preparation:** The retake/improvement marks of the students, if any, shall be written in the original tabulation sheet by the concerned examination committee;

(iii) **Manifestation in semester final result sheet**: The semester final result sheet, which shall be published for the students, shall not show the numerical marks but shall show the LG, GP in each course, GPA and CGPA. If a student get 'F' grade in any course, it will remain permanently on the grade sheet and his/her final transcript.

b) The internal members of the examination committee shall ordinarily act as tabulators. If necessary, the Controller of Examinations on the recommendation of the relevant examination committee shall appoint tabulators from other than the members of the examination committee. The tabulators shall prepare 03 (three) sets of final result sheets and the Chairman of the examination committee shall send the final result sheets to the Controller of Examinations through the Chairman of the Department, duly signed by the tabulators. An examination statement shall be prepared by the Chairman of the examination committee and to be sent to the Controller of Examinations which shall include:

(i) Number of courses with marks and credit points;
(ii) The name of the class test/quiz/internship report/examiners with number of examinees;
(iii) The name of the question setters of each course;
(iv) The name of the script examiners/evaluators in each course with the number of scripts.
(v) The name of the question moderators.
(vi) The name of the participating members in the Viva-voce examination with the number of examinees; and
(vii) The name of the tabulators with the number of examinees. Some essential papers shall also be attached with the tabulated result sheets. Such as:
- List of evaluators of monograph/field work report/project report/internship report/etc. with the roll numbers of the students (in case of final result of the programme);
- Resolution of the examination committee with recommendation for publication of results.

c) The Controller of Examinations shall publish the results of each semester, year and the whole programme, subject to the approval of the Vice-Chancellor/Regent Board and thereafter shall send copy of the tabulation sheets duly singed by him with date to the Chairman of the concerned Department. The Controller of Examination shall also provide the transcript/grade sheet showing course-wise LG and the corresponding GP (the numerical marks shall not be shown), the CGPA, LG and the interpretation of the CGPA of the candidates. Final grade must be spelled out clearly in the certificate/ transcript.

[*Example: C+= 'C+' (C plus); A-='A-' (A minus); B='B' (B regular)*].

(i) The result of the semester final examinations (except final year second semester) shall be published **within 03 (three) weeks** from the date of last examination.

(ii) Result sheets of each examination as prepared by the Controller of Examinations shall be compared and signed by at least two tabulators.

16. Promotion

(i) All promotions from first year first semester to final year second semester shall be year based.

(ii) For promotion to the next year, a student has to score at least YGPA 2.00.

(iii) A student obtaining 'F' grade in any course shall be allowed to improve only with the available batch/batches within her/his total course duration.

17. Degree Requirements

For the B. Sc. (Engineering), BURP, B. Sc. (Honours), BBA, BSS (Honours), and BA (Honours) degrees, each student shall require to:

(i) Earn the required number of total credit points successfully;

(ii) Earn a minimum CGPA of 2.00;

(iii) Complete the programme within 07 (seven) academic years of his/her first admission year into the programme; and

For the B. Acrh. and B. Pharm (Professional) degrees, each student shall require to:

(i) Earn the required number of total credit points successfully;

(ii) Earn a minimum CGPA of 2.00 ;

(iii) Complete the programme within 8 (eight) academic years of his/her first admission year into the programme.

18. Improvement of Grades

(i) If a student obtains a grade lower than B- (B minus) in the courses allotted in any year, s/he will be allowed to repeat to sit for maximum 50% courses only once with the following batch for the purpose of grade improvement. A student failing to improve his or her grade in a course can retain the earlier grade.

(ii) **Improvement in final year first and second semester courses**: Student would be allowed to sit for improvement examination in the final year first and second semester courses only with the following batch.

19. Drop Out

(i) If a three times re-admitted student in any semester failed to earn minimum required GPA for promotion s/he shall be dropped our from the programme.

(ii) For the degrees of B. Sc. (Engineering), BURP, B. Sc. (Honours), BBA, BSS (Honours), and BA (Honours), if it seems that it is not possible for a student to complete the programme within 07 (seven) academic years (14 Semesters), s/he shall be dropped out from the programme.

(iii) For the degrees of B. Sc. (Engineering), BURP, B. Sc. (Honours), BBA, BSS (Honours), and BA (Honours), if a student fails to earn required total credit points within 07 (seven) academic years since first admission, s/he will be dropped-out from the programme.

(iv) For degrees of B. Acrh. and B. Pharm (Professional), if it seems that it is not possible for a student to complete the programme within 08 (eight) academic years (16 Semesters), s/he shall be dropped out from the programme.

(v) For degrees of B. Acrh. and B. Pharm (Professional), if a student fails to earn required total credit points within 08 (eight) academic years since first admission, s/he will be dropped-out from the programme.

20. Credit Transfer

No credit transfer from any other Programmes/Universities/Institutions to the Pabna University of Science and Technology shall be allowed for the programme.

21. Academic Administration

a) **Academic Calendar:** The academic calendar prepared by the Dean of the Faculty showing dates of beginning and closing classes, commencement of examinations and probable dates for publication of the result shall be published by the respective Departmental academic committee before commencement of

each semester. The copy shall be sent to the Controller of Examinations and the respective University authority.

b) **Academic and co-academic activities:** Within the framework of these rules and regulations and the rules of the university, the Departmental academic committee may adopt policies for strengthening the academic and co-academic activities of the Department.

22. Computation of Grade Point Average

(a) Grade Point Average:

AGrade Point Average (GPA)shall be calculated for each semester as follows:

$$\text{GPA}=\frac{\sum_{i=1}^{n} C_i * G_i}{\sum_{i=1}^{n} C_i}, \qquad \text{(i)}$$

where, n is the number of courses offered during the semester, C_i is the number of credits allotted to a particular course, and $G_i$is the grade point earned for that course.

(b) Yearly Grade Point Average:

AYearly Grade Point Average (YGPA)shall be calculated for each academic year as follows:

$$YGPA = \frac{\sum_{j=1}^{2} C_j * G_j}{\sum_{j=1}^{2} C_j}, \qquad \text{(ii)}$$

where, 2 is the number of semester, C_j is the number of credits allotted to a semester and G_j is the GPA earned for that semester.

(c) Cumulative Grade Point Average:

TheCumulative Grade Point Average (CGPA)gives the cumulative performance of the students from the first year up to the end of the year to which it refers, and will be calculated as follows:

$$CGPA = \frac{\sum_{k=1}^{m} C_k * G_k}{\sum_{k=1}^{m} C_k}, \qquad \text{(iii)}$$

where, m is the total number of years being considered, C_k is the total number of credits registered during a year, and $G_k$is the YGPA of that particular year.

22.1 Numerical Examples of computing GPA and CGPA

22.1.1 Example for Computing GPA

Say, a student completed eight courses in a semester and obtained the following grade:

Course	Credit	Grade (C_i)	Grade Points (G_i)	C_i*G_i
ICE-1111	3.00	A^+	4.00	12.00
ICE-1121	3.00	F	0.00	0.00
ICE-1131	3.00	A	3.75	11.25
ICE-1141	3.00	D	2.00	6.00
ICE -1151	3.00	A^+	4.00	12.00
ICE-1122	1.50	A^-	3.50	5.25
ICE-1132	1.50	F	0.00	0.00
ICE-1100	0.75	D	2.00	1.50
Total	**18.75**			**48**

Then, the GPA of the semester is calculated as follows:

GPA= 48.00/18.75 =2.56

22.1.2 Example for Computing YGPA

Say, a student completed two semesters in a year and obtained the following GPAs

Year	Semester	Credit C_j	GPA Earned, G_j	G_j*C_j
First	First	19.50	3.70	72.150
First	Second	20.50	3.93	80.565
	Total	40.00		**152.715**

Then, the YGPA is calculated as follows:

YGPA=152.715/40.00=3.82

22.1.3 Example for Computing CGPA

Say, a student completed four semesters and obtained the following GPAs

Year	Semester	Credit, C_k	GPA Earned, G_k	G_k*C_k
First	First	19.50	3.70	72.150
First	Second	20.50	3.93	80.565
Second	First	21.25	3.96	84.150
Second	Second	20.25	4.00	81.000
	Total	**81.5**		**317.865**

Then, the CGPA is calculated as follows:

CGPA=317.865/81.50=3.90

23. Dean's List

As a recognition of excellent academic performance, the name(s) of student(s) obtaining an average CGPA of 3.80 or above (without any improvement) shall be published after completion of the undergraduate programmes in the Dean's List in each Faculty. Students penalized/punished for any offense will not be considered for the Dean's List. Such a student will not be considered for any other academic rewards also.

24. Effect of the Ordinance

This Ordinance shall be effective from the academic session 2018-2019.

25. Amendment of the Ordinance

This Ordinance may be amended by the Academic Council on the recommendation of the five Faculties of the University.

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SUMMARY OF COURSES

B.Sc. (Engineering)courses for 1st year 1st semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credits**
1.	**ICE-1101**	Fundamentals of ICT	3.00	3.00
2.	**ICE-1102**	Fundamentals of ICT Sessional	3.00	1.50
3.	**ICE-1103**	Basic Electronics	3.00	3.00
4.	**ICE-1104**	Basic Electronics Sessional	3.00	1.50
5.	**ICE-1105**	Applied Electricity and Magnetism	3.00	3.00
6.	**ICE-1106**	Applied Electricity and Magnetism Sessional	1.50	0.75
7.	**Math-1101**	Differential Calculus and Geometry	3.00	3.00
8.	**Hum-1101**	Bangladesh Studies	3.00	3.00
9.	**ICE-1107**	Viva-voce	1.50	0.75
		Total ➔	**24**	**19.5**

B.Sc. (Engineering) courses for 1st year 2nd semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credits**
1.	**ICE-1201**	Analog Electronics	3.00	3.00
2.	**ICE-1202**	Analog Electronics Sessional	3.00	1.50
3.	**ICE-1203**	Programming with C	3.00	3.00
4.	**ICE-1204**	Programming with C Sessional	3.00	1.50
5.	**ICE-1205**	Circuit Theory and Analysis	3.00	3.00
6.	**ICE-1206**	Circuit Theory and Analysis Sessional	1.50	0.75
7.	**Math-1201**	Integral Calculus and Differential Equations	3.00	3.00
8.	**BBA-1201**	Industrial Management and Accountancy	3.00	3.00
9.	**Eng-1201**	Fundamental English	2.00	2.00
10.	**Eng-1202**	Fundamental English Sessional	2.00	1.00
11.	**ICE-1207**	Viva-voce	1.50	0.75
		Total ➔	**28**	**22.5**

B.Sc. (Engineering) courses for 2nd year 1st semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credits**
1.	**ICE-2101**	Digital Electronics	3.00	3.00
2.	**ICE-2102**	Digital Electronics Sessional	3.00	1.50
3.	**ICE-2103**	Object Oriented Programming	3.00	3.00
4.	**ICE-2104**	Object Oriented Programming Sessional	3.00	1.50
5.	**ICE-2105**	Discrete Mathematics and Numerical Methods	3.00	3.00
6.	**ICE-2106**	Discrete Mathematics and Numerical Methods Sessional	1.50	0.75
7.	**Math-2101**	Vector, Matrix and Linear Algebra	3.00	3.00
8.	**Stat-2101**	Elementary Statistics and Probability	3.00	3.00
9.	**Stat-2102**	Elementary Statistics and Probability Sessional	1.50	0.75
10.	**ICE-2107**	Viva-voce	1.50	0.75
		Total ➔	**25.5**	**20.25**

B.Sc. (Engineering) courses for 2nd year 2nd semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credits**
1	**ICE-2201**	Data Structure and Algorithm	3.00	3.00
2	**ICE-2202**	Data Structure and Algorithm Sessional	1.50	0.75
3	**ICE-2203**	Analog Communication	3.00	3.00
4	**ICE-2204**	Analog Communication Sessional	1.50	0.75
5	**ICE-2205**	Signals and Systems	3.00	3.00
6	**ICE-2206**	Signals and Systems Sessional	1.50	0.75
7	**ICE-2207**	Electromagnetic Fields and Waves	3.00	3.00
8	**Math-2201**	Complex Variable Analysis, Laplace and Fourier Transforms	3.00	3.00
9	**Stat-2201**	Sampling Distribution and Hypothesis Testing	3.00	3.00
10	**Stat-2202**	Sampling Distribution and Hypothesis Testing Sessional	1.50	0.75
11	**ICE-2208**	Viva-voce	1.50	0.75
		Total ➔	**25.5**	**21.75**

B.Sc. (Engineering) courses for 3rd year 1st semester				
Sl.	**Course Code**	**Course Title**	Contact Hrs/week	**Credits**
1	**ICE-3101**	Artificial Intelligence and Robotics	3.00	3.00
2	**ICE-3102**	Artificial Intelligence and Robotics Sessional	1.50	0.75
3	**ICE-3103**	Web Programming	3.00	3.00
4	**ICE-3104**	Web Programming Sessional	1.50	0.75
5	**ICE-3105**	Database Management Systems	3.00	3.00
6	**ICE-3106**	Database Management Systems Sessional	1.50	0.75
7	**ICE-3107**	Computer Architecture and Microcontroller Design	3.00	3.00
8	**ICE-3108**	Computer Architecture and Microcontroller Design Sessional	1.50	0.75
9	**ICE-3109**	Digital Signal Processing	3.00	3.00
10	**ICE-3110**	Digital Signal Processing Sessional	1.50	0.75
11	**ICE-3111**	Viva-voce	1.50	0.75
		Total ➔	**24**	**19.5**

B.Sc. (Engineering) courses for 3rd year 2nd semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credits**
1	**ICE-3201**	Network Programming with Java	3.00	3.00
2	**ICE-3202**	Network Programming with Java Sessional	1.50	0.75
3	**ICE-3203**	Telecommunication Engineering	3.00	3.00
4	**ICE-3204**	Telecommunication Engineering Sessional	1.50	0.75
5	**ICE-3205**	Digital Communication	3.00	3.00
6	**ICE-3206**	Digital Communication Sessional	1.50	0.75
7	**ICE-3207**	Digital Image and Speech Processing	3.00	3.00
8	**ICE-3208**	Digital Image and Speech Processing Sessional	1.50	0.75
9	**ICE-3209**	Antenna Engineering	3.00	3.00
10	**ICE-3210**	Antenna Engineering Sessional	1.50	0.75
11	**ICE-3211**	Project Design and Development	3.00	1.50
12	**ICE-3212**	Viva-voce	1.50	0.75
		Total ➔	**27**	**21**

B.Sc. (Engineering) courses for 4th year 1st semester				
Sl.	**Course Code**	**Course Title**	Contact Hrs/week	**Credits**
1	**ICE-4101**	Data Communication and Networking	3.00	3.00
2	**ICE-4102**	Data Communication and Networking Sessional	1.50	0.75
3	**ICE-4103**	Cellular and Mobile Communication	3.00	3.00
4	**ICE-4104**	Cellular and Mobile Communication Sessional	1.50	0.75
5	**ICE-4105**	Information Theory and Coding	3.00	3.00
6	**ICE-4106**	Information Theory and Coding Sessional	1.50	0.75
7	**ICE-4107**	Cryptography and Computer Security	3.00	3.00
8	**ICE-4108**	Cryptography and Computer Security Sessional	1.50	0.75
9	**ICE-41xx**	**Optional-I**	3.00	3.00
10	**ICE-4110**	Viva-voce	1.50	0.75
		Total ➔	**22.5**	**18.75**

B.Sc. (Engineering) courses for 4th year 2nd semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credits**
1.	**ICE-4201**	Wireless Communication	3.00	3.00
2.	**ICE-4202**	Wireless Communication Sessional	1.50	0.75
3.	**ICE-4203**	System Analysis and Software Testing	3.00	3.00
4.	**ICE-4204**	System Analysis and Software Testing Sessional	1.50	0.75
5.	**ICE-4205**	Neural Networks	3.00	3.00
6.	**ICE-4206**	Neural Networks Sessional	1.50	0.75
7.	**ICE-42xx**	**Optional-II**	3.00	3.00
8.	**ICE-42xx**	**Optional-II**	1.50	0.75
9.	**ICE-42xx**	**Optional-III**	3.00	3.00
10.	**ICE-4210**	Thesis	3.00	3.00
11.	**ICE-4211**	Viva-voce	1.50	0.75
		Total ➔	**25.5**	**21.75**

List of Optional Courses

Optional-I

Optional-I should be selected from the following courses:

Sl.	Course Code	Course Title	Contact Hrs./week	Credits
1.	ICE-4112	Advanced Computer Networks	3	3
2.	ICE-4113	Management Information System	3	3
3.	ICE-4114	E-Commerce and E-Governance	3	3
4.	ICE-4115	Information Security and Cyber Laws	3	3

Optional-II

Optional-II should be selected from the following courses:

Sl.	Course Code	Course Title	Contact Hrs./week	Credits
1.	ICE-4212	Microwave and Fiber Optic Communication	3	3
2.	ICE-4213	Microwave and Fiber Optic Communication Sessional	1.50	0.75
3.	ICE-4214	Computer Vision	3	3
4.	ICE-4215	Computer Vision Sessional	1.50	0.75
5.	ICE-4216	Natural Language Processing	3	3
6.	ICE-4217	Natural Language Processing Sessional	1.50	0.75
7.	ICE-4218	Design of VLSI Circuits and Systems	3	3
8.	ICE-4219	Design of VLSI Circuits and Systems Sessional	1.50	0.75

Optional-III

Optional-III should be selected from the following courses:

Sl.	Course Code	Course Title	Contact Hrs./week	Credit
1.	ICE-4220	Cloud Computing	3	3
2.	ICE-4221	Radar and Satellite Communication	3	3
3.	ICE-4222	Biomedical Engineering	3	3
4.	ICE-4223	Mobile Computing	3	3
5.	ICE-4224	Advanced Robotics	3	3

Pabna University of Science and Technology

Summary of Undergraduate Course Planfor the Degree of Bachelor of Science (B.Sc.) in Engineering in Information and Communication Engineering

Sl. No.	Year-Semester	Theory		Sessional& Others		Total Credit
		No. of Course	Credit	No. of Course	Credit	
1.	1st- 1st	5	15	4	4.50	**19.50**
2.	1st- 2nd	6	17	5	5.50	**22.50**
3.	2nd-1st	5	15	5	5.25	**20.25**
4.	2nd- 2nd	6	18	5	3.75	**21.75**
5.	3rd- 1st	5	15	6	4.50	**19.50**
6.	3rd- 2nd	5	15	7	6.00	**21.00**
7.	4th- 1st	5	15	5	3.75	**18.75**
8.	4th- 2nd	5	15	6	6.75	**21.75**
Grand Total➔		**42**	**125**	**43**	**40**	**165**

B.Sc. (Engineering) courses for 1st year 1st semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credit**
1.	**ICE-1101**	Fundamentals of ICT	3.00	3.00
2.	**ICE-1102**	Fundamentals of ICT Sessional	3.00	1.50
3.	**ICE-1103**	Basic Electronics	3.00	3.00
4.	**ICE-1104**	Basic Electronics Sessional	3.00	1.50
5.	**ICE-1105**	Applied Electricity and Magnetism	3.00	3.00
6.	**ICE-1106**	Applied Electricity and Magnetism Sessional	1.50	0.75
7.	**Math-1101**	Differential Calculus and Geometry	3.00	3.00
8.	**Hum-1101**	Bangladesh Studies	3.00	3.00
9.	**ICE-1107**	Viva-voce	1.50	0.75
		Total ➔	**24**	**19.5**

DETAIL SYLLABUS

ICE-1101: Fundamentals of ICT

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42
Exam Time: 3 Hours; Marks: 100

Course Objectives	The objective of this course is to give a basic idea about computer, history of computer, different parts of computer, memory, hardware and software, operating system, database etc.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • To understand the basics of computers and digital computing. • Be familiar with different number systems used in computing system • Be familiar with computational problem solving, programming languages and tools, compilers and interpreters, memory, hardware and software, operating system, database.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Concept of ICT: Data, Information & Knowledge, Data processing cycle, Information Technology (IT), Communication Technology (CT), Convergence of IT & CT, Types of ICT, Progress of ICT adoption, Components of ICT, Role of ICT in present era, ICT and Economic Development, Impact of ICT on social life, Ethics of ICT usages, ICT Act and Policy.

Introduction to Computer: Evolution of Computers, Generations of Computer, Classifications of Computer, Fundamental units of a Digital Computer, Characteristics of a Digital Computer, Parts of a Computer System, Computer Crime and Security Systems.

Computer I/O Devices: Input Devices: Keyboard, Pointing Devices, Scanning Devices, Optical Input Devices, Digital Camera, Voice Recognition System, Data Acquisition Sensors, Media Input Devices, Output Devices: Display Monitor, Printers, Plotters, Voice Output Systems, Projectors, Terminals.

Memory and Computer Organization: Computer Memory, Classification of Memory, RAM, ROM, Storage Systems, Magnetic Storage Devices: Magnetic Tapes, Magnetic Disks (HDD);Optical Storage Devices: CD-ROM, DVD-ROM; Magneto-optical Storage Devices, Solid State Storage Devices, Flash Memory, Cache Memory, Smart Card; Motherboard, Central Processing Unit (CPU),Internal Communications, Machine Cycle, Bus, Instruction Sets.

PART-B

Software Fundamentals: Software, Classification of Software, System Software: Operating System (OS), Types of OS, Concept of DOS, MS-DOS, WINDOWS, MacOS, UNIX, LINUX; Network OS, Embedded OS, Symbian, Android, iOS; Application Software: Word Processing Program, Spreadsheet Program, Presentation Program, Utility Programs, Device Drivers, Firmware, BIOS, Booting Process of a Computer.

Networking Basics: Computer Networks, Classification of Computer Networks, LAN, WAN, CAN, MAN, HAN, Server based Network, Client-Server Network, Peer-Peer Network, Network Topologies,Network Media, Network Devices.

Data Communications & Internet: Communication System, Basic Elements of Data Communication, Data Transmission Mode, Wireless Communication System, Wireless Access Point: Bluetooth, WiFi, WiFi Hotspot, WiMax; Concept of Mobile Communication System, GSM & CDMA, Internet, Intranet, Extranet, WAP, WWW, VOIP, E-Commerce, M-Commerce, Online Banking, M-Banking, Internet Banking.

Database and Programming Concept: Database Management System (DBMS), RDBMS, Relationships, Normalization, Computer Program, Code, Machine Code, Programming Languages, Compilers and Interpreters, Algorithm, Flowchart, Psudocode, Categories of Programming Languages.

Books Recommended:

1. Introduction to Computers : Peter Norton
2. Fundamentals of Computers : Balagurusamy
3. Fundamentals of Computers : V. Rajaraman
4. Information Technology – The Breaking Wave : Dennis P. Curtin

ICE-1102: Fundamentals of ICT Sessional

Credit: 1.50; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to introduce students with Microsoft office application that includes Microsoft word, excel, power point and Microsoft access.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Work with MS word for documentation. • Prepare PowerPoint presentations. • Prepare Excel sheets. • Create database using MS Access.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Fundamentals of ICT.

ICE-1103: Basic Electronics

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The objective of this course is to introduce the students about semiconductor devices. This course is to familiarize the students with various types of diodes, transistors, FETs and the operational amplifier.
Course Learning	Students who successfully complete the course will be able to:

Outcomes (CLO)	• Use the laws and theorems in order to solve electronic circuits. • Manipulate voltages, currents, and resistances in electronic circuits. • Demonstrate familiarity with basic electronic components and use them to design simple electronic circuits.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Theory of Semiconductor: Electronic Structure of Elements, Energy Band Diagram of Conductor, Insulator and Semiconductor, Covalent Bonding in Semiconductors, Types of Semiconductor, Semiconductor Diode, Biasing Conditions of Semiconductor Diode, Forward and Reverse Biased p-n Junction and their Characteristics, Junction Breakdown, Effects of Temperature on Extrinsic Semiconductors.

Diode Applications: Introduction, Rectifier Circuit, Half-wave, Full-wave and Bridge Rectifiers, Clippers, Clampers and Voltage Multiplier Circuit, Filter Circuit, Different types of Filter, Regulated Power Supply.

Special Diodes and Optoelectronic Devices: Zener Diode, Varactor Diode, Tunnel Diode, PIN Diode, Photodiodes, Phototransistors, SCR, UJT, DIAC, TRIAC, LCD, LED, solar cells.

PART-B

Bipolar Junction Transistor (BJT): Introduction, PNP and NPN transistors construction and operation, Biasing and thermal stability; CB, CE and CC configuration and their I/O characteristics, Transistor switching time, Transistor amplifying action.

Transistor Biasing & Load Line Analysis: Transistor Biasing, Need for biasing a transistor, Factors affecting bias variations, Stability factor, Biasing Rule, Different types of Transistor biasing, Operating Point, Load Line analysis, Stabilization, DC load line, Q-point and maximum undistorted output.

Field Effect Transistor (FET): Introduction, Types of FET, Construction, Characteristics curve, Principle of operation, Channel conductivity, Channel ohmic and pinch-off region, Characteristics parameter of the FET, Effect of temperature on FET, Common Source AC amplifier, Common Drain amplifier, Depletion type and Enhancement type MOSFET.

Books Recommended:

1. Electronic Devices and Circuit Theory : Robert L. Boylestad, LNashelsky
2. A Textbook of Electrical Technology : B.L.Theraja , A.K.Theraja
3. Principle of Electronics : V. K. Mehta
4. Hand Book of Electronics : Gupta & Kumar

ICE-1104: Basic Electronics Sessional

Credit: 1.50; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to introduce students to the field of Electronics so that they can able to learn the behavior of basic electronic devices: Resistors, Capacitors, Inductors, Transformers, Diodes, Transistors (BJT and MOSFET), Voltage Regulators and Operational Amplifiers.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Use the basic tools and instruments of the lab. • Obtain the behavior of basic real electronic applications. • Use the laws and theorems in order to solve electronic circuits to contrast theoretical and experimental data and results. • Read the specifications of electronic components. • Use the lab instruments correctly to develop electric measurements in order to verify the performance of prototypes (power supply, waveform function generator, oscilloscope and multimeter).
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Basic Electronics.

ICE-1105: Applied Electricity and Magnetism

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems. To design and construct single phase and three phase transformer.
Course Learning Outcomes (CLO)	On successful completion of this course students will be able to: • Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields (Field intensity, Flux density etc.) • Determine the electromagnetic force exerted on charged particles, current elements. • Design electromagnetic energy storage devices like capacitor, inductor • Apply fundamental circuit laws (Ohm's law, Kirchhoff's laws) and key electrical circuit theorems (series and parallel elements, voltage/current divider, nodal and mesh analysis) to predict the behavior of DC and AC resistive circuits. • Analyze RLC circuits in the steady-state and transient conditions using differential equations and phasor analysis. • Explain the concept and characteristics of resonance in RLC circuits.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class test/Quizzes/Presentation, and 10% Attendance.

PART-A

Electrostatic: Electric Charge, Coulomb's Law, Electric field and Electric field Strength Calculation, Gauss's Law and its Application, Capacitors and Capacitances, Electric field in dielectric media, Energy in an electric field.

Steady Electric Current: Electric Potential and Potential Difference, Potential due to Point Charge, Electric Current and Current Density, Electron Drift Velocity, Resistance and Resistivity, Conductance and Conductivity, Ohm's Law, Resistors in Series and Parallel, Voltage Divider and Current Divider Law, Open and Short Circuits, Kirchhof's

Current Law (KCL) and Kirchhof's Voltage Law (KVL), Electromotive Force (emf).

Transient Current: Introduction,Circuit elements, Transients in RC, RL and LRC circuits, Time constant.

PART-B

Magnetic Field and its Interaction: Magnetic Induction, Magnetic Force due to a Moving Charge, Lorentz Force, Magnetic Force on a Current Carrying Wire, Torque on a Current Loop, Moving Coil Galvanometer, Ampere's law,Biot-Savart's law and its applications.

Electromagnetic Induction: Faraday's Experiments, Faraday's law of Electromagnetic Induction, Lenz's Law, Induced Current and Voltage, Self-Inductance and Mutual Inductance, Energy Stored in a Magnetic Field.

Transformers: Different Types of Transformer, Transformer Action, Transformer Construction, Loading a Transformer, Equivalent Circuit of Transformer, Transformer Testing, Transformer Regulation, Efficiency of Transformer.

Books Recommended:

1. Physics, Part –II : R. Resnick and D. Halliday
2. Basic Electronics : Bernard Grobe
3. A Textbook of Electrical Technology Vol-I to Vol-IV : B.L.Theraja , A.K.Theraja

ICE-1106: Applied Electricity and Magnetism Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	On successful completion of this course students will be able to: • Apply fundamental Ohm's law, Kirchhoff's laws, series and parallel elements, voltage/current divider law, nodal and mesh analysis to predict the behavior of DC and AC resistive circuits. • Analyze RLC circuits in the steady-state condition. • Design and construct single phase and three phase transformer.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Applied Electricity and Magnetism

Math-1101: Differential Calculus and Geometry

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	• To understand the concept of function and their classifications, limit, continuity and differentiability. • To find the rate at which one quantity changes relative to another. • To interpret the geometrical meaning of different types of derivative and their applications. • To understand the concept of geometrical structure, different conicoid, their co-ordinates, shape and figure of two and three dimensions. • To learn about the coordinate transformation in two dimension and identification of different conic sections and their standard form of both two and three dimensions. • To recognize 3D figures and their properties i.e. sphere, cone, cylinder, paraboloid, ellipsoid and hyperboloid.
Course Learning Outcomes (CLO)	At the end of the course students will be able to: • Understand the concept of function and their classifications, limit, continuity and differentiability. • Find the rate at which one quantity changes relative to another. • Explain the geometrical meaning of different types of derivative and their applications. • Understand the concept of geometrical structure, different conicoid, their co-ordinates, shape and figure of two and three dimensions. • Learn about the coordinate transformation in two dimension and identification of different conic sections and their standard form of both two and three dimensions. • Recognize 3D figures and their properties i.e. sphere, cone, cylinder, paraboloid, ellipsoid and hyperboloid.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Differential Calculus:

Concept of functions: Variables, Constants, Types of Functions (polynomial, rational, transcendental, even, odd, periodic), Domain, Codomain, Image, and Range of a Function; inverse function and graphs of standard functions.

Limit and continuity: Epsilon-delta definition and geometric interpretations.

Differentiability: Elementary properties, geometric interpretation, Successive differentiations and Leibniz theorem.

Expansions of functions: Rolle'sTheorem, Mean value theorem, Taylor's and McLaurin's theorems, approximation of a function by polynomials and series, indeterminate forms and L'Hospital's rule.

Application of derivative: Application of derivative for curve tracing, maxima and minima of functions of a single variable, tangent, normal, Asymptote, curvature.

Function of double variables: Function of double variables, domain, continuity, partial derivatives and total derivative, Euler's theorem, Jacobian and Hessian.

PART-B

Geometry of Two Dimensions:

Co-ordinate systems: Cartesian co-ordinates, Polar co-ordinates, Parameters, Standard Equations in different co-ordinates systems and their parametric representations, Transformation of co-ordinates.

Pair of straight lines: Condition for a general equation of 2nd degree in two variables to represent pair of straight lines, Properties of pair of straight lines.

System of circles: Circles and system of circles, General properties,orthogonality of two circles, limiting circle, radical axis, co-axial circles.

Conics: The general equation of 2nd degree in two variables and reduction to standard forms, identification of conics; Parabola, Ellipse and Hyperbola: Derivation of standard forms and properties.

Geometry of Three Dimensions:

Co-ordinate systems: Cartesian, Cylindrical and Spherical co-ordinate systems, Direction cosines and direction ratios, Projection, Angle between two lines.

Planes and Straight lines : Planes, different form of planes and conversions, angle between two planes, Lines, different form of lines and conversions, angle between two lines, angle between a line and a plane, Plane containing a line, plane containing two lines, shortest distance between two lines.

General equations of second degree: The general equations of second degree and reduction to standard forms, identification of conicoids, cone, Generators, condition for a general equation of second degree to represent Cylinder or Cone, right circular cone, right circular Cylinder.

Sphere: Equation of sphere, a plane and a sphere, a line and a sphere, plane of contact, tangent planers, polar planes, angle of intersections of two spheres, condition of orthogonality, radical line, plane and centers, co-axial spheres.

Books Recommended:

1. Calculus : H. Anton, I. Bivens, and S. Davis
2. Differential Calculus : Das and Mukherjee
3. Analytic Geometry of Conic Sections : C Smith
4. A Treatise on Three dimensional Geometry : J. T Bell
5. A text book on Co-ordinate geometry with vector analysis : Rahman&Bhattacharjee

Hum-1101: Bangladesh Studies

Credit: 3.00 **Contact Hours: 3.00 Hours/Week**

PART-A

Historical Background of Bangladesh: 1204-1947: Muslim rule from 1204-1757, British rule from 1757-1947, Indian Independence Act, 1947. 1947-1971: Language Movement of 1952, General Election of 1954 along with 21-point program, Constitution of Pakistan of 1956 (Feature, National Assembly of 1956), Power and Functions of President and Prime Minister, Causes of failure of the constitution of 1956, Martial-Law of 1958 and its impact on Pakistan politics, Constitution of 1962 (Basic democracy and causes of its failure), Movement for Autonomy (Disparity towards East Pakistan with its description), 6-point program of 1969, Agartala Conspiracy case, 1969, Mass upsurge of 1969, Election of 1970 and its result, Declaration of Independence, Mujib Nagar government and final victory of the war of liberation.

Government of Bangladesh: Constitution of the Peoples' Republic of Bangladesh-1972, Executives of Bangladesh government (power and functions of President and Prime Minister), Legislature of Bangladesh, The Judiciary system of Bangladesh, Administration system of District administration, Local government and Local self-government.

PART-B

Development of Bangladesh: Basic Economic Problems of Bangladesh, Solution of the Economic Problems, Concepts of Development and Underdevelopment, Economic Growth and Economic Development, Causes of Economic Backwardness, Methods of Process and Determinants of Development, Economic Development of Bangladesh, Modernization, Problems and Solution of Agriculture Sector of Bangladesh, Process of Industrialization in Bangladesh, Problems and prospects of Small and Medium-Scale Industries, Importance of Small and Cottage Industries in the Economy of Bangladesh.

Economic Planning in Bangladesh: Short and Long-range Planning, Population policy and Manpower Training.

Resources for Development: Internal and External resources, Private and Public resources, Methods for Mobilization of Domestic Resources, Role of Foreign Aid, Foreign Capital in Economic Development.

Books Recommended:

1. Bangladesh Politics: Problems and Issues	:	RownakJahan
2. Constitutional Development in Bangladesh	:	DilaraChowdhury
3. Government & Politics of Pakistan	:	Dr. M. A. Chowdhury
4. The Economy of Bangladesh	:	A. R Khan
5. Development Planning in Bangladesh	:	Nurul Islam

B.Sc. (Engineering) courses for 1st year 2nd semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credits**
1.	**ICE-1201**	Analog Electronics	3.00	3.00
2.	**ICE-1202**	Analog Electronics Sessional	3.00	1.50
3.	**ICE-1203**	Programming with C	3.00	3.00
4.	**ICE-1204**	Programming with C Sessional	3.00	1.50
5.	**ICE-1205**	Circuit Theory and Analysis	3.00	3.00
6.	**ICE-1206**	Circuit Theory and Analysis Sessional	1.50	0.75
7.	**Math-1201**	Integral Calculus and Differential Equations	3.00	3.00
8.	**BBA-1201**	Industrial Management and Accountancy	3.00	3.00
9.	**Eng-1201**	Fundamental English	2.00	2.00
10.	**Eng-1202**	Fundamental English Sessional	2.00	1.00
11.	**ICE-1207**	Viva-voce	1.50	0.75
		Total ➔	**28**	**22.5**

DETAIL SYLLABUS

ICE-1201: Analog Electronics

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	To prepare students to perform the analysis of any Analog electronics circuit. To empower students to understand the design and working of BJT / FET amplifiers, oscillators and Operational Amplifier. Student should be able to recognize/identify passive linear Circuits.

Course Learning Outcomes (CLO)	On successful completion of this course students will be able to: • Understand the design and working of BJT amplifiers. • Design amplifier circuits using BJT • Know about different power amplifier circuits, their design and use in electronics and communication circuits. • Design multistage amplifier using different coupling methods. • Know the concept of feedback amplifier and their characteristics. • Know the effect of negative feedback on different parameters of an Amplifier and different types of negative feedback topologies. • Design different types of active filters using operational amplifier. • Understand the fundamentals and areas of applications for the integrated circuits.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Basic Transistor Amplifiers: Classification of amplifiers, CB,CE and CC amplifiers, Gain and Characteristics of CB,CE and CC amplifiers, Different types of power amplifiers, Distortion of amplifiers, Noise, Concept of Decibel System.

Multistage Amplifier: Amplifier coupling, RC coupled two-stage amplifier, Advantages of RC coupling, Impedance coupled two-stage amplifier, Advantages of Impedance coupled amplifier, Transformer coupled two-stage amplifier and its advantages, disadvantages and applications, DC two-stage amplifier and its advantages, disadvantages and applications, Darlington pair, Comparison between Darlington pair and emitter follower, Multistage frequency effect.

Amplifiers with negative feedback: Concept of Feedback, Negative Feedback, Positive Feedback, Need for negative feedback, Voltage and Current Feedback, Virtual Feedback, Effect of feedback on Impedance, Gain, Bandwidth and Distortion.

PART-B

Sinusoidal and Non-sinusoidal Oscillators: Oscillator, Condition of Oscillation and Stabilization, Oscillator vs Amplifier, Hartley Oscillator, Colpitt's Oscillator, Phase Shift and Wein-bridge Oscillators, Resonant Circuit Oscillators, Different types of Multivibrators and their uses, Schmitt Trigger, Transistor Blocking Oscillator.

Integrated Circuits: Introduction, IC classifications, Fabrication of components on monolithic IC, Simple monolithic ICs, IC packings, Scale of integration, Advantages and disadvantages of IC, Applications of IC.

Analog Integrated Circuits: Basic concept of Operational Amplifier, Properties of an ideal Op-Amp, Non-inverting Inverting and Differential amplifiers; Integrator, Differentiator, Weighted Summer, Subtractor, Slew rate, CMRR, audio amplifier, constant gain Op-Amp, Op-Amp based oscillatory circuits and their applications, Frequency Response and Bandwidth of Op-Amp, The 555 IC timer, Astable and Monostable operation of 555 timer.

Active Filter: Types of filters, Low-pass filter: First order low-pass Butter worth filter, Second order low-pass Butter worth filter, High-pass filter: First order high-pass Butter worth filter, Second order high-pass Butter worth filter, Higher order filters, Band-pass filters: Wide Band-pass filter, Narrow Band-pass filter, Band Rejected filters: Wide band rejected filters, Narrow band rejected filters, All-pass filters.

Books Recommended:

1. Fundamentals of Electrical Engineering and Electronics : B.L Theraja
2. Principle of Electronics : V. K. Mehta
3. Electronic Devices and Circuits : Allen Mottershead
4. Electronic Devices and Circuits : Millman and Halkias

ICE-1202: Analog Electronics Sessional

Credit: 1.50; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 6 Hours; Marks: 100

Course Objectives	To prepare students to analyze of any Analog electronics circuit. Student should be able to analyze idealized passive linear Circuits. Numerically determine circuit variables, voltage and/or current amplitude, frequency, phase accurately up to the required precision.

Course Learning Outcomes (CLO)	On successful completion of this course students will be able to: • Understand the amplitude and frequency responses of common amplifier circuits. • Design multistage amplifier and feedback amplifier and their characteristics. • Develop the skill to build, and troubleshoot Analog circuits. • Design circuits and systems for particular applications using linear integrated circuits. • Design different types of active filters using operational amplifier. • Demonstrate the ability to design practical circuits that perform the desired operations.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Analog Electronics

ICE-1203: Programming with C

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. The course presents the basics of C environment, data representation control structure, functions, arrays, pointers, strings, user defined data types, and file I/O. The special track is organized as a series of lectures, hands-on workshops and exercises using C programming languages and focusing on discussing how to write a program of moderate complexity by using C language. Also by learning the basic programming constructs students can easily switch over to any other language in future.

Course Learning Outcomes (CLO)	After the course the students are expected to be able to : • Identify situations where computational methods and computers would be useful. • Given a computational problem, identify and abstract the programming task involved. • Approachthe programming tasks using techniques learned and write pseudo-code. • Choose the right data representation formats based on the requirements of the problem. • Use the comparisons and limitations of the various programming constructs and choosethe right one for the task in hand. • Write the program on a computer, edit, compile, debug, correct, recompile and run it. • Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

C Programming Fundamentals: History of C, Characteristics of C, Structure of C, The C Character set, Keywords and Identifiers, Data types, Constants, Variables, Operators, Expressions, Escape Sequences, Library Functions, Data Input and Output.

Decision Making and Looping:*if* statements, *if-else* statements, Nesting of *if…else* statements, the *else…if* ladder, the *switch* statements, the *?:* operator, the *goto* statement, *break* and *continue* statements, the *while* statement, the *do* statement, the *for* statement.

Arrays: One dimensional array, Declaration of one dimensional arrays, Initialization of one dimensional arrays, Two dimensional arrays, Initialization of two dimensional arrays, Introduction to multi-dimensional array.

Character Arrays and String: Declaring and initializing string variables, Reading string from terminal, Writing string to screen, Comparison of two strings, String-handling functions, Searching and Sorting of strings.

PART-B

User-defined Function: Definition of functions, Function declaration, Category of functions: no arguments and no return values, arguments but no return values, arguments with return values, no arguments but returns a value; Recursion, Passing arrays to functions, Passing string to function.

Structures and Union: Defining a Structure, Declaring Structure variables, Accessing Structure members, Structure initialization, Arrays of Structures, Arrays within Structure, Structure within Structure, Structures and Functions, Union, Size of Structure.

Pointers: Understanding Pointers, Accessing the address of a variable, Declaring Pointer variables, Initialization of a Pointer variable, Accessing a variable through its Pointer, Pointers and Arrays, Pointers and character strings, Array of Pointers, Pointers as function arguments, Function returning Pointers, Pointers to Function, Pointers to Structures.

File Management in C and Dynamic Memory Allocation: Defining and opening a file, Closing a file, Input/Output operation on files, Command line arguments, Dynamic memory allocation, Allocating a block of memory: MALLOC, Allocating multiple blocks of memory: CALLOC.

Books Recommended:

1. The Complete Reference C : Herbert Schieldt
2. Programming with C : Byron S Gottfried
3. Programming in ANSI C : E. Balagurushamy
4. The C Programming Language : Kernighan and Ritche

ICE-1204: Programming with C Sessional

Credit: 1.50; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this sessional course is to introduce the students to the field of programming using C language. The students will be able to enhance their analyzing and problem solving skills and use the same for writing programs in C.
Course Learning Outcomes (CLO)	After Completion of this course the student would be able to: • Read, understand and trace the execution of programs written in C language. • Write the C code for a given algorithm. • Implement Programs with pointers and arrays,

	perform pointer arithmetic, and use the pre-processor. • Write programs that perform operations using derived data types.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Programming with C

ICE-1205: Circuit Theory and Analysis

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	To develop problem-solving skills and understanding of circuit theory through the application of different techniques and principles of electrical circuit analysis to solve common circuit problems.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Learn the properties of electric elements and the techniques to measure voltage and current. • Understand fundamental laws and elements of electric circuits. • Understand waveforms, signals, and steady-state responses of RLC circuits. • Analyze electrical circuits.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Electrical Circuit: Electrical units and Standards, Electrical power sources, Electrical circuit elements and models, Series *dc* circuits, Parallel *dc* circuits, Series-Parallel *dc* circuits, Voltage and Current sources.

Analysis of *dc* networks: Branch-Current Analysis, Mesh Analysis, Nodal Analysis, Bridge Networks.

Network Theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Millman's Theorem, Substitution Theorem, and Reciprocity Theorem.

PART-B

Sinusoidal Alternating Waveforms: Characteristics and Definitions, Frequency Spectrum, Representation of ac quantities, Phase Relations, Average Value, Effective (RMS) value, Response of basic R, L, and C elements to a sinusoidal voltage or current, Frequency response of basic elements, Average Power and Power Factor, Phasor Algebra.

Series and parallel *ac* circuits: Impedance and Phasor Diagram, Voltage Divider Rule, Admittance and Susceptance, Current Divider Rule, Frequency response for series and parallel *ac* elements.

Resonance: The Quality Factor, Series and Parallel resonant circuits, Effect of Q-value, Impedance and Bandwidth.

Books Recommended:

1. Electronic Devices and Circuit Theory : Robert L. Boylestad, Louis Nashelsky
2. Introductory Circuit Analysis : Robert L. Boylestad
3. Circuit Analysis: Theory and Practice : Allan H. Robbins and Wilhelm C Miller

ICE-1206: Circuit Theory and Analysis Sessional

Credit: 0.75; Contact Hours: 3.00 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to introduce students about basic Electric/Electrical circuits so that they can able to design electric/electrical circuits and characterize circuit behavior using the appropriate instruments and techniques.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Access and use the most basic functions of electrical test and measurement equipment including oscilloscopes, multimeters, function generators, and power supplies. • Read circuit schematics and construct linear circuits using resistors, capacitors, and inductors. • Measure resistance, DC and AC voltages, current, and power, and experimentally verify the results for a variety of electrical circuits. • Test circuits, analyze data and compare measured performance to theory and simulation.

	• Troubleshoot and repair simple electric circuits.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Circuit Theory and Analysis

Math-1201: Integral Calculus and Differential Equations

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	• To interpret that differentiation is the reverse process of integration. • To know the relation between the area and ant derivatives and how to calculate an ant derivative. • To learn different techniques of integration. • To apply differentiation and integration for solving some real life problems. • To obtain necessary basic information regarding ordinary differential equations such as classification, origin, initial and boundary value problem. • To identify first order ordinary differential equations, their solution technique and applications. • To learn the higher order linear ordinary differential equations and techniques to solve those. • To explain systems of linear differential equations using method of elimination, matrix method and eigenvalues.
Course Learning Outcomes (CLO)	At the end of the course students will be able to: • Interpret that differentiation is the reverse process of integration. • Know the relation between the area and ant derivatives and how to calculate an ant derivative. • Learn different techniques of integration. • Apply differentiation and integration for solving some real life problems. • Obtain necessary basic information regarding ordinary differential equations such as classification, origin, initial and boundary value problem. • Identify first order ordinary differential equations,

	their solution technique and applications. • Learn the higher order linear ordinary differential equations and techniques to solve those. • Explain systems of linear differential equations using method of elimination, matrix method and eigenvalues.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Integral Calculus:

Concepts of Integral Calculus: Anti-derivativesand techniques of indefinite integrals.

Definite integrals: Geometric interpretation of definite integrals, Fundamental theorem of calculus, General properties of definite integrals, Evaluation of definite integrals; Reduction formulas; Beta and gamma functions, their properties and applications to solve integrals.

Improper integrals: Improper integrals, convergence of improper integrals.

Applications of definite integrals: Applications of definite integrals to find area and arc-length of 2-curves, solid revolutions, volume and surface area of hollow and solids bodies.

PART-B

Differential Equations:

Introduction To Differential Equations: Definitions and classifications of differential equations, formation of differential equations, existence and uniqueness theorem (Statement and application only), Initial-Value Problems, Boundary-value problems, Differential Equations as Mathematical Models.

First order and first degree differential equations: Equations solvable by seperation of variables, homogeneous equations, first order linear equation, Bernoulli equations, Riccati equation, exact equations, integrating factor, equations made exact by integrating factor.

First order higher degree differential equations: solvable for x, y and p, Clairaut's equation, singular solutions, orthogonal and oblique trajectories.

Methods of solving Higher order linear differential equations: Higher order linear homogeneous differential equations with constant coefficients, reduction of order, basic theorems; Homogeneous linear equations with

constant coefficients, Method of undetermined coefficients, Method of variation of parameters, Operator method.

Linear equation with variable coefficients: Cauchy-Euler equation, Legendre equation, operational factoring, exact equation.

Series solutions of linear differential equations: Taylor series method, Frobenius method.

Systems of linear differential equations: Method of elimination, Euler's method, matrix method.

Books Recommended:

1. Integral Calculus : Das and Mukherjee
2. Elements of the differential and integral calculus : William Smyth
3. Differential Equations : G.F. Simmons
4. Ordinary Differential Equations : M.A. Ansary
5. Differential Equations : S. L. Ross
6. Differential Equations : B.D. Sharma
7. Differential Equations With boundary value problems : D. G. Zill, w. S. Wright, and m. R. Cullen

BBA-1201: Industrial Management and Accountancy

Credit: 3.00 **Contact Hours: 3.00 Hours/Week**

PART-A

Industry, Types of industry, Business, Types of business, Management, Principles of management, Functions of management, Levels of management, Roles of management, scientific management and core management skills.Factory location and layout,Work environment, Plant utility, Lighting, Ventilation, Air-conditioning, Sanitation and Noise Control, Manpower Planning Process, Recruitment, Selection and Training, Issue in Managing Social Needs and Productivity, Hygiene and Motivators, Negotiation Skills, Growth of Trade Unions, Leadership and Management in the Trade Union, Collective Bargaining, Industrial project planning and management.

PART-B

History, scope, nature and purpose of accounting,Basic accounting principles, Transactions, Journal, Ledger and Trial Balance, Cash book, Bank reconciliation statement. Preparation of financial statement. Cost accounts and its objects. Cost classification, Elements of cost, preparation of cost sheet, Overhead allocation, Use of relevant costs in decision-making, Standard costing. Material cost variance. Break even analysis, Cost-Benefit analysis. Taxations in Bangladesh.

Books Recommended:

1. Schaum's Easy Outline of Accounting : Joel Lerner and JamesCashin
2. Accounting for Non-Accountants, The Fast and Easy Way to Learn the Basics : Wayne A. Label

Eng-1201: Fundamental English

Credit: 2.00; Contact Hours: 2.00 Hours/Week; Lecturers: 28; Exam Time: 3 Hours; Marks: 100

Course Objectives	The aim of this course is to develop students' reading and writing skills.
Course Learning Outcomes (CLO)	At the end of this course, students will be able to: • Read and understand a text carefully. • Build a good store house of words. • Know how to change different form of words. • Apply different formation of sentences. • Write on open or guided topic. • Write a standard formal or informal letters. • Know how prepare a technical, lab or newspaper report. • Write a standard job application. • Reflect qualitative research paper.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Reading: Reading comprehension- precise writing, vocabulary building, synonyms and antonyms, use of words in different parts of speech, true-false (yes / no / not-given), fill in the blanks, tree chart, flow chart.

Grammar:parts of speech (changing), different types of sentences, tense, right forms of verbs, verb conjugation, transformation of sentences, appropriate preposition, idioms and phrase, voice, narration, correction of sentences, WH question.

PART-B

Writing: Paragraph writing- amplification of ideas, structures and classifications, topic sentence, topic developer, topic termination, classification of paragraph.

Essay writing: essay with hints and without hints, free hand essay writing on current issues, components of an essay.

Business writing: agenda, notice, memo, meeting minutes, quotation, tender

Letter writing: job application, resume, formal and informal letter, letter to newspaper.

Report writing: technical report, lab report, and newspaper report, Research paper writing.

Books Recommended:

1. Mastering English Language Skills : S M Amanullah
2. Ship or Sheep : Ann Baker
3. A Guide to Correct Speech : S M Amanullah
4. A Handbook of Paragraph Writing : Prof Jahurul Islam
5. Listening : Alderson A. and Lurich, T.
6. Oxford Dictionary of Current Idiomatic English : Mackin, R. & A.P. Cowie.

Eng-1202: Fundamental English Sessional

Credit: 1; Contact Hours: 2.00 Hours/Week; Lecturers: 14; Exam Time: 6 Hours; Marks: 100

Course Objectives	This course aims to improve students' listening and speaking skills.
Course Learning Outcomes (CLO)	At the end of the course students will be able to: • Know how to pronounce both words and sentences correctly. • Learn IPA (International Phonetic Alphabet) and Sub-skills of listening. • Exercise Sound Recognition, Dictation and Detection from Audio Tape. • Use correct pronunciation in practical life activities. • Know the different techniques of presentation skills. • Develop public speaking. • Describe real life events and pictures. • Exercise probable interview questions, dialogue and daily life conversation.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Listening: IPA (International Phonetic Alphabet), pronunciation, phonetic transcriptions, sub skills of listening and sound recognition, dictation and detection from audio tape.

Speaking: Presentation skills, argumentative presentation, persuasive presentation, public speaking, greetings and self-introduction, describing events and persons, asking for advice and giving suggestions, accepting, refusing, contrasting, classifying, interview questions, conversation and dialogue on recent topic.

B.Sc. (Engineering) courses for 2nd year 1st semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credits**
11.	**ICE-2101**	Digital Electronics	3.00	3.00
12.	**ICE-2102**	Digital Electronics Sessional	3.00	1.50
13.	**ICE-2103**	Object Oriented Programming	3.00	3.00
14.	**ICE-2104**	Object Oriented Programming Sessional	3.00	1.50
15.	**ICE-2105**	Discrete Mathematics and Numerical Methods	3.00	3.00
16.	**ICE-2106**	Discrete Mathematics and Numerical Methods Sessional	1.50	0.75
17.	**Math-2101**	Vector, Matrix and Linear Algebra	3.00	3.00
18.	**Stat-2101**	Elementary Statistics and Probability	3.00	3.00
19.	**Stat-2102**	Elementary Statistics and Probability Sessional	1.50	0.75
20.	**ICE-2107**	Viva-voce	1.50	0.75
		Total ➔	**25.5**	**20.25**

DETAIL SYLLABUS

ICE-2101: Digital Electronics

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	This course will provide students with the knowledge required to understand and troubleshoot digital electronic circuits. Among the topics discussed are number systems, codes, logic gates, Boolean statements, combinational logic, flip-flops, counters, shift registers,

	memory and storage, and integrated circuit technologies.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Explain number systems and convert number systems. • Explain logical AND,OR,NOT,NAND,NOR,EX-OR,EX-NOR functions. • Understand the basic concepts switching circuits, Boolean algebra, A/D conversion. • Understand how to minimize a Boolean expression or switching function using various techniques. • Write Boolean equation by various logic circuits and shows its truth table. • Explain various MSI combinational circuits. • Show the applications of combinational circuits. • Determine the characteristics of switching devices, FFs and A/D conversion. • Explain counters and registers. • Recognize asynchronous and synchronous counters. • Design up and down conters. • Explain memory units with properties.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Number Systems: Binary Numbers, Number base conversion, Octal and Hexadecimal Numbers, Complements, Binary Codes, Binary storage, Digital Logic.

Boolean Algebra and Logic Gates: Basic definitions, Axiomatic definitions of Boolean algebra, Basic theorem and properties, Boolean functions, Canonical and standard forms, Other logic operations, Digital Logic Gates.

Simplification of Boolean Functions: Map Method, Two and three variable maps, Four variable map, five and six variable maps, Product of Sum simplification, NAND & NOR implementation, Other two-level implementations, Don't care conditions, Tabulation Method, Determination and selection of Prime Implicants.

PART-B

Combinational Logic: Design Procedure, Adders, Subtractors, Boolean Code conversion, Analysis procedure, Multilevel NAND and NOR

Exclusive-OR and equivalence function, Binary Parallel Adder, Decimal Adder, Magnitude Comparator, Encoder, Decoder, Multiplexer, De-multiplexer, PLA.

Sequential Logic: Flip-Flops, Triggering of Flip-flop, Analysis of clocked sequential circuits, State reduction and assignment, Flip-flop excitation tables, Design Procedure, Design of counters, Design with state equations.

Applications: Registers, Shift registers, Buses, Ripple Counters, Synchronous Counters, Timing Sequences, Semiconductor memories, RAM, ROM, EPROM, EEPROM, A/D and D/A converters and their Applications.

Books Recommended:

1. Digital Electronics : Malvino
2. Digital Logic and Computer Design : M. Morris Mano
3. Switching Theory and Digital Electronics : Dr. V. K. Jain

ICE-2102: Digital Electronics Sessional

Credit: 1.50; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to introduce students about the concepts of Combinational circuits and the concepts of sequential circuits such as flip-flops, registers, and counters.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Learn the basic concepts of logic gates. • Construct basic combinational circuits and verify their functionalities. • Design procedures to design basic sequential circuits. • Learn about counters. • Learn about Shift registers. • Understand the basic digital circuits and to verify their operation.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Digital Electronics.

ICE-2103: Object Oriented Programming

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The course is design to extend student knowledge in Object Oriented Programming such as class, object, method and constructor. Students will also be able to implement object-oriented designs using encapsulation, inheritance, polymorphism and exception handling.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • Describe the basic knowledge of Object Oriented Programming. • Relate class, object, method and their relationship in a program. • Solve error in a program and also how can handle different types of event. • Have sufficient knowledge in java and C++ programming languages.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Object oriented programming and procedural oriented programming, encapsulation, inheritance, polymorphism, data abstraction, data binding, static and dynamic binding, message passing, C++ and Java as object oriented language.

Classes: structure of classless. public, private and protected members, array of object, argumented member function, and non-augmented objects, nested member class and their object, pointer objects and pointer members, object a argument of function, static class member and static class. Friend function, friend class,

Inheritance: mode of inheritance, classifications of inheritance, virtual inheritance.Array of objects of derived class.

Constructor and destructors: default constructor, argumented constructor, copy constructor, dynamic constructor, constructor function for derived class and their order of execution, destructor.

PART-B

Introduction to Java: History of Java, Java Features and advantages, creating classes with Java, Concept of constructors, Using JDK, Java

application and Applet, Variables, Data Types, Arrays, Operators and Control Flow.

Methods: Using methods, declaring a class method, Implementation of Inheritance, Calling a class method, Passing parameters, Local variables and variable scope, Operator and function overloading.

Using Standard Java Packages: Creating Graphical user interfaces with AWT, Managing graphics objects with GUI layout Managers, Event handling of various components.

Exception Handling: Overview of exception handling, the basic model, Hierarchy of Event classes, Throw Clause, Throws Statement, Try-Catch Block.

Streams and Input/Output Programming: Java's File Management techniques, Stream manipulation classes.

Books Recommended:

1. C++ The Complete Reference : Herbert Schildt
2. Java: How to Program : Deitel&Deitel
3. Beginning Java : Ivor Horton

ICE-2104: Object Oriented Programming Sessional

Credit: 1.5; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this sessional course is to introduce the fundamentals of object oriented programming in java and C++ based on ICE-2103 including defining class, invoking method, using class libraries, designing, handling events and exception, managing stream-based I/O.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • Understand how to produce object-oriented software using C++ and Java Programming languages. • Understand how to apply the major object-oriented concepts to implement object oriented programs in C++ and Java.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Class Test/Quizzes/Presentation, and 10% Attendance.

Laboratory based on Object Oriented Programming

ICE-2105: Discrete Mathematics and Numerical Methods

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	This course is designed to provide the mathematical foundations for information and communication engineering. Students should learn the essentials of discrete mathematical structures and numerical methods. To accomplish these objectives, the course emphasizes mathematical reasoning and problem solving techniques, and to provide the student with numerical methods of solving the linear or non-linear equations, interpolation, differentiation, and integration.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • Express a logic sentence in terms of predicates,quantifiers, and logical connectives. • Use tree and graph algorithms to solve problems. • Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions. • Apply numerical methods to obtain approximate solutions to mathematical problems • Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations. • Analyze and evaluate the accuracy of common numerical methods.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Mathematical Logic: Connectives, Normal Forms, Theory of inference for proposition calculus, Predicate calculus, Inference theory of predicate calculus, Methods of proof, Mathematical induction.

Relation Ordering and Structure: Relations, Properties of binary relation in a set, Composition of binary relation, Relation matrix and graph of a relation, Partial ordering, Path in relation and digraph. Partially ordered set, Extremal element of Poset, Lattice, Finite Boolean

algebra, Function on Boolean algebra, Boolean functions as Boolean polynomials.

Graphs and Trees: Introduction to graph, Graph terminology, Representing graph and graph isomorphism, Paths, Reachability, Connectivity, Euler and Hamilton path, Mathematical problems, Graph coloring, Matrix representation of graph, Introduction to Tree, Tree terminology.

Groups, Semigroups and Monoids: Definition of Groups and examples, Homo-morphism, Product and Quotients of groups, Homomorphism of Semigroups and Monoids, Grammars and Languages, Formal definition of a Language.

PART-B

Approximations and Errors: Accuracy and Precision, Error Definitions, Round-Off Errors, Truncation Errors.

Roots of Equations: Graphical Methods, The Bisection Method, The False-Position Method, The Iteration Method, The Newton-Raphson Method, The Secant Method.

Interpolation: Newton-Gregory Formula for Forward and Backward Interpolation with equal intervals, Divided Differences, Newton's and Lagrange's Divided-Difference Interpolating Polynomials for unequal intervals, Central Difference, Gauss's Central Difference Formula, Stirling's Interpolation Formula, Bessel's Interpolation Formula.

Curve Fitting: Linear Regression, Linear Curve Fitting Methods, Least Square Method, Non-Linear Curve Fitting Methods, Polynomial of *n*th Degree, Power Function, Exponential Function, Polynomial Regression.

Numerical Differentiation and Integration: Numerical Differentiation, Numerical Integration, The Trapezoidal Rule, Simpson's Rules, Weddle's Rule.

Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's Series, Picard's Method, Euler's Method, Modifications and Improvements of Euler's Methods, Runge-Kutta Methods, Adaptive Runge-Kutta Methods.

Books Recommended:

1. Discrete Mathematics and its Applications : Kenneth H Rosen
2. Theory and Problems of Discrete Mathematics : Lipshutz
3. Numerical Analysis : Vasishtha
4. Numerical Methods for Engineers : Steven Chapra

ICE-2106: Discrete Mathematics and Numerical Methods Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to introduce to students the different algorithms of discrete mathematics and different methods of numerical analysis. The students will be able to enhance their analyzing and problem solving skills with the implementation of different methods using the programming language.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Understand basic theories and algorithms of discrete mathematics in practical. • Understand to implement common numerical methods using programming language and find the approximate solutions. • Implement and find the solution of linear and nonlinear equations, and the solution of differential equations.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Discrete Mathematics and Numerical Methods.

Math-2101: Vector, Matrix and Linear Algebra

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The main objective of the course is to introduce the methods oflinear algebra, matrix, and vector analysis to the students.These methods provide the students a natural aid to theunderstanding of some physical concept in solving engineeringproblems.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Comprehense the use of various forms ofnumbers to solve numerical problems. • Explain the characteristics of scalar andvector valued functions and master these incalculations. • Provide a physical interpretation of thegradient, divergence, curl and related concepts. • Solve other problems appropriate for acourse in

	linear algebra, trigonometry and vectoranalysis.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Vectors and scalars: Definitions and fundamental laws, product of vectors, geometrical and physical interpretations, reciprocal vectors.

Vector Geometry: Equation of planes, straight lines and spheres.

Vector differentiation: Vector differentiation, Vector differential operators, gradient, divergence, curl and their physical interpretations.

Vector integration: Ordinary integrals of vectors, line integrals, surface integrals, and volume integrals. Green's theorem, Gauss' theorem and Stokes' theorem and their applications.

Curvilinear co-ordinates: Transformation of coordinates, orthogonal curvilinear coordinates, unit vectors in curvilinear systems, arc length and volume elements. Gradient, divergence and curl in curvilinear systems. Special orthogonal coordinate systems: cylindrical coordinates and spherical coordinates.

PART-B

Matrix: Definition of matrix, Different types of matrix, Algebra of matrix, Adjoin and inverse of a matrix, Elementary transformations of matrix, Matrix polynomials, Calay-Hamilton theory with uses of rank and nullity, Normal and Canonical forms, Solution of Linear equations, Eigenvalues and Eigenvectors.

Linear Algebra: Vector space, subspace, sum and direct sum, Linear dependence and independence, Basis and Dimension, Linear transformation: Range, Kernel, nullity, rank, singular and non-singular transformations, Matrix representation of a linear operator. Change of basis, similarity, Matrices and linear mappings. Characteristic roots and Vectors of linear transformations.

Books Recommended:

1. Vector Analysis : Murray Spiegel and S Lipschutz
2. Theory and Problems of Matrices : F. Ayres
3. Matrices : M.L. Khanna
4. Linear Algebra : Seymour Lipschutz and Marc Lipson

Stat-2101: Elementary Statistics and Probability

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The purpose of this course is to provide students about concepts ofbasic statistics, statistical distributions and probability and theirextensive use in real life situations, in particular, in the area ofscience and engineering. The goal is to familiarize students withpowerful analytical and numerical tools in the areas of probabilityand statistics that can be used to solve real life problems.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Plan and implement a statistical study. • Summarize the results of a study usinggraphs and numerical measures. • Interpret and apply the results ofstatistical works. • Choose the appropriate probabilitymodels to describe real world situations. • Identify the appropriate statistical procedure to analyze the data. • Report statistical results in a clear and coherent form
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Statistics: Meaning and Scope, Variables and Attributes, Collections and presentation of statistical data.Frequency distribution and Graphical Representation.

Statistical Analysis: Location, Dispersion and their measures, Frequency distribution; Mean, Median, Mode and other measures of central tendency; Standard deviation and other measures of dispersion; Moments,Cumulants,Skewness, Kurtosis; Elementary probability theory and discontinuous probability distributions (Binomial, Poisson and Negative Binomial); Characteristics of distributions; Elementary sampling theory; Estimation; Hypothesis Testing and Regression Analysis.

PART-B

Elements of Probability: Sample Space, Events, Union and Intersection of Events. Probability of Events. Loss of probability. Frequency limit and probabilities. Addition law of probability. Application to Occupancy

problems, Bose-Einstein statistics, Fermi-Dirac statistics, Conditional probabilities. Bayes probability, Chebysev's Inequality.

Random Variables and Probability Distribution: Basic concepts, Discrete and continuous random variables, Density and distributional functions. Mathematical expectation and variance. Conditional expectation and conditional variance, Expected values and variance of the density distributions. Moments and Cumulants generating functions, Characteristics function. Study of Binomial, Poisson, Normal, Geometric, Negative binomial, Hypergeometric, Multinomial, Cauchy and Wibul distribution.

Books Recommended:

1. Interpreting Data : Anderson
2. The Elements of Probability Theory : Cramer H.
3. Introductory Statistics : Hoel. P. G.
4. Probability : S Lipschutz

Stat-2102: Elementary Statistics and Probability Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The purpose of this laboratory course is to provide students regarding the implementation ofstatistical distributions and probability functions and theirextensive use in real life situations, in the area ofscience and engineering. The goal is to familiarize students with different software tools to solve statistical problems.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Plan and implement a statistical problems using software tools. • Summarize the results of a study usinggraphs and numerical measures. • Implement different probability models to describe real world situations.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Elementary Statistics and Probability.

B.Sc. (Engineering) courses for 2nd year 2nd semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credits**
1	**ICE-2201**	Data Structure and Algorithm	3.00	3.00
2	**ICE-2202**	Data Structure and Algorithm Sessional	1.50	0.75
3	**ICE-2203**	Analog Communication	3.00	3.00
4	**ICE-2204**	Analog Communication Sessional	1.50	0.75
5	**ICE-2205**	Signals and Systems	3.00	3.00
6	**ICE-2206**	Signals and Systems Sessional	1.50	0.75
7	**ICE-2207**	Electromagnetic Fields and Waves	3.00	3.00
8	**Math-2201**	Complex Variable Analysis, Laplace and Fourier Transforms	3.00	3.00
9	**Stat-2201**	Sampling Distribution and Hypothesis Testing	3.00	3.00
10	**Stat-2202**	Sampling Distribution and Hypothesis Testing Sessional	1.50	0.75
11	**ICE-2208**	Viva-voce	1.50	0.75
		Total ➔	**25.5**	**21.75**

DETAIL SYLLABUS

ICE-2201: Data Structure and Algorithm
Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The main objective of the course is to understand basic data structures and algorithms. The student will be able to assess how the choice of data structures and algorithm design methods impacts the performance of programs. The course aim to describe the systematic way of solving problems, and various methods of organizing large amounts of data.
Course Learning	Students who successfully complete the course will be able to:

Outcomes (CLO)	• Define basic static and dynamic data structures and relevant standard algorithms for them. • Describe different types of data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, binary search trees, and graphs and know how to apply them effectively in problem solving. • Analyze and select the most suitable and effective algorithm for solving a certain problem. • Demonstrate the advantages and disadvantages of specific algorithms and data structures. • Evaluate algorithms and data structures in terms of time and memory complexity of basic operations.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Data types & data structures, data structure operations.

Array, Record and Pointer: Linear Arrays, Relationships of Arrays, Operation on Arrays, Multidimensional arrays, Pointer to Array, Record structures, Representation of Records, Sparse Matrices.

Stacks, Queues and Recursion: Different types of Stacks and Queues: Circular, Dequeues, etc., Evaluation of expressions, Recursion, Direct and Indirect Recursion, Depth of Recursion, Implementation of recursive procedures by Stacks.

Linked List: Linked lists, Representation of linked list, Traversing & searching a linked list, doubly linked list & dynamic storage management, generalized list, Garbage collection & compaction.

Trees and Graphs: Basic terminology of tree and graph, Binary tree, Binary tree representation, Tree traversal, Extended binary tree, Huffman codes/algorithm, Graphs, Graph representation, Shortest path and transitive closure, Traversing a graph.

Sorting: Searching, Insertion sort, Shell sort, Heap sort, Radix sort, Divide and conquer method: Merge sort, Quick sort, Selection sort, binary search.

Symbol Tables: Static tree tables, Dynamic tree tables, Hash tables overflow handling, Theoretical evaluation of overflow techniques.

PART-B

Algorithms: Introduction to algorithms, performance analysis of algorithms.

Greedy method: The general method, Knapsack problem, job sequencing, minimum-cost spanning trees, optimal storage on tapes.
Dynamic programming: The general method, multistage graphs, all pair's shortest paths, single source shortest paths problems.
Backtracking algorithms: The general method, 8-queen, sum of subsets, graph coloring and Hamiltonian cycle problems.
Books Recommended:

1. Fundamentals of Data Structures : E. Horowitz and S. Sahni
2. Computer Algorithm : E. Horowitz and S. Sahni
3. Theory and Problems of Data Structures : S Lipschutz
4. Introduction to Algorithms : T. H. Cormen, Leiserson

ICE-2202: Data Structure and Algorithm Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory is to develop skills to design and implement linear and nonlinear data structures. After completion of this laboratory, the student will able to gain knowledge in practical applications of data structures.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Determine and demonstrate bugs in the program, recognize needed basic operations with data structures. • Formulate new solutions for programming problems or improve existing code using learning algorithms and data structures. • Implement and find the solution ofdifferent greedy algorithms, dynamic programming, and backtracking algorithms.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Data Structure and Algorithm

ICE-2203: Analog Communication

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42;

Exam Time: 3 Hours; Marks: 100

Course Objectives	To introduce the concepts of basic communication system, types of noise affecting communication system and noise parameters. To introduce students to various modulation and demodulation techniques of analog communication and uses of modulation. To introduce the basics of picture transmission and reception, analysis and synthesis of composite video signal, receiver and picture tubes and television camera tubes.
Course Learning Outcomes (CLO)	On successful completion of this course students will be able to: • Gain the knowledge of components of analogue communication system. • Use of different modulation and demodulation techniques used in analog communication.. • Analyze transmitter and receiver circuits. • Compare and contrast, advantages, disadvantages and limitations of analog communication systems • Analyze generation and detection of FM signal and comparison between amplitude and angle modulation schemes. • Identify different radio receiver circuits and role of AGC. • Understand the fundamental concepts of television transmitter and receiver systems, the transmission of video signals and importance of television standards to effectively work with broadcasting applications, trouble shooting of television systems. • Understand different color television systems used worldwide and its compatibility.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Basic principles, Fundamental elements, System limitations, Message Source, Bandwidth requirements, Transmission media types, Bandwidth and Transmission capacity. Noise: Source, Characteristics of various types of Noise and Signal to Noise Ratio (SNR). Communication systems: Analog and Digital.

Modulation and Demodulation: Linear modulation - AM, SSB, DSB, and SSB generation, PLL Circuit to generate linear modulated signals, low and high power modulators, Exponential modulation- FM and PM, demodulation of AM, FM.

Broadcasting Transmitter: Transmitter classification, Elements of transmitter, AM and FM transmitters, SSB transmitter, stabilized master oscillator, Frequency multipliers, Mixer circuits, RF power amplifier, Pre-emphasis circuits, Transmitter performance-carrier frequency requirements, audio frequency response, distortion, signal to distortion ratio.

PART-B

Radio Receiver: Receiver classification, Elements of receiver, AM and FM receivers, SSB receiver, Comparison of AM and FM receivers, Noise in receiver, AGC circuits, AFC circuits, Noise limiters, Receiver sensitivity, Cross modulation, Spurious responses.

Fundamentals of TV: Transmission and reception of picture information, Scanning; Standard scanning pattern; Synchronization; Blanking pulses; Composite video signal, vestigial sideband transmission, TV channels.

TV Receiver: Fundamentals of TV receiver; Picture tubes, Deflection circuit, High voltage power supply.

Books Recommended:

1. Electrical Communication : D. Roddy and Coolen
2. Radio Engineering **:** G.K. Mithal
3. Electronics Communication System : Kennedy and Davis
4. Communication Systems : Simon Haykin
5. Monochrome and Color TV **:** Gulati

ICE-2204: Analog Communication Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	To study various display system and its application. Understand function of picture tubes and television camera tubes.

Course Learning Outcomes (CLO)	On successful completion of this course students will be able to: • Design and Analyze transmitter and receiver circuits. • Study various display system and its application. • Compare design issues of analog communication systems. • Analyze and compare among different types of modulation schemes. • Understand the transmission of video signals and importance of television standards to effectively work with broadcasting applications, trouble shooting of television systems.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Analog Communication.

ICE-2205: Signals and Systems

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	This course will provide students with the knowledge required to understand various signals and systems.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Describe signals mathematically and understand how to perform mathematical operations on signals. The operations should include operations on the dependent as well as independent variables. • Familiar with commonly used signals such as Continuous-time, Discrete-time, Even, Odd, Periodic, Non-periodic, Deterministic, Random, Energy, Power, unit step, ramp, impulse function, sinusoidal signals, and complex exponential signals. • Describe systems using linear constant coefficient differential equations and using their impulse response. • Understand system properties - linearity, time invariance, presence or absence of memory, causality, bounded-input bounded-output stability, and

	invertibility. • Identify whether a given system exhibits these properties and its implication for practical systems. • Perform the process of convolution (convolution sum, convolution integral, circular convolution) between signals and understand its implication for the analysis of linear time-invariant systems. • Understand the notion of an impulse response. • Compute the output of an LTI system given the input and the impulse response through convolution sum and convolution integral. • Understand the intuitive meaning of frequency domain and the importance of analyzing and processing signals in the frequency domain. • Compute the Fourier series or Fourier transform (DFT, FFT) of a set of well-defined signals from first principles. • Use the properties of the Fourier transform to compute the Fourier transform (and its inverse) for a broader class of signals.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Signal: Introduction to Signal modeling, Classification of Signals, Basic Operations on signals, Types of Signals.

System: Continuous-Time and Discrete-Time System, Stable and Unstable System, Memory and Memoryless System, Invertible and Noninvertible System, Time-invariant and Time-variant System, Linear and Nonlinear System, Causal and Noncausal System, Interconnection of System, Auto and CrossCorrelation..

LTI Systems: Discrete-time Linear Time-invariant System, Properties of LTI System, Properties of Discrete-time LTI System, Linear Convolution, Circular Convolution, Deconvolution.

PART-B

Fourier Series: Fourier Series Representation of Continuous-time periodic Signal, Properties of Continuous-time Fourier Series, Power Density Spectrum of Periodic Signal, Convergence of Fourier Series, Fourier Series Representation of Discrete-time periodic Signal, Properties of Discrete-time Fourier Series.

Fourier Transform: Continuous-time Fourier transforms, spectrum Analysis of Aperiodic Signals, Properties of Continuous-time Fourier Transform, Representation of Discrete-time Aperiodic Signals, Properties of Discrete -time Fourier Transform, DFT, IDFT.

Books Recommended:

1. Digital Signal Processing : S Poornachandra, B Sasikala
2. Signals and Systems : Simon Haykin& Barry Van Veen
3. Digital Signal Processing: Principles, Algorithms, and Applications : John G. Proakis&Dimitris G. Manolakis
4. Discrete-Time Signal Processing : Alan V. Oppenheim&Ronald W. Schafer

ICE-2206: Signals and Systems Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The primary objective of this course is to provide a thorough understanding and analysis of signals and systems using MATLAB.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Understand basics of MATLAB syntax, functions and programming. • Generate and characterize various continuous and discrete time signals. • Perform the basic operations on the signals. • Design and analyze linear time-invariant (LTI)systems and compute its response. • Analyze the spectral characteristics ofsignals using Fourier analysis
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Signals and Systems.

ICE-2207: Electromagnetic Fields and Waves

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	To provide the basic skills required to understand, develop and design various engineering applications involving electromagnetic fields. To expose the students to the ideas of electromagnetic waves and structure of transmission line and Waveguide. To be able to use Smith Chart to solve transmission line problem.
Course Learning Outcomes (CLO)	On successful completion of this course students will be able to: • Understand different concepts of electromagnetic field theory. • Understand the phenomena of wave propagation. • Generalizethe concepts of guided structures like transmission line. • Work with plane wave, calculate the reflection and transmission coefficients • Understand and can apply Poyenting theorem to calculate average power. • Understand the meanings of characteristic impedance and complex propagation constant and can relate them to the basic transmission line parameters (L',C',R' and G'). • Calculate input impedance and reflection coefficient of an arbitrarily terminated transmission line and can use Smith chart to convert these quantities • Understand the concept of propagating modes, TE and TM decomposition evanescent modes and cutoff frequency in waveguides • Calculate the cutoff frequency and propagation constant for parallel plate, rectangular and circular waveguides.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Field Equations: Field equations based on laws of Coulomb, Ampere and Faraday; Displacement current; Maxwell's equation; Units and

dimensions of field vectors; E-H symmetry; Lorentz's lemma; Scalar and Vector potentials; Retarded potentials.

Electromagnetic Waves: Wave equations; Plane wave concept; Plane electromagnetic waves in Free-Space, Conducting, Dielectric and Ionized media. Pointing vector; Joule Heating in good conductors; Intrinsic impedance and Propagation Constant.

Radio Wave Propagation: Surface and space wave propagation, Sky wave through Ionosphere. Pulse method for measuring height and electron concentration of Ionospheric region; Chapman theory of layer formation, Ionospheric storm.

PART-B

Reflection and Refraction of Electromagnetic Waves: Boundary conditions; The laws of reflection and Snell's law of refraction; Reflection from dielectrics and conductors; Fresnel's equations; The Brewster angle; Total reflection; Skin effect; Phase and Group velocities, Reflection and Refraction in the Ionosphere.

Transmission Lines: Transmission line equations and parameters; Transmission line configuration and formulae; Transmission line at radio frequency; Impedance matching; Line termination; Smith chart; SWRQ and band width; Balanced and unbalanced feeder from transmitter to antenna; Transmission at audio frequency; Distortionless line.

Waveguides: Application of Maxwell's equations to the rectangular waveguides, The $TM_{m,n}$ wave in the rectangular waveguide, The $TE_{m,n}$ wave in the rectangular waveguide; Cylindrical waveguides.

Books Recommended:

1. Networks, Lines and Fields : J.D. Ryder
2. Introduction to Electromagnetic Field and Wave : Corson and Lorain

Math-2201: Complex Variable Analysis, Laplace and Fourier Transforms

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The main objectives of the course are to familiarize students with the complex plane and complex functions, introduce the basic theory of conformal mapping and its applications to engineering problems, cover the basic theory of complex integration in depth, provide students with knowledge of the theory of power series (Taylor and Laurent Series) and discuss its applications to

	residue integration and various problems in the field of Engineering, discuss Fourier series and integrals in detail, cover the Fourier transform and its inverse in depth, and familiarize students with the theory of Laplace and z-tranforms
Course Learning Outcomes (CLO)	After completion of the course students are expected to be able to: • Perform operations with complex numbers. • Explain the concepts of differentiability and analyticity of complex functions and apply them to problems from complex function theory. • Apply the theory of conformal mapping to solve problems from various fields of engineering. • Compute complex integrals. • Utilize the theory of complex integration and power series to solve problems from the area of residue calculus. • Apply Fourier series and transforms to differential and integral equations. • Implement Laplace and Z-transforms to solve problems in signal and systems theory
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

The complex number system: Complex plane, the extended plane and its spherical representation (Riemann sphere).

Complex function: Single and many valued function, Branch point, limit, continuity and differentiability of complex functions.

Analytic functions: Necessary and sufficient conditions, Mobius transformation, Power series. Harmonicfunction.

Complex Integration: Power series representation of analytic functions, zeros of analytic functions, Cauchy's theorem, Morera's theorem, Cauchy integral formula, Singularities and its classifications.

Maximum modulus theorem, the homotopic version of cauchy's theorem and simple connectivity, the open Mapping theorem, Taylor's and Laurent series, Fundamental theorem of algebra, Rouches theorem. The argument principle, The Residue Theorem Contour integration.

Conformal mapping: Conformal mapping, bilinear mapping. Applications of conformal mapping, Riemann Mapping theorem, Riemann zeta function, Analytic continuation, Riemann surface.

PART-B

Laplace Transforms: Introduction to the Laplace Transform; Laplace transforms of some elementary functions, sufficient conditions for existence of Laplace Transforms, Inverse Transforms and Transforms of Derivatives; The Unit Step Function; Constant Coefficient Equations with Piecewise Continuous Forcing Functions; The Inverse Laplace Transform; Operational Properties I:Translation on the *s*-Axis,Translation on the *t*-Axis; Operational Properties II: Derivatives of a Transform, Transforms of Integrals,Transform of a Periodic Function; The Dirac Delta Function; Some special theorems on Laplace Transforms, Partial fractions, Solutions of differential equations by Laplace Transforms, Evaluation of improper integrals.

Fourier Analysis: Fourier Series; Fourier Cosine and Sine Series, Real and complex form of Fourier series, Finite transform, Fourier Integral, Fourier transforms and their uses in solving boundary value problems of wave equations.

Books Recommended:

1. Functions of one complex variable : J. B. Conway
2. Laplace Transforms : Murray Spiegel
3. Fourier and Laplace Transforms : R. J. Beerends
4. Complex Variables and Applications : J.W Brown, and R.V. Churchill
5. Differential Equations With boundary value problems : D. G. Zill, w. S. Wright, and m. R. Cullen

Stat-2201: Sampling Distribution and Hypothesis Testing

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The purpose of this course is to provide students about concepts of basic statistics, statistical distributions and their extensive use in real life situations, in particular, in the area of science and engineering. Topics covered include basic descriptive measures, measures of association, probability theory, confidence intervals, and hypothesis testing. The goal is to familiarize students with powerful analytical and numerical tools in the areas of probability and statistics that can be used to solve real

	life problems.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • Plan and implement a statistical study. • Summarize the results of a study using graphs and numerical measures. • Interpret and apply the results of statistical works. • Identify the appropriate statistical procedure to analyze the data. • Report statistical results in a clear and coherent form. • Perform basic statistical inference tasks. • Demonstrate their knowledge of the basics of inferential statistics by making valid generalizations from sample data. • Interpret statistical analysis and draw conclusions in the presence of uncertainty.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Sampling Distribution: Fisher's Lemma, Study of χ^2-Distribution, T-Distribution and F-Distribution, Properties, Uses and Applications, Distribution of sample correlation coefficient in the null case, Sampling Distribution of the Medians and Range.

Elements of Point Estimations: Basic Concepts, Consistent estimates, unbiased estimates, Mean and variance of estimated Ideas of Efficiency, Principle of Maximum Likelihood, Illustration from Binomial, Poisson and Normal Distributions.

PART-B

Decision Rules: Statistical decisions, Statistical hypothesis: Critical region, Best critical region, Types of errors, Procedure of test of hypothesis, Most Powerful Test, Standard Errors.

Test of Significance: Test of single mean and single variance, Comparison of two sample Means, Proportions and Variances, Bartlett's test for homogeneity of variances, Test for Correlation and Regression coefficients, Exact test for *2×2* tables, Test for *r×c* tables, Three-way contingency tables, Large Sample Test of Significance, Non-Parametric Test, One Sample and two Sample Sign Test, Run Test and Rank Sum Test.

Books Recommended:

1. Intermediate Mathematical Statistics : Beaumont, G.
2. Introductory Engineering Statistics : Gutman, Wills and Hunter
3. The advanced Theory of Statistics : Lindgren, B.W.

Stat-2202: Sampling Distribution and Hypothesis Testing Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to introduce students with the basic concepts of data analysis and statistical computing. The main objective is to provide students with pragmatic tools for assessing statistical claims and conducting their own statistical analyses.
Course Learning Outcomes (CLO)	After completing this laboratory course, students should be able to: • Collect, manage and store statistical data ready for analysis. • Apply fundamental statistical methods to explore, analyze and visualize data and test statistical hypotheses. • Construct appropriate graphical displays of data and explain the role of such displays in data analysis. • Assess the nature of random variables and probability distributions through direct calculation.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Sampling Distribution and Hypothesis Testing.

B.Sc. (Engineering) courses for 3rd year 1st semester				
Sl.	**Course Code**	**Course Title**	Contact Hrs/week	**Credits**
1	**ICE-3101**	Artificial Intelligence and Robotics	3.00	3.00
2	**ICE-3102**	Artificial Intelligence and Robotics Sessional	1.50	0.75
3	**ICE-3103**	Web Programming	3.00	3.00
4	**ICE-3104**	Web Programming Sessional	1.50	0.75
5	**ICE-3105**	Database Management Systems	3.00	3.00
6	**ICE-3106**	Database Management Systems Sessional	1.50	0.75
7	**ICE-3107**	Computer Architecture and Microcontroller Design	3.00	3.00
8	**ICE-3108**	Computer Architecture and Microcontroller Design Sessional	1.50	0.75
9	**ICE-3109**	Digital Signal Processing	3.00	3.00
10	**ICE-3110**	Digital Signal Processing Sessional	1.50	0.75
11	**ICE-3111**	Viva-voce	1.50	0.75
		Total ➔	**24**	**19.5**

DETAIL SYLLABUS

ICE-3101: Artificial Intelligence and Robotics

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning. Students will implement a small AI system in a team environment. The knowledge of artificial intelligence plays a considerable role in some applications students develop for courses in the program. The objective of the course also focuses on Fuzzy logic fundamentals, Natural language processing, Expert system and Robotics.
Course	After studying this course, students should be able to:

Learning Outcomes (CLO)	• Select Artificial Intelligence techniques for problem solving. • Compare AI with human intelligence and traditional information processing, and discuss its strengths and limitations and its application to complex and human-centered problems. • Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations. • Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning. • Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents and expert systems. • Demonstrate profciency developing applications in an 'AI language', expert system shell, or data mining tool. • Demonstrate profciency in applying scientifc method to models of machine learning. • Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications. • Demonstrate a knowledge based system.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Overview of AI, Historical background, Conventionalcomputing vs Neural computing, Human vs Computer, Turing test, Scopes, Possibilities, Goals and Applications of AI.

Knowledge Acquisition and Representation: Knowledge and its properties, Types of knowledge, Knowledgeacquisition,Knowledgerepresentation, Knowledge representation issues, Knowledgerepresentation schemes: Knowledgerepresentation using Predicate logic, Rules, Frames, Scripts, Semantic nets, Conceptual graphs, etc.

Problem Solving through search: Agents and environments, Nature of environments, Structure of agents, Problem solving agents, Problem formulation, Problem solving performance, Uninformed search strategies, Breath-first search, Depth-first search, Depth-limited search, Iterative

deepening depth-first search, Bidirectional search, Informed search strategies, Greedy best-first search, A* search, Memory-bounded heuristic search, Heuristic functions, Local search algorithms and optimization problems, Constraint satisfaction problems.

PART-B

Logical Reasoning: Logical agents, Knowledge-based agents, Propositional logic, Reasoning patterns in propositional logic, Inferences, First-order logic, Knowledge engineering in first-order logic, Inferences in first-order logic, Unification, Forward chaining, Backward chaining, Resolution.

Uncertain Knowledge and Reasoning: Uncertainty, Review of probability, Probabilistic Reasoning, Representing knowledge in uncertain domain, Bayesian networks, Inferences in Bayesian networks, Probabilistic Reasoning over time, Temporal models, Hidden Markov models, Dynamic Bayesian networks.

Robotics and Expert System: Introduction, Robot hardware, Robotic perception, Robotic movements, Robot controlling, Robot software architecture, Application domains, Natural language processing, Machine learning, Expert system, Fuzzy logic concept.

Books Recommended:

1. Artificial Intelligence A Modern Approach : Stuart Russell and Peter Norvig
2. Artificial Intelligence : E. Ritch and K. Knight
3. Introduction to Turbo Prolog : Carl Townsend
4. Introduction to AI : D. W. Patterson

ICE-3102: Artificial Intelligence and Robotics Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to make the students knowledgable and expertise in design and development of AI problems as well as solutions through searching. To make the students familiar with AI programming, Natural language processing, and implementing different problem solving algorithms.
Course Learning Outcomes (CLO)	After completing this course, students should be able to: • Implement different search algorithms to solve AI problems. • Solve toy problems as well as real world problems. • Design and develop interesting games.

	• Develop different problem solving agents. • Design a knowledge based system.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation, and 10% Attendance.

Laboratory based on Artificial Intelligence and Robotics.

ICE-3103: Web Programming

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	To understand the concepts, principles, strategies, and methodologies of web applications and development. Technical Communicators need an awareness of the potential and constraints of web programming and how it affects writing in a web environment. The course will give you grounding in the nuts and bolts of the tags, script, and code that create web pages. It will not turn you into a programmer, but it will help you understand how the web and web pages work. This knowledge will allow you to build on the skills you will have and to understand the potentials and limitations placed on writing for web pages.
Course Learning Outcomes (CLO)	Completion of this course means you will able to: • Demonstrate competency in the use of common HTML code. • Demonstrate competency using FTP to transfer web pages to a server. • Construct efficient file structure for web sites. • Evaluate the functions of specific types of web pages in relationship to an entire web site. • Design electronic text and web pages that include the standard textual components needed on web pages. • Understand how CSS will affect web page creation. • Understand the role of JavaScript in web page creation. • Modify CSS and JavaScript for use on a web site. • Understand how PHP will affect web page creation.
Assessment	Total marks of the course is distributed as:

Methods	70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

HTML & HTML5: Introduction, Editors, Basic Elements, Attributes, Formatting, Links, Tables, Lists, Forms, Colors, HTML Graphics, and HTML5: Elements, Semantic, Forms, Graphics, Media, APIs.

JavaScript: Introduction , Why JavaScript, Output, Statements, Comments, Variables, Data Types, Objects, Functions, Operators, Comparisons, Conditions, Switch, Loops, Breaks, Regular Expressions, Ajax, JS HTML DOM.

PART-B

CSS & CSS3: Introduction, Syntax, ID and Class, Texts, Fonts, Links, Lists, Tables,Selectors, Attr Selectors, CSS3: Gradients, 2D Transform, 3D Transform, Transition, Animations, Media

PHP & MySQL: Basic syntax, Types, Variables, Constants, Expressions, Operators, Control Structures, Functions, Classes and Objects, Exceptions, HTTP authentication with PHP, Cookies, Sessions, Database, MySQL, Database Connections.

Books Recommended:

1. PHP Bible : Tim Converse
2. PHP and MySQL Web Development : Luke Welling, Laura Thomson
3. Beginning PHP and MySQL : W. Jason Gilmore
4. PHP 6 and MySQL 5 : Larry Ullman

ICE-3104: Web Programming Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	This course is intended to teach the basics involved in publishing content on the World Wide Web. This includes the 'language of the Web' HTML, the fundamentals of how the Internet and the Web function, a basic understanding of graphic production with a specific stress on creating graphics for the Web, and a general grounding introduction to more advanced topics such as programming and scripting. This will also expose students to the basic tools and applications used in Web publishing.

Course Learning Outcomes (CLO)	After the course students will be able to : • Analyze a web page and identify its elements and attributes. • Create web pages using HTML and Cascading Style Sheets. • Build dynamic web pages using JavaScript (Client side programming). • Build dynamic web pages using PHP (Server side programming).
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Web Programming

ICE-3105: Database Management Systems

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The objective of the course is to introduce database management systems with an emphasis on how to organize, maintain and retrieve information efficiently from a Data Warehouse.
Course Learning Outcomes (CLO)	Upon the successful completion of this course students will be able to: • Describe the fundamental elements of database management systems. • Provide an explanation on the basic concepts of relational data model, entity-relationship (ER) model, relational algebra, relational database design and Structured Query Language (SQL). • Make conversion of the ER-model to relational tables, populate relational database and formulate SQL queries on data. • Develop ER-models to represent simple to complex database application scenarios. • Improve the database design by normalization. • Familiarize with primary database storage structures

	and access techniques such as file and page organizations, indexing methods including B tree, and hashing.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Database systems, Database system versus file system, View of data, Database languages, Database users and administrators, Database architecture, Advantage and disadvantages, Applications.

Database Models: Structure of Relational database, Relational Algebra, Entity-Relationship Model, Constraints, Keys, Entity-relationship diagram, Design of an E-R database schema.

Structured Query Language: Background, Data definition, BasicSQLStructure, Set operation, Aggregate functions, Null values, Modification of the database.

PART-B

Well-organized Database Design: Features of good relational designs, Database Normalization, pitfalls in Relational database design, Functional dependencies, Decomposition a relational schema, Referential integrity, Assertions, Triggers, Security and authorization.

Data Storage and Organization: Physical Storage Media, RAID, Storage Access, File Organization, Record organization in a file, Indexing, Hashing.

Transaction Management: Transaction concept, Transaction state, Automaticity and durability, Concurrent executions, Concurrency control, Log-based protocols, Deadlock detection and recovery, Failure classification, Recovery and automaticity, Log-based recovery.

Books Recommended:

1. Database System Concepts : Silberschatz, Korth
2. Understanding Database Management Systems : Joseph A. Vaste
3. Introduction to Database Management System, A Practical Approach. : Gerry M. Litton

ICE-3106: Database Management Systems Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to introduce students with the tools used in information manipulation from database using MySQL/SQL interface in order to be able to recognize, maintain and retrieve information according to their requirements.
Course Learning Outcomes (CLO)	After studying this course, students will be able to: • Provide better explanation on the underlying concepts of database management techniques. • Perfectly design and implement and normalize a database schema for a given problem-domain. • Populate and query a database using Data Manipulation Language (DML), Data Definition Language (DDL) commands. • Enforce integrity constraints on a database using a state-of-the-art Relational Database Management System (RDBMS). • Program Structured Query Language (SQL) including stored procedures, stored functions, cursors and packages.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Database Management Systems

ICE-3107: Computer Architecture and Microcontroller Design

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The objective of this course is to introduce the students about the principles of computer organization and the basic architectural concepts by emphasizing on performance, cost analysis, pipelining, memory hierarchy, virtual model management and I/O system. So that they can be able to learn the internal computer architecture and its design for real time application.
Course Learning Outcomes	Students who successfully complete the course will be able to: • Understand the structural architecture, function and

(CLO)	characteristics of computer and microcomputer systems. • Understand the architecture of different functional units and components of computers. • Recognize the elements of modern instruction sets and their impacts on processor design. • Explain completely the function of each element of memory architecture. • Recognize and differentiate different methods for computer I/O. • Describe the solution of any logical problem through microcontroller.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Design Methodology: Introduction, Combinational circuits, Sequential circuits, Register Level, Register-Level Components, Design Method, Processor-Level, Processor-Level Components, Design Techniques.

Processor basics: CPU organization, Information and Number Formats, Instruction Set, Instruction Format and Instruction Types, Addressing Modes.

Control Design: Introduction, Instruction sequencing, Instruction interpretation, Hardwired control, Multiplier control unit, CPU control unit, Micro-programmed control; Microinstruction, Micro-programmed sequencer.

Memory Organization: Memory devices and characteristics, RAM organization, Serial access memory; Virtual memory, Memory hierarchy, Main-memory allocation, Segments and Pages, High speed memories; Interleaving, Cache memory, Associative memory,

PART-B

Microprocessors: Evolution of microprocessors, Microprocessor organization, 8086 microprocessors, Microprocessor applications, Series of Intel and Pentium microprocessors and their addressing modes.

Assembly Language Programming: Instruction classification, Instruction format; Examples: data transfer group, Arithmetic group, Logical group, Branch group, I/O and Machine control group, Instruction timing and operation status; Introduction to 8086 instructions, Some examples of 6800 programming; Stack and subroutine.

Microcontroller*:* Different types of microcontroller, Processor architecture, microcontroller memory types, microcontroller features, 8051 microcontroller architecture, 8051 addressing modes, 8051 hardware features, 8051 programming

PIC Microcontroller: PIC microcontroller features, PIC 16C6X/7X microcontroller, architecture, memory organization, I/O ports, Interrupts, Timers, A/D I/O.

Books Recommended:

1. Computer Architecture and Organization : John P. Hayes
2. Microprocessor Hardware Interfacing and Application : Barry B. Brey
3. Digital Logic and Computer Design : Morris Manno
4. Programming and customizing 8051 microcontroller : MykePredko
5. The concepts & features of microcontroller : Raj Kamal

ICE-3108: Computer Architecture and Microcontroller Design Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objectives of this laboratory course is to introduce students with the tools for using microprocessors and microcontrollers in real time operation based on high performance at a marginal cost.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Analyze logical solution of any real time problem with certain Input and Output (I/O). • Compare accepted standards and guidelines to select appropriate Microprocessor (8085 & 8086) and Microcontroller to meet specified performance requirements. • Apply programming knowledge and demonstrate proficiency using the various addressing modes and data transfer instructions of the target microprocessor and microcontroller. • Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external peripherals.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report

	and 10% Attendance.

Laboratory based on Computer Architecture and Microcontroller Design

ICE-3109: Digital Signal Processing

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	This course is designed to provide students with a comprehensive treatment of the important issues in design, implementation and applications of digital signal processing concepts and algorithms. The course will cover some traditional topics such as transforms and filter design including DFT, FFT, Z-transform.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Understand digital signals in time and frequency domain. • Apply different transforms on digital signals. • Analyze different characteristics of a digital signal in the frequency domain. • Construct different types of digital filters.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Signals, Systems and Signal Processing; Classification of Signals, The Concepts of Frequency in Continuous-Time and Discrete-Time Signals, A/D and D/A conversions.

The z-Transform: The Z-Transform, Properties of the Z-Transform, Rational Z-Transforms, Inversion of the Z-Transform, Analysis of Linear Time-Invariant Systems in the Z-Domain, The One-Sided Z-Transform.

Sampling and Reconstruction of Signals: Ideal sampling and Reconstruction of Signals, Discrete-time processing of Continuous-Time Signals, Analog-to-Digital and Digital-to-Analog Converters, Sampling and Reconstruction of Continuous-Time Band pass Signals, Sampling of Discrete-Time Signals, Oversampling A/D and D/A Converters.

PART-B

The discrete Fourier Transform: Frequency-Domain Sampling, Properties of the DFT, Linear Filtering Methods Based on the DFT, Frequency Analysis of signals using the DFT.

First Fourier Transform Algorithms: Efficient Computations of the DFT: FFT Algorithms, Applications of FFT Algorithms, A Linear Filtering Approach to Computations of the DFT, Quantization effects in the Computation of the DFT.

Design of Digital Filters: General considerations, Design of FIR filters, Design of IIR Filters from Analog Filters, Frequency Transformations.

Books Recommended:

1. Digital Signal Processing: Principles, Algorithms, and Applications : John G. Proakis, Dimitris G. Manolakis
2. Digital Signal Processing : S Poornachandra, B Sasikala
3. Discrete Systems and Digital Signal Processing with MATLAB : Taan S. Elali

ICE-3110: Digital Signal Processing Sessional

Credit: 0.75; Contact Hours: 3.00 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The primary objective is to carry out software experiments illustrating the basic principles and techniques of digital signal processing and to learn the programming of real-time signal processing algorithms using MATLAB.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Introduce the basic principles, methods, and applications of digital signal processing, to explore its algorithmic, computational, and programming aspects. • Program digital signal processing algorithms in MATLAB, including the design, implementation, and real-time operation of digital filters, and applications of the fast Fourier transform.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Design and Analysis of Signal and Systems

B.Sc. (Engineering) courses for 3rd year 2nd semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credits**
1	**ICE-3201**	Network Programming with Java	3.00	3.00
2	**ICE-3202**	Network Programming with Java Sessional	1.50	0.75
3	**ICE-3203**	Telecommunication Engineering	3.00	3.00
4	**ICE-3204**	Telecommunication Engineering Sessional	1.50	0.75
5	**ICE-3205**	Digital Communication	3.00	3.00
6	**ICE-3206**	Digital Communication Sessional	1.50	0.75
7	**ICE-3207**	Digital Image and Speech Processing	3.00	3.00
8	**ICE-3208**	Digital Image and Speech Processing Sessional	1.50	0.75
9	**ICE-3209**	Antenna Engineering	3.00	3.00
10	**ICE-3210**	Antenna Engineering Sessional	1.50	0.75
11	**ICE-3211**	Project Design and Development	3.00	1.50
12	**ICE-3212**	Viva-voce	1.50	0.75
		Total ➔	**27**	**21**

DETAIL SYLLABUS

ICE-3201: Network Programming with Java

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The objective of this course is to introduce students to the basic of network programming, in the networking implementations. This course will provide the students with understanding of socket programming to interconnect computers and network programming. The module will cover topics such as class, treads, I/O stream and simple GUI methods By the end of the module, students should have an understanding of interfacing between computer and simple object oriented applications.
Course	After studying this course, students should be able to:

Learning Outcomes (CLO)	• Discuss network programming with Java in general, including some of the history and features that Java brings to network programming. • Type, compile, and execute example Java programs from the textbook that demonstrate key concepts of network programming. • Modify example programs to further demonstrate key concepts of network programming. • Create original programs in Java that demonstrate key concepts of network programming. • Create Java network programs that fulfill specific deliverables and provide significant network capability, as required, to fulfill assignment objectives and deliverables.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction to Java Applets: Introduction, Sample Applets provided with JDK, Simple Java Applet: Drawing a String, Applet Life-Cycle Methods, Initializing an Instance Variable with Method init, Sandbox Security Model.

Multimedia: Applets and Applications: Introduction, Loading, Displaying and Scaling images, Animating a Series of Images, Image Maps, Loading and Playing Audio Clips, Playing Video and Other Media with Java Media Framework.

GUI Component: Introduction, Simple GUI based Input/Output with JOptionPane, Overview of Swing Component, Displaying Text and Images in a Window, Text Fields and an Introduction to Event Handling with Nested Classes, Common GUI Event Types, How Event Handling Works, JButton, JCheckBox, JRadioButton, JComboBox, JList, Mouse Event Handling, Adapter Class, JPanel with Mouse, FlowLayout, BorderLayout, GridLayout, JTextArea, JSlider, Using Manus with Frames, JPopupMenu, JDesktopPane, JInternalFrame.

PART-B

Multithreading: Introduction, Thread States, Thread Priorities and Thread Scheduling, Creating and Executing Threads, Thread Synchronization, Producer/Consumer Relationship, Multithreading with GUI.

Networking: Introduction, Manipulating URLS, Reading a File on a Web Server, Establishing a Simple Server using Stream Sockets, Establishing a Simple Client using Stream Sockets, Client/Server Interaction with Stream Socket Connections, Connectionless Client/Server Interaction with Datagrams, Security and the Network.

Accessing Databases with JDBC: Introduction, Relational Databases, SQL, Instruction on Setting MySQL User Account, Creating a Database Books in MySQL, Manipulating Databases with JDBC, Stored procedures.

Books Recommended:

1. Java How To Program : Deitel&Deitel
2. Core Java Vol. 1 & 2, The Sun Microsystems : Cay Horstmann and Gary Cornell

ICE-3202: Network Programming with Java Sessional

Credit: 0.75; Contact Hours: 3.00 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to introduce students to the basic of network programming, so that they can able to design sockets, analyse stream, multithreading, connect and create database etc.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Implement TCP sockets in both client and server programs. • Analyse streams and treads in network's input and output. • Design applet programs. • Design multi-threading applications. • Design secure Socket. • Connect database.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Network Programming with Java

ICE-3203: Telecommunication Engineering

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	This course is designed to make the students understand the fundamentals of switching and networking principles used in telecommunication systems. They will understand the working principle and design of early automatic switching systems such as Strowger and crossbar switching as well as the concepts of telephone networks. They will also be able to learn the basic operations of electronic switching systems and resource sharing by multiplexing, to understand the computer controlled switching systems and to know the concepts of traffic engineering such as GoS, QoS and performance analysis based on queuing theory.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to : • Identify the fundamentals of switching and networking principles used in telecommunication systems. • Explain the working principle of automatic switching systems such as Strowger and crossbar switching. • Analyze the traffic requirements and design the switching system accordingly. • Develop concepts of various aspects of telephone networks such as switching hierarchy & routing, transmission, numbering & charging plans and signaling techniques. • Identify the basic principles of the modern electronic switching system. • Explain and design multistage networks. • Analyze and evaluate fundamental telecommunication traffic models. • Apply the principles of queuing theory in evaluating the performance of telecommunication networks.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Simple Telephone Communication**,** Basic Switching System, Transmission Bridge, Subscriber Line Circuit, CB Cord Circuit, Junction Working.

Strowger Switching Systems: Rotary Dial Telephone, Signaling Tones, Strowger Switching Components, Step-By-Step Switching, Design Parameters, 100-Line Switching System, 1000-Line Blocking Exchange, 10,000-Line Exchange.

Crossbar Switching: Principlesof Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configuration, Cross Point Terminology, Crossbar Exchange Organization.

PART-B

Electronic Switching: Stored Program Control, Centralized SPC, Software Architecture, Application Software, Enhanced Services, Two-Stage Network, Three-Stage Network, N-Stage Network, Concepts Of TDM, Basic Time Division Space Switching, Basic Time Division Time Switching,

Traffic Engineering: Network Traffic Load And Parameters, Grade of Service (Gos) And Blocking Probability, Modeling Switching Systems, Incoming Traffic And Service Time Characterization, Blocking Models And Loss Estimates, Delay Systems.

Telephone Networks: Subscriber Loop Systems, Switching Hierarchy and Routing, Transmission Plan, Transmission Systems, Numbering Plan, Charging Plan, Signaling Techniques, Inchannel Signaling, Common Channel Signaling (CCS).

Books Recommended:

1. Telecommunication Switching Systems and Networks : ThiagrajanViswanathan
2. Telecommunication Switching Principle : M. T. Hills
3. Digital Telephony : J.C. Bellamy

ICE-3204: Telecommunication Engineering Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	Produce graduates with the necessary background and technical skills to work professionally in one or more of the following areas: telecommunication hardware and software design, computer network design, telecommunication system design and integration in wire line, mobile and satellite systems.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • To give practical exposure on basic switching and networking principles • Analyze the traffic requirements and design the switching system accordingly. • To explain and design multistage networks. • Analyze and evaluate fundamental telecommunication traffic models.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on TelecommunicationEngineering

ICE-3205: Digital Communication

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The main objective of this course is to provide students with a good understanding of digital communications principles and digital techniques required in the rapidly expanding field of digital signal transmission and modulation in communication systems.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Analyze and measure the performance of a baseband and pass band digital communication system in terms of error rate and frequency spectrum. • Describe the performance of line coding techniques and methods to mitigate inter symbol interference (ISI). • Understand the generation and detection technique of base band system.

	• Recognize the generation, detection of signal space diagram, spectrum, bandwidth efficiency, and probability of error analysis of different band pass modulation techniques. • Define and determine the performance of different error handling mechanism for the reliable transmission of digital information bearing signal and information over the channel. • Understand and analyze various signal spreading techniques and determine bit error performance of various digital communication systems.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Sources and signals, Basic signal processing operation in digital communication, Channels for digital communication, Channel capacity theorem, Channel coding theorem.

Detection and Estimation: Model of digital communication system, Gram-Schmidt orthogonalization procedure, Geometric interpretation of signal, Detection of signals in noise, Probability of error, correlation receiver, matched filter receiver, Estimation: concept and criteria, Maximum Likelihood Estimation, Weiner filters, adaptive filters, Linear prediction.

Sampling Process: Sampling theorem, Quadrature sampling of band-pass signals, Reconstruction of a message process from its samples, Signal distortion in sampling.

Waveform Coding Techniques: PAM, PCM, DPCM, Delta Modulation Channel noise, Quantization noise, SNR, Robust quantization.

PART-B

Baseband Shaping for Data Transmission: Power spectra of discrete PAM signals, Inter-symbol interference, Nyquist criterion, Correlation coding, Eye pattern, Baseband M-ary PAM systems, Adaptive equalization for data transmission.

Digital Modulation Techniques: Digital modulation formats, coherent and noncoherent binary modulation techniques, Coherent quadrature modulation techniques, M-ary modulation techniques, Power spectra, Bandwidth efficiency, Effect of inter-symbol interference, Bit versus symbol error probabilities, Synchronization.

Spread Spectrum: SS principle, Pseudo noise sequences, A Notion of Spread Spectrum, direct sequence spread spectrum, frequency hopping spread spectrum, Spreading code for Multi-user DSSS, Multiuse FHSS.

Books Recommended:

1. Digital Communication Systems : Simon Haykin
2. Digital Communication : John G. Proakis
3. An Introduction to Analog and Digital Communications : Simon Haykin and Michael Moher

ICE-3206: Digital CommunicationSessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to introduce students with the steps involved in the analysis of digital communication system. So that the students will be able to synthesize a digital communication module with the given specifications.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Understand basic theories of Digital communication system in practical. • Design and implement different modulation and demodulation techniques. • Analyze digital modulation such as Pulse Code Modulation (PCM), Pulse Amplitude Modulation (PAM) techniques and shift keying techniques by using MATLAB tools. • Identify and describe different techniques in modern digital communications, in particular source coding and channel coding using MATLAB tools
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Digital Communication.

ICE-3207: Digital Image and Speech Processing

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course	The main objective of the course is to (i) understand and

Objectives	analyze image and speech processing problems and (ii) design algorithms to solve image and speech processing problems and meet design specifications
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • Understand the relevant aspects of digital image representation and their practical implications. • Understand 2-D convolution, the 2-D DFT, and have the ability to design systems using these concepts. • Understand the role of alternative color spaces, and the design requirements leading to choices of color space. • Have an understanding of the underlying mechanisms of image compression, filtering, transformation, edge detection, image restoration.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Digital Image Fundamentals: Digital image processing, Image representation and modeling, Image sampling and quantization, Image transformation, Image representation, Some basic relationship between pixels.

Color Models: Properties of light, Intuitive color concepts, RGB color model, YIQ color model, CMY color model, HSV color model, Conversion between HSV and RGB models, color selection and application.

Image Enhancement: Point operation, Gray level transformation, Histogram modeling, Spatial operations, Transform operations, Multispectral image enhancement, Color image enhancement.

Image Transforms: Fourier transform, Discretefourier transform, Discrete cosine transform, Wavelet transform, Haar transform.

Image Segmentation and Compression: Spatial feature extraction, Image segmentation, Edge detection, Boundary extraction, Region representation, Pixel coding for image data compression, Predictive techniques, Transform coding, Standards for image compression-JPEG, MPEG.

PART-B

Basic Concepts: Speech fundamentals: Articulatory phonetics, Production and classification of speech sounds, Acoustic phonetics, Acoustics of speech production, Short-time Fourier transform, Filters.

Speech Analysis: Features, Feature extraction and pattern comparison techniques, Speech distortion measures, Mathematical and perceptual consideration, Log spectral distance, Cepstral distances, LPCandPLPcoefficients.

Speech Recognition: Large vocabulary continuous speech recognition, Architecture of a large vocabulary continuous speech recognition system, Speech restoration, Speaker recognition, Speaker separation, Pitch estimation.

Speech Synthesis: Text-to-speech synthesis, Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness –role of prosody, Music analysis-synthesis.

Books Recommended:

1. Digital Image Processing : Rafael C. Gonzalez
2. Digital Image Processing using MATLAB : Rafael C. Gonzalez
3. Fundamentals of Speech Recognition : Lawrence RabinerandBiing-Hwang Juang

ICE-3208: Digital Image and Speech Processing Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory is to develop skills to design and implement different image filtering, image transformation techniques, and image compression technique.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Determine and demonstrate bugs in the program, recognize needed basic operations of digital image processing. • Formulate new solutions for programming problems or improve existing code using different image filtering, image transformation, and edge detection algorithm. • Implement and find the solution ofdifferent image compression algorithms, image sharpening, and face detection algorithms.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Digital Image and Speech Processing

ICE-3209: Antenna Engineering	
Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100	
Course Objectives	The objective of this course is to introduce the fundamental principles of antenna theory and to apply them to the analysis, design, and measurement of antenna systems. Students will learn how to characterize antennas and how to use antennas in wireless communication systems. A comprehensive theory of different types of antennas and its radiation characteristics, antenna arrays and experimentally measurement techniques to validate the theoretical data will also be discussed in detail.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • Define antenna, and explain the different types of antennas and the radiation mechanism. • Name the fundamental parameters of antenna and compute the basic antenna parameters using standard formulas. • State and explain Duality theorem, Reciprocity, Reaction theorems, the concept of microstrip and smart antennas, and their applications. • Recognize antennas and antenna arrays as per their operating frequency ranges and radiation pattern for the specific applications. • Design and analyze for the different types of antennas such as: Linear Wire Antennas, Loop Antennas, Antenna Arrays, microstrip and smart Antennas. In addition, evaluate various antenna measurements techniques to assess antenna's performance.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Antennas: Introduction, Wire Antennas; Aperature, Microstrip, Array,

Reflector and Lens Antennas; Radiation mechanism; Current distribution on a thin wire antenna.

Fundamental Parameters of Antenna: Radiation patterns, Radiation power density, Radiation intensity, Directivity, Gain, Antenna efficiency, Half-power beamwidth, Beam efficiency, Bandwidth, Polarization, Input impedance, Antenna radiation efficiency, Vector effective length, Maximum directivity and maximum effective area, Antenna temperature,

Linear Wire Antennas: Introduction, Infinitesimal dipole, Small dipole, Region separation: Far-field and near-field, Finite length dipole, Half wavelength dipole, Linear elements near infinite perfect conductor, Ground Effects.

PART-B

Loop Antennas: Introduction, Small circular loop, circular loop of constant current, circular loop with nonuniform current, Ground and earth curvature effect, Ferrite loop, Mobile communication system Applications

Antenna Arrays: Two element array, N-element linear array: Uniform amplitude and spacing, Directivity, 3D characteristics, Uniform spacing and nonuniform amplitude; Superconductivity, Planar array.

Antenna measurements: Antenna Ranges, Radiation patterns, Gain and directivity measurements; Radiation efficiency; Impedance, current and polarization measurements; Scale model measurements.

Books Recommended:

1. Antenna Theory : C. A. Balanis
2. Antennas : J D Kraus
3. Antenna Engineering Handbook : John Volakis
4. Radio Engineering Principles of Communication Systems : G K Mithal

ICE-3210: Antenna Engineering Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The main objective of this sessional course is to make well-known students with the computer simulation and/or programming tools such as MATLAB, and different antenna hardware systems. With the help of Antenna Trainer Kits, students can set up a complete transmitting-receiving communication system and hence, can measure the radiated field and draw the radiation pattern practically. Further, computer simulation exercises are intended to help the student in familiarize

	and mastering the subject matter with implementation aspects and the application of theoretical knowledge to practical problems.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • Understand basic antenna parameters. • Measure antenna parameters. • Identify, analyze and interpret the fundamental parameters of antennas. • Set up a complete communication system and measure radiation pattern. • Formulate the radiation fields of an antenna, at both near-and far-zone; and identify the duality and reciprocity principles. • Formulate and analyze the radiation from wire antennas (dipoles, monopoles, loop antennas). • Formulate and analyze the antenna arrays. • Ability to design and conduct experiments, gather data, analyze and interpret results for investigating antenna engineering problems. • Formulate and analyze the aperture antennas and microstrip antennas.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Antenna Engineering.

ICE-3211: Project Design and Development

Design and development of project based on the subjects taught in the previous semesters.

B.Sc. (Engineering) courses for 4th year 1st semester				
Sl.	**Course Code**	**Course Title**	Contact Hrs/week	**Credits**
1	**ICE-4101**	Data Communication and Networking	3.00	3.00
2	**ICE-4102**	Data Communication and Networking Sessional	1.50	0.75
3	**ICE-4103**	Cellular and Mobile Communication	3.00	3.00
4	**ICE-4104**	Cellular and Mobile Communication Sessional	1.50	0.75
5	**ICE-4105**	Information Theory and Coding	3.00	3.00
6	**ICE-4106**	Information Theory and Coding Sessional	1.50	0.75
7	**ICE-4107**	Cryptography and Computer Security	3.00	3.00
8	**ICE-4108**	Cryptography and Computer Security Sessional	1.50	0.75
9	**ICE-41xx**	**Optional-I**	3.00	3.00
10	**ICE-4110**	Viva-voce	1.50	0.75
		Total ➔	**22.5**	**18.75**

List of Optional Courses

Optional-I

Optional-I should be selected from the following courses:

Sl.	Course Code	Course Title	Contact Hrs./week	Credits
1.	**ICE-4112**	Advanced Computer Networks	3	3
2.	**ICE-4113**	Management Information System	3	3
3.	**ICE-4114**	E-Commerce and E-Governance	3	3
4.	**ICE-4115**	Information Security and Cyber Laws	3	3

DETAIL SYLLABUS

ICE-4101: Data Communication and Networking	
Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100	
Course Objectives	The objective of this course is to provide students an overview of the concepts and fundamentals of data communication and computer networks and fundamental knowledge of the various aspects of computer networking and enables students to appreciate recent developments in the area. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) , routing protocols, bridges, routers and gateways; network naming and addressing; and local and remote procedures. On completion of the course, the student should be able in part to design, implement and maintain a typical computer network (LAN).
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Build an understanding of the fundamental concepts of computer networking. • Familiarize the student with the basic taxonomy and terminology of the computer networking area. • Understand the foundations: Signal, frequency, phase, amplitude, bandwidth, synchronization, protocols etc. • Analyze different types of guided and unguided media • Understand and apply different data encoding techniques • Understand multiplexing techniques with the importance • Understand different error control and flow control techniques

	• Understand ATM and Frame relay, Congestion control etc. • Introduce the student to advanced networking concepts, preparing the student for entry advanced courses in computer networking. • Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Data Communication Model, Protocol, OSI Model, TCP/IP Protocol Suite, Addressing, Data and Signals: Periodic Analog Signals, Digital Signals, Transmission Impairments, Data Rate Limits, Performance; Digital Transmission: Digital-to-Digital Conversion, Analog-to-Digital Conversion, Transmission modes; Analog Transmission: Digital-to-analog Conversion, Analog-to-analog Conversion; Bandwidth Utilization: Multiplexing, Spread Spectrum, Transmission Media: Guided Media, Unguided Media; Switching: Circuit-Switched Networks, Packet Switching, Structure of a Switch, X.25, Frame Relay.

Data Link Layer: Link Layer Addressing, ARP, Error Detection and Correction: Introduction, Block Coding, Cyclic Codes, Checksum, Forward Error Correction; Data Link Control: DLC Services, Data Link Layer Protocols, HDLC, Point-to-Point Protocol, Multiple Access: Random Access, Controlled Access, Channelization; Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Telephone Networks, Cable Networks, SONET, ATM; Wireless LANs: Introduction, IEEE 802.11, Bluetooth, WiMAX, Cellular Telephony, Satellite Networks, Connecting LANs: Connecting Devices, Virtual LANs.

PART-B

Network Layer: Network Layer Services, Packet Switching, Network Layer Performance, IPv4 Addresses, DHCP, NAT, Forwarding of IP Packets; Network Layer Protocols: Internet Protocol (IP), ICMPv4, Mobile IP; Unicast Routing: Introduction, Routing Algorithms, Unicast Routing Protocols, RIP, OSPF, BGP4; Multicast Routing: Introduction, Multicast Protocols, IGMP; Next Generation IP: IPv6 Addressing, IPv6 Protocol, ICMPv6; Transport Layer: Introduction, Transport Layer Protocols, User Datagram Protocol (UDP), Transmission Control Protocol (TCP) and SCTP.

Application Layer: World Wide Web, HTTP, FTP, Electronic Mail, SMTP, TELNET, SSH, Domain Name System, Network Management: Introduction, SNMP; Multimedia: Compression, Multimedia Data, Multimedia in the Internet, Real-Time Interactive Protocols, RTP, RTCP, SIP; Quality of Service: Data Flow Characteristics, Flow Control to Improve QoS, Integrated Services (IntServ), RSVP, Differentiated Services (DiffServ); Cryptography and Network Security: Confidentiality, DES, IDEA, Public Key Algorithm, Digital Signatures; Internet Security: IPSec, SSL, PGP, Firewalls.

ISDN and Broadband ISDN: ISDN Principles, User Interface and Services, ISDN Channels, User Access and Protocols, B-ISDN Functional Architecture and Protocols.

Books Recommended:

1. Data Communications and Networking : Behrouz A. Forouzan
2. Data and Computer Communications : William Stallings
3. Computer Networking: A Top-Down Approach : James F. Kurose and Keith W. Ross
4. Computer Networks : Andrew S. Tanenbaum

ICE-4102: Data Communication and Networking Sessional

Credit: 0.75; Contact Hours: 3.00 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to create network using cisco packet tracer and to introduce with different network devices.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Learn the basic concepts of designing networks. • Configure LAN, WLAN, VLAN • Configure different routing protocols. • Configure static and dynamic routing through different protocols.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Data Communication and Networking.

ICE-4103: Cellular and Mobile Communication

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	To make the students familiar with cellular and mobile communication system and limitations of 2G, 3G and beyond. To identify the basic requirements of cellular concept, frequency reuse, hand-off strategies, channel assignment strategies, interference and system capacity. To analyze and understand the fading channel and their models. To understand the mobile data networks and different types of cellular communication standards.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Explain the basic principles of mobile communication system. • Illustrate the frequency reuse and handoff strategies. • Realize the effect of interference (CCI & ACI) and corresponding system capacity. • Analyze the channel planning of a cellular network. • Classify the small-scale and large-scale fading and effects. • Explain mobile data networks and their protocols. • Compare various generations of mobile communication standards.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Evolution of mobile radio communication, Overview of existing network infrastructure, Voice-oriented and data-oriented wireless networks, Generations of cellular networks: 1G, 2G, 2.5G, 3G and beyond, Wireless communication systems: Paging, Cordless telephone, Cellular telephone, Call generation cycle in cellular telephone.

Mobile Radio Propagation: Radio propagation mechanisms, Large-scale pathlossmodels: Free space propagation model, Tow-ray model, Outdoor propagation models: Path-loss models for mega, macro, and micro cellular areas, Indoor propagation models:Path-loss models for pico and femto-cellular areas, Signal penetration into building,

Distance-power relationship and shadow fading, Small-scale multipath propagation, Effect of multipath and Doppler shift, Types small scale fading, Rayleigh and Rician distribution, Statistical models for multipath fading channels.

Cellular Topology: The cellular concept, Cellular hierarchy, Cell fundamentals, Signal-to-interference ratio calculation, Frequency reuse, Interference and system capacity, Co-channel interference, Adjacent channel interference, Power control for reducing interference, Trunking and Grade of service.

PART-B

Capacity Expansion Techniques in Cellular Networks: Capacity expansion techniques, Architectural methods for capacity expansion: Cell splitting, Cell sectoring, Lee's microcell method, Using overlaid cells, Using smart antennas, Channel allocation techniques and capacity expansion: Fixed channel allocation (FCA), Dynamic channel allocation (DCA), Hybrid channel allocation (HCA), Comparison of FCAandDCA, Channel borrowing technique.

Mobility and Radio Resource Management: Mobility management, Location management, Handoff management, Architectural issues in handoff, Handoff decision time algorithm, Handoff management process, Types of handoff, Mobile IP, Radio resources and power management.

Digital Cellular Standards: AMPS and ETACS, United Stales Digital cellular (IS-54 and IS-136), Global System for mobile (GSM), CDMA digital cellular standard (IS-95), CT2 Standards for Cordless Telephones, WAP, WML, Bluetooth compatible cellular telephone system.

Books Recommended:

1. Wireless Communications: Principles and Practice : Theodore S. Rappaport
2. Principles of Wireless Networks : KavenPahlavan, Prashant Krishnamurthy
3. Wireless Communication : A Molisch
4. Wireless Communications : Andrea Goldsmith
5. Mobile Communications : Jochen H. Schiller

ICE-4104: Cellular and Mobile Communication Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to introduce students about various laboratory experiments to

	describe and analyze various examples of cellular and mobile communication systems using tools of MATLAB.
Course Learning Outcomes (CLO)	After completing this course, students should be able to: • Examine the effect of interference (CCI & ACI) and corresponding system capacity. • Determine the type of appropriate model for wireless fading channel. • Determine different capacity enhancement techniques and cellular hairerchy.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Cellular and Mobile Communication

ICE-4105: Information Theory and Coding

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	This course provides a basic understanding of the nature of information, the effects of noise in analogue and digital transmission systems and the construction of both source codes and error-detection/ error-correction codes.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Understand the fundamental concept of entropy and information as they are used in communications. • Enhance knowledge of probabilities, entropy, measures of information. • Determine the amount of information per symbol and information rate of a discrete memoryless source. • Design lossless source codes for discrete memoryless source to improve the efficiency of information transmission. • Evaluate the information capacity of discrete memoryless channels and determine possible code rates to achievable on such channels. • Apply Shannon-Hartley theorem for information transmission on Gaussian channels to determine the capacity. • Select a suitable lossy data compression technique for

	a given situation • Appreciate information theoretic results as fundamental limits on performance of communication systems. • Understand the implications and consequences of fundamental theories and laws of information theory and coding theory with reference to the application in modern communication and computer systems.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Entropy, Relative Entropy and Mutual Information: Entropy, Joint Entropy and Conditional Entropy, Relative Entropy and Mutual Information, Relationship between Entropy and Mutual Information, Chain Rules for Entropy, Relative Entropy and Mutual Information, Jensen's Inequality and its Consequences, Log Sum Inequality and Its Applications, Data-Processing Inequality, Sufficient Statistics, Fano's Inequality.

Asymptotic Equipartition Property: Asymptotic Equipartition Property Theorem, Consequences of the AEP: Data Compression, High-Probability Sets and the Typical Set.

Entropy Rates of a Stochastic Process: Markov Chains, Entropy Rate, Entropy Rate of a Random Walk on a Weighted Graph, Functions of Markov Chains.

PART-B

Source Coding: Prefix code, Kraft Inequality, McMillan's Theorem, Optimal Codes, Bounds on the Optimal Code Length, Huffman Codes, Shannon–Fano–Elias Coding, Universal Codes and Channel Capacity, Run-Length Coding, Arithmetic Coding, The Lempel-Ziv Algorithm.

Channel Coding and Capacity: Discrete Memoryless Channels, Noiseless Binary Channel, Noisy Channel with Nonoverlapping Outputs, Binary Symmetric Channel, Properties of Channel Capacity, Preview of the Channel Coding Theorem, Channel Coding Theorem, Information Capacity Theorem, Zero-Error Codes, Fano's Inequality and the Converse to the Coding Theorem, Equality in the Converse to the Channel Coding Theorem, Linear block codes , Hamming Codes, Cyclic Codes, Convolution codes, Maximum Likelihood Decoding of Convolutional Codes.

Books Recommended:

1. Elements of Information Theory : Thomas M. Cover, Joy A. Thomas
2. Fundamentals of Information Theory and Coding Design : Roberto Tongeri, Christopher J.S deSilva
3. Information Theory : Stefan M Moser
4. Probability and Computing : Michael mitzenmacher, Eli Upfal
5. Digital Communication Systems : Simon Haykin

ICE-4106: Information Theory and Coding Sessional

Credit: 0.75; Contact Hours: 3.00 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The course aims to make students familiar with the advanced knowledge of coding and information theory used in the modern wireless systems and applications and to enable them to work on relevant projects in wireless systems with MATLAB.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Understand the principles of coding techniques used in digital communication systems. • Implement various compression and error detection & correction schemes. • Understand of various coding techniques for different types of channels. • Recognize advances of coding theory in next generation broadband communication systems.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Information Theory and Coding.

ICE-4107: Cryptography and Computer Security	
Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100	
Course Objectives	This course provides students with concepts of computer security, cryptography,.basic algorithms for symmetric and asymmetric cryptography and their mathematical principles, address the confidentiality, key management, Digital signature and authentication as well as their applications, secure protocols, detection and other security techniques. Upon the completion of this course, students should be able to understand, appreciate, employ, design and implement appropriate security technologies and policies to protect computers and digital information.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to : • Know about various encryption techniques. • Understand the concept of Public key cryptography. • Study about message authentication and hash functions • Impart knowledge on Network security
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Overview of the various cryptographic services, Mechanisms and attacks, The OSI security architecture, Model for Network Security, Principles of Security, Types of Attacks.

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques Caesar Cipher, Monoalphabetic Ciphers, PlayfairCipher, Hill Cipher, Polyalphabetic Ciphers, One-time pad, Transposition Techniques, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic.

Symmetric Ciphers: DES and the Strength of DES, Theory of Block Cipher Design, Block Cipher Modes of Operation, The AES Cipher, Triple DES, RC5, Key Distribution, Random Number Generation.

PART-B

Public-Key Encryption: Prime Numbers and Testing for Primality, Discrete Logarithms, Principles of Public-Key Cryptosystems, the RSA Algorithm, Key Management, Diffie-Hellman Key Exchange.

Hashes and Messages Digests: Authentication Requirements and Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs, MD5 Message Digest Algorithm, Secure Hash Algorithm.

Digital Signatures and Authentication: Digital Signature, Authentication Protocols, Digital Signature Standard.

Books Recommended:

1. Cryptography and Network Security: Principles and Practice : William Stallings
2. Cryptography and Network Security : AtulKahate
3. Cryptography and Network Security : Behrouz A. Forouzan, DebdeepMukhopadhyay

ICE-4108: Cryptography and Computer SecuritySessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this sessional course is to introduce the students to the field of Cryptography and network programming using different encryption algorithm. The students will be able to enhance their analyzing and problem solving skills and use the same for improving security in any system.

Course Learning Outcomes (CLO)	After the course students will able to: • Give practical exposure on basic security attacks, encryption algorithms, and authentication techniques. • Provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures. • Explain various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes. • Familiarize symmetric and asymmetric cryptography
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Cryptography and Computer Security.

Optional-I

Optional-I should be selected from the following courses:

Sl.	Course Code	Course Title	Contact Hrs./week	Credits
1.	**ICE-4112**	Advanced Computer Networks	3	3
2.	**ICE-4113**	Management Information System	3	3
3.	**ICE-4114**	E-Commerce and E-Governance	3	3
4.	**ICE-4115**	Information Security and Cyber Laws	3	3

ICE-4112: Advanced Computer Networks

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The area of computer networking is undergoing rapid development; it's important to focus not only on what computer networks are today, but also on why and how they are designed the way they are. The aim of this course is to provide a sound conceptual grounding to computer networks and its design principles. In this course, we will study the fundamentals of building scalable computer networks. We will go through the thought-process that went into designing the Internet which is the best example of a computer network that has adapted and scaled to changing environment.
Course Learning Outcomes (CLO)	After studying this course, students will be able to: • Understand the TCP/IP protocol suite and the working of the Internet. • Form an understanding of the principles upon which the global Internet was designed. • Understand basic terminology so that students can understand networking research papers.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Network Layer:

ARP,RARP,ICMP,IPv4 Routing Principles, Routing and overview, DVR and LSR, the IGRP and EIGRP, BGP, Routing Information Protocol (RIP), OSPF (IPv4 /IPv6).Multicasting in IP Environments-Broadcasting, Multicasting, IGMP and Multicast Listener Discovery (MLD). The Distance Vector Multicast Routing Protocol (DVMRP), Multicast OSPF (MOSPF), Protocol Independent Multicast (PIM).

Transport Layer: Transport layer overview, UDP, TCP (Flow Control, Error Control, and Connection Establishment), TCP Protocol: TCP Tahoe, TCP Reno.

PART-B

Optical Networking: Introduction to Optical networking, its benefits and drawbacks, SONET layered architecture, frame format, SONET network configuration, its advantages and benefits.

Quality of Service: Introducing QoS, Queue Analysis, QoS Mechanisms, Queue Management algorithms, Resource Reservation, Diffserv and Intserv.

Overview of latest concepts:

TCP/IP Applications: VoIP, NFS, Telnet ,FTP,SMTP, SNMP, Finger, Whois and WWW, IP v6 and Next Generation Networks, xAAS(PAAS,SAAS,HAAS) and Cloud Computing, Big data, Elements of Social Network.

Books Recommended:

1. Internet networking with TCP/IP : Douglas E. Comer
2. TCP/IP Protocol Suite : B. A. Forouzan
3. TCP/IP Illustrated : W. Richard Stevens
4. Computer Networks-Protocols, Standards and Interfaces : U. Black
5. Computer Communication Networks : W. Stallings

ICE-4113: Management Information System

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The main objective of this course is to provide students with a broad perspective on Management Information Systems. It provides an overview of information systems, decision making, and information security challenges The course also deals with the concepts, skills, methodologies, techniques, tools, and perspectives essential for information systems analysts.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • Understand the leadership role of Management Information Systems in achieving business competitive advantage through informed decision making. • Analyze and synthesize business information and systems to facilitate the evaluation of strategic alternatives. • Effectively communicate strategic alternatives to facilitate decision making. • Illustrate redesigning the organization with information systems.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction to MIS: Definition, Characteristics, Types of MIS, Importance of information system, Limitations of Information system, Components and functions of an information system, Data Vs Information, Quality of good information, The process of converting data into information.

Conceptual Foundation: System Concepts, Information Systems, Information Technology, Differences between IS and IT, The role of IT and IS in organizational decision making, Information systems and Organizational Structure, Information Systems Resources, Classification of Information Systems

PART-B

Information and Managerial Decision Making Process: Information and role of management, Information and level of management, Information and Decision Making, Decision Support Systems, Different types of business problems, Different types of management decision making, Functions, components and Application of DSS, Executive Information Systems, Rationale for EIS, Characteristics of EIS,Differences among DSS, EIS, TPS and MIS, Artificial intelligence, AI technologies, Expert systems.

Controlling Information System: Computer-aided Systems, System vulnerability and abuse, Creating a control environment, Auditing information system.

Books Recommended:

1. Management Information Systems : James A. O'Brien
2. Management Information Systems- Organization and Technology : Laudon and Laudon

ICE-4114: E-Commerce and E-Governance

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The main objectives are as follows: • Understand concept of E-commerce and its types. • Be familiarized with technologies for E-commerce. • Understand different types of Online Payment systems. • Understand Selling and marketing on web. • Be familiarized with concept of E-business and E-business Models. • Understand various E-GovernanceStrategies

Course Learning Outcomes (CLO)	After the course students will able to: • Define and differentiate various types of E-commerce. • Describe Hardware and Software Technologies for E-commerce. • Explain payment systems for E - commerce. • Describe the process of Selling and Marketing on web. • Define and Describe E-business and its Models. • Discuss various E-GovernanceStrategies.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

E-Commerce Basics:E-Commerce Definition, Internet History and E-Commerce Development, Business-to-Business E-Commerce, Business-to-Consumer E-Commerce, E-Commerce Stages and Processes, E-Commerce Challenges, E-Commerce Opportunities.

E-Commerce Options: Internet Access Requirements, Web Hosting Requirements, Entry-Level Options, Storefront and Template Services, E-Commerce Software Packages, E-Commerce Developers, E-Business Solutions.

Marketing Issues: Online and Offline Market Research, Data Collection, Domain Names, Advertising Options, E-Mail Marketing, Search Engines, Web Site Monitoring, Incentives.

Planning and Development: Web Site Goals, International Issues, Planning Stages, Resource Allocation, Content Development, Site Map Development, Web Site Design Principles, Web Site Design Tools, Web Page Programming Tools, Data-Processing Tools. E-Commerce Components: Navigation Aids, Web Site Search Tools, Databases, Forms, Shopping Carts, Checkout Procedures, Shipping Options.

PART-B

Payment Processing: Electronic Payment Issues, E-Cash, Credit Card Issues, Merchant Accounts, Online Payment Services, Transaction Processing

Mobile Commerce: Over view of M-Commerce, advantages and limitations, WML,

Security Issues: Security Issues and Threats, Security Procedures, Encryption, Digital Certificates, SSL and SET Technologies, Authentication and Identification, Security Providers, Privacy Policies.

E-Core values: Ethical, legal, taxation and International issues

Customer Service: Customer Service Issues, E-Mail Support , Telephone Support , Live Help Services, Customer Discussion Forums, Value-Added Options.

The WWW: HTTP protocol, HTML, XHTML, XML, Javascript, CSS, DOM

Books Recommended:

1. Electronic Commerce: From Vision to Fulfillment : Elias M. Awad
2. E-Commerce : Jeffrey F., Rayport, Bernard J. Jaworsk
3. Understanding Electronic Commerce : David Kosiur
4. Introduction to E-Commerce : Jeffrey F. Rayport, et al.
5. E-Commerce Security Strategies: Protection the Enterprise : Debra Cameron
6. E-Commerce Strategies : Charles Trepper

ICE-4115: Information Security and Cyber Laws

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	Through this course students will learn the basics of Information Security, types of threats and attacks, Cybercrime, Anatomy of information security attacks, their countermeasures and Fundamentals of Cyber Law through Virtual Training Environments.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Design countermeasures against common information security attacks. • Implement operating system hardening; configure

	firewall and intrusion detection techniques (IDS). • Evaluate and implement information security in a network environment. • Evaluate the principles of risk and conduct a notional risk management exercise. • Justify the needs for business continuity planning and propose how to implement such a plan successfully within a modern enterprise. • Evaluate the trends and patterns that will determine the future state of cyber security.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

History of Information Systems and its Importance, basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Laptops Security Concepts in Internet and World Wide Web:

Brief review of Internet Protocols-TCP/IP, IPV4, IPV6.

Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles. 11 Security Threats to E-Commerce, Virtual Organization, Business Transactions on Web, E Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards.

PART-B

Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factorsin Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric

Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges Framework for Information Security, ISO 27001, SEE-CMM,Security Metrics, Information Security Vs Privacy.

Laws, Investigation and Ethics: Cyber Crime, Information Security and Law, Types & overview of Cyber Crimes, Cyber Law Issues in E-Business Management Overview of Indian IT Act, Ethical Issues in Intellectual property rights, Copy Right,Patents, Data privacy and protection, Domain Name, Software piracy, Plagiarism, Issues in ethical hacking.

Books Recommended:

1. Information Systems Security : Godbole
2. Information Security : Merkov, Breithaupt
3. Foundations of Information Technology : Yadav
4. Information Assurance for the Enterprise : Schou, Shoemaker
5. Cyber Laws Simplified : Sood

B.Sc. (Engineering) courses for 4th year 2nd semester				
Sl.	**Course Code**	**Course Title**	**Contact Hrs/week**	**Credits**
12.	**ICE-4201**	Wireless Communication	3.00	3.00
13.	**ICE-4202**	Wireless Communication Sessional	1.50	0.75
14.	**ICE-4203**	System Analysis and Software Testing	3.00	3.00
15.	**ICE-4204**	System Analysis and Software Testing Sessional	1.50	0.75
16.	**ICE-4205**	Neural Networks	3.00	3.00
17.	**ICE-4206**	Neural Networks Sessional	1.50	0.75
18.	**ICE-42xx**	**Optional-II**	3.00	3.00
19.	**ICE-42xx**	**Optional-II**	1.50	0.75
20.	**ICE-42xx**	**Optional-III**	3.00	3.00
21.	**ICE-4210**	Thesis	3.00	3.00
22.	**ICE-4211**	Viva-voce	1.50	0.75
		Total ➔	**25.5**	**21.75**

List of Optional Courses
Optional-II

Optional-II should be selected from the following courses:

Sl.	**Course Code**	**Course Title**	**Contact Hrs./week**	**Credit**
1.	**ICE-4212**	Microwave and Fiber Optic	3	3

		Communication		
2.	**ICE-4213**	Microwave and Fiber Optic Communication Sessional	1.50	0.75
3.	**ICE-4214**	Computer Vision	3	3
4.	**ICE-4215**	Computer Vision Sessional	1.50	0.75
5.	**ICE-4216**	Natural Language Processing	3	3
6.	**ICE-4217**	Natural Language Processing Sessional	1.50	0.75
7.	**ICE-4218**	Design of VLSI Circuits and Systems	3	3
8.	**ICE-4219**	Design of VLSI Circuits and Systems Sessional	1.50	0.75

Optional-III

Optional-III should be selected from the following courses:

Sl.	Course Code	Course Title	Contact Hrs./week	Credit
1.	**ICE-4220**	Cloud Computing	3	3
2.	**ICE-4221**	Radar and Satellite Communication	3	3
3.	**ICE-4222**	Biomedical Engineering	3	3
4.	**ICE-4223**	Mobile Computing	3	3
5.	**ICE-4224**	Advanced Robotics	3	3

DETAIL SYLLABUS

. ICE-4201: Wireless Communication

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The objective of the course is to investigate various advanced techniques for wireless communications, including statistical fading channel models, digital communication over fading channel, diversity for fading mitigation, adaptive modulations, MIMO systems and space-time coding, and multicarrier modulation/OFDM.
Course Learning Outcomes (CLO)	After studying this course, students will be able to: • Understand the theory of wireless propagation environment and wireless communication systems. • Design and analyze optimum receivers for various wireless communication in fading channel • Understand the theories and practice of diversity,

	multiple input multiple output (MIMO) system, space time coding, spread spectrum modulation, orthogonal frequency division multiple access. • Simulate and design wireless communication systems.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction to Wireless Systems: Introduction to wireless networks, Wireless network topologies, Traffic routing in wireless networks, Wireless vs fixed telephone networks, Wireless data services, Common channel signaling, ISDN and broadband ISDN, Signaling system no. 7 (SS7), Personal communication services (PCS).

Digital Modulation Performance: SNR and bit/symbol energy, Error probability in AWGN channel for BPSK, QPSK, MPSK, MQAM, FSK, CPFSK and differential modulation; Alternate Q-function; Performance in fading channel, Outage probability, Average probability of error, Combined outage and average error probability, Doppler spread, ISI.

Diversity & Equalization: Receiver diversity system model, Selection combining, Threshold combining, MRC, EGC, Transmit diversity, Alamouti scheme. Diversity analysis, Equalizer noise enhancement; Equalizer types; ISI free Transmission; ZF and MMSE Equalizer; MLSE, Decision feedback equalizer; Training and tracking for Adaptive equalizers.

PART-B

Multiuser Systems: Multiuser Channels: The uplink and downlink, Multiple Access: Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access (SDMA), Frequency Hopped Multiple Access (FHMA),Code-Division Multiple Access (CDMA), Space Division Multiple Access (SDMA),Hybrid Techniques, Random Access: Pure ALOHA, Slotted ALOHA, Carrier Sense Multiple Access (CSMA), Scheduling, Power control, Downlink (Broadcast) and uplink (Multiple Access) Channel Capacity, Uplink/Downlink Duality, MIMO Multiuser Systems.

Multi Carrier Modulation: Data transmission using multicarrier, MCM with overlapping subchannel, Subcarrier fading mitigation, Discrete implementation of multicarrier, Cyclic prefix, OFDM, Matrix reorientation of OFDM, Challenges in multicarrier Systems, MIMO-OFDM, SC-FDMA, MC-CDMA.

Books Recommended:

1. Wireless Communications : Andrea Goldsmith
2. Wireless Communications: Principles and Practice : Theodore S. Rappaport
3. Principles of Wireless Networks : KavenPahlavan, Prashant Krishnamurthy
4. Wireless Communication : A Molisch
5. Mobile Communications : Jochen H. Schiller

ICE-4202: Wireless Communication Sessional

Credit: 0.75; Contact Hours: 3.00 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The primary objective of this laboratory course is to provide a thorough understanding and analysis of wireless communication using MATLAB.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Understand basics of MATLAB syntax, functions and programming. • Generate and characterize various signals. • Perform different modulation techniques.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Wireless Communication.

ICE-4203: System Analysis and Software Testing

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	To develop various methods and procedures of system engineering by different components and phases of its development life cycle. The prime aim is to develop, test, and maintenance of large systems and high-quality software at low cost with small scale time-frame.
Course	After studying this course, students should be able to:

Learning Outcomes (CLO)	• Apply contemporary software testing processes in relation to software design and development. • Create test strategic plans, design test cases, prioritize and execute them. • Manageupcoming incidents and risks associated with a project. • Contribute to efficient delivery of software solutions of any real time problems and implement improvements in the software development processes. • Gain expertise in system and software design, implement in various computer based systems and IT processes.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: System Concepts and Information Systems Environments, System Development Life Cycle, Role of System Analyst.

System Analysis: System Planning and the Initial Investigation, Information Gathering, Tools of Structured Analysis, Cost/Benefit Analysis,

System Design: The process and stages of system design. Input/output and forms design, File organization and database design.

System Implementation: System Testing and Quality Assurance**,**Implementation and Software Maintenance, Hardware/Software selection, Project scheduling and Software, Security, Disaster/Recovery and Ethics in System Development.

PART-B

Software Development Life Cycle: Components of the Development Frame Work, Phases of SDLC, Software Process, Software Process Models, Linear Sequential Model, Prototyping Models, RAD, Incremental Model, Spiral Model and Fourth Generation Techniques.

Software Project Management and Project Planning: Project Management Spectrum- People, Product, Process, Project, Structure of the Development Team, Coordination and Communication Issues, Software Scope, Resources, Decomposition, Project Planning Objectives, Software Metrics and Project Estimation, LOC Based and FP Based Estimation,

Empirical Estimation Model, The COCOMO Model, Risk Management.

Software Testing, Reliability and Maintenance: Different Testing Philosophy and Methods, Software Reliability and Availability, Software Reengineering, Maintenance Process, Configuration Management, Development of an Application Using Software Engineering Concepts, Computer-aided Software Engineering, CASE workbenches, Software Engineering Environments.

Software Design Concepts and Analysis Principles: Software Design, Analysis Principles, Functional, Behavioral and Data Modeling, Prototyping Methods and Tools, Elements of the Analysis Modes, SADT, Requirement Analysis Using DFD, Data Dictionaries and ER Diagrams, Basic Design Principles Important Design Concepts-Abstraction, Refinement, Modularity, Portioning, Functional Independence, Classification of Cohesiveness and Coupling, Architectural Mapping, Interface Design Considerations, Object Oriented Design, Guidelines for User Interface Design, Design Documentation.

Books Recommended:

1. System Analysis and Design : Elias M Awad
2. Software Engineering : I Sommerville

ICE-4204: System Analysis and Software Testing Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to introduce students with the software testing tools, logical methods and techniques. As a result, they will be able to analyze any software behavior using appropriate methods and techniques by newly introduced tools.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Learn how to use existing resources to develop efficient and quality system and software, reduce their cost and maintain them properly. • Use methods and tools of testing and maintaining system and software. • Learn to find out system anomalies, defect, software bug that may create any undesired consequences for user. • Learn to use testing tools such as white box, black box, gray box testing, Software Development Life

	Cycle (SDLC) verification, validation and syntax testing.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation, and 10% Attendance.

Laboratory based on System Analysis and Software Engineering.

ICE-4205: Neural Networks	
Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100	
Course Objectives	The main objective of this course is to provide the students with the basic understanding of neural networks. Develop the skills to gain a basic understanding of neural network theory. Introduce students to artificial neural networks and major deep learning algorithms, the problem settings, and their applications to solve real world problems.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Know the main provisions of neuromathematics. • Know the main types of neural networks. • Know and apply the methods of training neural networks. • Know the applications of artificial neural networks. • Formalize the problem, to solve it by using a neural network. • Understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations • Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications. • Reveal different applications of these models to solve engineering and other problems. • Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains. • Implement deep learning algorithms and solve real-

	world problems.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Neural network, Characteristics and capabilities of neural network, Human nervous system, Models of a neuron, Activation function, Neural networks as directed graphs, Feedback system, Network architectures, Knowledge representation through artificial network, Neural networks vs artificial intelligence, Historical background of neural network.

Learning: Introduction, Learning rules: Error-correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzman learning, learning paradigms: Learning with a teacher, Learning without a teacher, Learning tasks: Pattern association, Pattern recognition, Function approximation, Control, Filtering, Beamforming, Adaptation, Statistical nature of learning.

PART-B

Perceptron: Perceptron, Perceptron convergence theorem, Multilayer perceptron, Back-propagation algorithm with performance and limitation, XOR problem, Decision rule, Back-propagation and differentiation, Hessian matrix, Cross validation, Network pruning techniques, Convolutional networks.

Neural Networks Design: Introduction, Cover's theorem on the separability of patterns, Interpolation problem, Regularization theory, Regularization networks, Radial-basis function networks and multilayer perceptrons, Optimal hyperplane for linearly separable and nonseparable patterns, Support vector machine for pattern recognition.

Neural Networks Analysis: Personal components analysis, Hebbian-based personal components analysis, PCA algorithms, Computation methods, Mapping models, Self-organizing map, SOM algorithm, Learning vector quantization, Neurodynamical models, Hopfield model.

Books Recommended:

1. Neural Networks A Comprehensive Foundation : Simon Haykin
2. Fundamentals of Neural Networks: Architectures, Algorithms And Applications : Laurene V. Fausett
3. Neural Networks and Learning Machines : Simon Haykin

ICE-4206: Neural Networks Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The primary objective of this laboratory course is to provide a practical understanding of neuro computation and analysis of different learning rules. Program the related algorithms and design the required and related systems to measure the validation and accuracy.
Course Learning Outcomes (CLO)	After completing this course, students should be able to: • Recognize the mathematical foundations of neural network models. • Explain the different types of neural networks and different types of learning models. • Apply back propagation algorithm for multilayer neural networks.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Neural Networks

ICE-4210: Thesis

Credit: 3.00 **Contact Hours: 3.00 Hours/Week**

A detail theoretical study and practical work of some problems in communications, networking and ICT related arena. This may be of investigative research nature or it may be laboratory research oriented. The report may be purely economic, technical or both and may include the comparative study of different choices for the solution of the problems.

Optional-II

Optional-II should be selected from the following courses:

Sl.	Course Code	Course Title	Contact Hrs./week	Credit
1.	**ICE-4212**	Microwave and Fiber Optic Communication	3	3
2.	**ICE-4213**	Microwave and Fiber Optic	1.50	0.75

		Communication Sessional		
3.	**ICE-4214**	Computer Vision	3	3
4.	**ICE-4215**	Computer Vision Sessional	1.50	0.75
5.	**ICE-4216**	Natural Language Processing	3	3
6.	**ICE-4217**	Natural Language Processing Sessional	1.50	0.75
7.	**ICE-4218**	Design of VLSI Circuits and Systems	3	3
8.	**ICE-4219**	Design of VLSI Circuits and Systems Sessional	1.50	0.75

ICE-4212: Microwave and Fiber Optic Communication

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	This course introduces students to the basic concepts and applications of microwave systems, microwave components and devices. It explains how to measure different components related to microwave measurement and antenna system. It also introduces students to the basic ideas of light propagation principle in optical fiber and learn about different types of fibers as well as different propagating modes in fiber. This course also focuses on different kinds of optical losses, dispersions, sources and detectors. Optical network and characteristic will also be added here.
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • Understand basic concept of microwaves, microwave measurements, microwave link, microwave antenna. • Describe the construction, working principle, applications of basic microwave components and devices. • Understand the concept of optical fiber communication and the basic principle of light propagation in optical fiber. • Explain different types of optical fiber and modes. Characterized and solve the problem to justify the characteristics. • Demonstrate the understanding of transmission

	characteristics such as attenuation, dispersion, different losses etc. to realize the propagation. • Compare the characteristics of different optical sources and detectors to determine the appropriate tools for communication. • Demonstrate the applications of an optical fiber as an amplifier, sensor and network device.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

PART-A

Microwave Components and Devices: Klystron, Magnetron, TWT, Maser, Circuit theory for wave guide system, T-Junction, Magic-T, Hybrid-T, cavity, Excitation of wave guide, Probe and aperture coupling, Directional coupler, Planer microwave components.

Microwave Link: Microwave link and its advantage, Frequency assignment and modulation methods, transmitting and receiving equipment, Base band repeater, IF repeater, Microwave carrier supply, Microwave antenna, Microwave relay system.

Maser and Laser: Basic principles of masers, Ammonia maser, Solid-state laser, Semiconductor and Gas laser; Microwave transducer for laser communication. Application of maser and laser in telecommunication and satellite communication.

PART-B

Optical Communication System: The general system, Advantages of optical fiber communication materials, Types of fibers, Ray theory transmission, Light propagation principle in optical fiber, Electromagnetic mode theory for optical propagation, Cylindrical fiber, Single mode fiber, Multimode fiber, Transmission characteristics of optical fibers-Attenuation, Loss and Dispersion mechanisms, Link budget using direct detection.

Fiber Optic Technology: Preparation of optical fibers, Optical fiber cables, Fiber optic connectors, Couplers, Multiplexers and Splices, Wavelength converters, Routers, Optical amplifiers, Coherent and WDM systems.

Optical Communication Equipments: Optical Sources- Principles, Technology, Parameters, Characteristics and Modulation; Optical Detectors- Principles, Technology, Parameters, Characteristics and

Noise Consideration, Direct detection receiver performance considerations, Optical amplification and integrated optics.

Books Recommended:

1. Microwave Engineering : David M. Pozar
2. Microwave Measurements and Technique : Thomas G Lavevghetta
3. Electronics Communication System : Kennedy and Davis
4. Optical Fiber Communication : J.M.Senior
5. Fiber-Optic Communication Systems : Govind P. Agrawal
6. Electrical Communication. D. Roddy and Coolen

ICE-4213: Microwave and Fiber Optic Communication Sessional

Credit: 0.75; Contact Hours: 1.5 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this course is to introduce Students optical fiber communication based experiments by hand with kit. There are some experiments will also do by simulation. By doing this course, students will be able to gather practical knowledge about optical fiber communication
Course Learning Outcomes (CLO)	Students who successfully complete the course will be able to: • Identify and demonstrate the working of various mirowave and optical components. • Analyze Microwave Passive Devices by conducting experiments and measuring various parameters. • Analyze Microwave Active Devices by conducting experiments and measuring various parameters. • Analyze the characteristics of Optical Sources by conducting experiments and measuring various parameters. • Analyze the characteristics of optical fiber by conducting experiments and measuring various parameters. • Analyze antenna performance by conducting experiments and measuring various parameters.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report

	and 10% Attendance.

Laboratory based on Microwave and Fiber Optic Communication.

ICE-4214: Computer Vision

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	To introduce students the fundamentals of image formation. To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition. To develop an appreciation for various issues in the design of computer vision and object recognition systems and to provide the students with programming experience from implementing computer vision and object recognition applications.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Review image processing techniques for computer vision. • Identify basic concepts, terminology, theories, models and methods in the field of computer vision. • Describe known principles of human visual system. • Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition. • Understand three-dimensional image analysis techniques. • Understand motion analysis. • Study some applications of computer vision algorithms • Suggest a design of a computer vision system for a specific problem.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Introduction to computer vision, imaging basics.

Digital Image Formation and Low-level Processing: Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine,

Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

Depth Estimation and Multi-camera Views: Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, RANSAC, 3-D reconstruction framework; Auto-calibration.

Feature Extraction: Edges - Canny edge detection, thresholding and linking, edge thinning, Second-order approaches to edge detection; Line detectors, Corners - Harris and Hessian Affine, Orientation of Histogram, SIFT, SURF, HOG, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters.

PART-B

Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, Texture Segmentation; Object detection.

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models, SVM; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

Motion Analysis: Background Subtraction and Modeling, Optical Flow, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

Books Recommended:

1. Computer Vision: Algorithms and Applications : Richard Szeliski,
2. Computer Vision: A Modern Approach : D. A. Forsyth, J. Ponce
3. Multiple View Geometry in Computer Vision : Richard Hartley, Andrew Zisserman

ICE-4215: Computer VisionSessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this laboratory course is to describe various procedures of image enhancement; image segmentation and image compression with programming experience from implementing computer vision and object recognition applications.
Course Learning Outcomes	After completing this course, students should be able to: • Define digital image space and frequency domain.

(CLO)	• Apply different types of filters on digital image to enhance the quality of an image. • Analyze images morphologically and compare different compression techniques. • Detect the edges of an image required for feature extraction. • Design of a computer vision system for a specific problem.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation/Performance and Lab Report and 10% Attendance.

Laboratory based on Computer Vision.

ICE-4216: Natural Language Processing

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The main objective of the course is to introduce basic mathematical models and methods used in NLP applications to formulate computational solutions, provide students with the knowledge on designing procedures for natural language resource annotation and the use of related tools for text analysis and hands-on experience of using such tools, introduce students to research and development work in information retrieval, information extraction, and knowledge discovery using different natural language resources, give an overview of the major technologies in speech recognition and synthesis including tools for acoustic analysis and hands-on experience of using such tools, give students opportunities to sharpen their programming skills for computational linguistics applications
Course Learning Outcomes (CLO)	Upon completion of the subject, students will be able to: • Understanding of the fundamental mathematical models and algorithms in the field of NLP. • Apply these mathematical models and algorithms in applications in software design and implementation for NLP.

	• Understand the principles of language resource annotation and its use in machine learning applications and apply the above principles in the analysis of data and acquire intended information through the use of available tools. • Understand the design and implementation issues in various NLP applications such as information retrieval and information extraction. • Understand the complexity of speech and the challenges facing speech engineers. • Understand the principles of automatic speech recognition andsynthesis. • Problem solving using systematic ways and learning independently.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction to Natural Language Processing: Brief History of NLP Research, Current Applications, Generic NLP System Architecture, Knowledge-Based Versus Probabilistic Approaches, Lexicon and Morphology, Phrase Structure Grammars.

Finite-State Techniques: Inflectional and Derivational Morphology, Finite-State Automatain NLP, Finite-State Transducers.

Prediction and Part-of-Speech Tagging: Corpora, Simple N-grams, Word Prediction, Stochastic Tagging, Evaluating System Performance.

PART-B

Parsing and Generation: Generative Grammar, Context-Free Grammars, Syntactic Parsing, Parsing and Generation with Contest-Free Grammars, Top Down and Bottom-Up Parsing, Weights and Probabilities, Parsing with Constraint-Based Grammars, Constraint-Based Grammar, Unification.

Compositional and Lexical Semantics: Simple Compositional Semantics in Constraint-Based Grammar, Semantic Relations, Word Net, Word Senses, Word Sense Disambiguation, Semantic Parsing.

Discourse and Dialogue: Anaphora Resolution, Discourse Relations.

Applications: Machine Translation, Question Answering System, Intelligent Information Retrieval.

Books Recommended:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and SpeechRecognition : D. Jurafsky& J. Martin
2. Developing Natural Language Interfaces Translation Engines: Techniques for Machine Translation : S. Russell & T. Arturo
3. Natural Language Understanding : J. Allen

ICE-4217: Natural Language ProcessingSessional	
Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100	
Course Objectives	The main objective of the course is to (i) Develops statistical techniques and algorithms to automatically process natural languages. (ii) Introduce a number of AI areas, such as text understanding and summarization, machine translation, and sentiment analysis. (iii) Introduces the foundations of technologies in NLP and their application to practical problems. (iv) Introduces the state-of-the-art research and practical techniques in NLP (v) providing students with the knowledge and capacity to conduct NLP research and to develop NLP projects.
Course Learning Outcomes (CLO)	Upon successful completion of this subject students should be able to: • Explain different NLP technologies and their applicability in different business situations. • Use NLP technologies to explore and gain a broad understanding of text data. • Use NLP methods to analyze the sentiment of a text document. • Use NLP methods to perform topic modeling. • Organize and implement a NLP project in a suitable environment. • Interpret the results of an NLP project.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation,and 10% Attendance.

Laboratory based on Natural Language Processing.

ICE-4218: Design of VLSI Circuits and Systems

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The objective of this course is to provide students with a sound knowledge of VLSI systems covering the following: Processor architectures, memory organization and performance analysis, and concepts and techniques for parallel processing and pipeline processing, High-speed synchronization design and system noise consideration and VLSI system design verification and testability, and system reliability. Introduced digital integrated circuits, CMOS devices and manufacturing technology.
Course Learning Outcomes (CLO)	On successful completion of this course students will be able to: • Analyze the CMOS layout levels, how the design layers are used in the process sequence, and resulting device structures. • Implement digital logic designs of various types. • Create models of moderately sized CMOS circuits that realize specified digital functions. • Introduce the concepts and techniques of modern integrated circuit design and testing. • Provide experience designing integrated circuits using Computer Aided Design (CAD) Tools. • Find Propagation delay, noise margins, and power dissipation in the digital VLSI circuits. • Design functional units including adders, multipliers, ROMs, SRAMs, and PLAs. Describe the sources and effects of clock skew.

Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

VLSI design methodology: top-down design approach, technology trends.

MOS technology: Introduction to MOS technology, operation of MOS transistor as a switch and amplifier, MOS, NMOS, CMOS inverters, pass transistor and pass gates, DC and transient characteristics.

Overview of fabrication process: NMOS, CMOS, Bi-CMOS process.

PART-B

NMOS and CMOS layout: Stick diagram, and design rules.

CMOS circuit characteristics: Resistance and capacitance, rise and fall time, power estimation.

Introduction to Bi-CMOS circuits: Shifter, adder, counter, multipliers. Data Path and memory structures, Buffer circuit design.

Design style: FPGA and PLDs.

Books Recommended:

1. Basic VLSI design: System & Circuit : K. Eshraghian& D. A. Pucknell
2. Logic Minimization Algorithms for VLSI Synthesis : R. K. Brayton
3. Introduction to VLSI Systems : C. A. Mead and L. A. Conway
4. CMOS VLSI Design: A Circuits and Systems Perspective : N. Weste and D. Harris
5. Digital Integrated Circuits : J. M. Rabaey
6. Introduction to VLSI Circuits and Systems : J. P. Uyemura

ICE-4219: Design of VLSI Circuits and Systems Sessional

Credit: 0.75; Contact Hours: 1.50 Hours/Week; Lecturers: 21; Exam Time: 6 Hours; Marks: 100

Course Objectives	The objective of this course is to develop idea of CMOS devices and manufacturing technology. Introduce CMOS logic gates and their layout design.

Course Learning Outcomes (CLO)	On successful completion of this course students will be able to: • Design static CMOS combinational and sequential logic at the transistor level, including mask layout. • Estimate and optimize interconnect delay and noise. • Design for higher performance or lower area using alternative circuit families. • Design functional units including adders, multipliers, ROMs, SRAMs, and PLAs • Complete a significant VLSI design project having a set of objective criteria and design constraints. • Design Memory in VLSI circuits. • Identify the various IC fabrication methods.
Assessment Methods	Total marks of the course is distributed as: 60% Examination, 30% Lab Test/Quizzes/Presentation, and 10% Attendance.

Laboratory based on Design of VLSI Circuits and Systems.

Optional-III

Optional-III should be selected from the following courses:

Sl.	Course Code	Course Title	Contact Hrs./week	Credit
1.	**ICE-4220**	Cloud Computing	3	3
2.	**ICE-4221**	Radar and Satellite Communication	3	3
3.	**ICE-4222**	Biomedical Engineering	3	3
4.	**ICE-4223**	Mobile Computing	3	3
5.	**ICE-4224**	Advanced Robotics	3	3

ICE-4220: Cloud Computing

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	This course will provide students with the comprehensive and in depth knowledge of cloud computing concepts, technologies, architecture and applications by introducing and researching the state of art in cloud computing fundamental issues, technologies, applications and implementations.

Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Give explanation on the core issues of cloud computing such as security, privacy, and interoperability. • Find out the appropriate technologies, approaches and algorithms for the related issues. • Identify possible problems and give explanation, analyze report, and evaluation of various cloud computing solutions. • Provide the absolute cloud computing solutions and appropriate recommendations according to the applications. • Generate new ideas and innovations in cloud computing technique.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction: Cloud computing definition, reference model, Characteristics, Benefits,Challenges, Distributed Systems, Virtualization, Service-oriented computing, Utility-oriented computing, Overview on computing platforms & technologies – AWS,GoogleAppEngine, MS Azure, Hadoop, Saleforce.com, Manjrasoft Aneka

Parallel & Distributed Computing: Parallel vs. Distributed computing, Elements ofparallel computing, Parallel processing - hardware architecture & approaches, Concept& Component of Distributed Computing, RPC, Service-oriented computing.

PART-B

Virtualization: Cloud reference model – IaaS, PaaS, SaaS, Types of clouds – Public, Private, Hybrid, Community, Cloud interoperability & standards, scalability &faulttolerance, Security, trust & privacy.

Concurrent Computing, High-throughput Computing and Data-Intensive Computing:Programming applications with Threads, Thread API, Parallel computation with Threads,Task computing, Frameworks for Task computing, Task-based application model,Data-intensive computing, characteristics, technology.

Cloud Platforms and Applications: Overview on Amazon Web Services, Google
AppEngine and Microsoft Azure, Cloud applications in scientific, business and consumer domain.

Books Recommended:

1. Mastering Cloud Computing: Foundations and Applications Programming : Buyya, Vecciola and Selvi
2. Cloud Computing: Implementation, Management and Security : Rittinghouse and Ransome
3. Cloud Computing : Aravind Doss
4. Cloud Computing: SaaS, PaaS, IaaS,Virtualization, BusinessModels, Mobile, Security and More : Kris Jamsa

ICE-4221: Radarand Satellite Communication

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The objective of this course is to introduce students to the fundamental mechanisms of radar and satellite communication. Besides that, to expose the knowledge in examples of applications and trade-offs that typically occur in engineering system design and to apply the knowledge in design problems.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Learn the satellite communication mechanism and the radar technology. • Analyze and evaluate a number of constraints to design the power budget for satellite links. • Compare earth station technology, Satellite navigation and the global positioning system (GPS).
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Introduction to Radar: Brief history, Types of radars, Information available from a radar, The radar equation, Radar frequency letter-band

nomenclature, Effect of operating frequency on radar, Radar nomenclature, Applications of radar, Conceptual radar system design.

MTI Radar: Introduction to MTI radar, Clutter filter response to Moving Targets, Clutter Characteristics, Definitions, Improvement Factor Calculations, Optimum Design of Clutter Filters, MTI Clutter Filter Design, MTI Filter Design for Weather Radars, Clutter Filter Bank Design, Performance Degradation Caused by Receiver Limiting, Radar System Stability Requirements, Dynamic Range and A/D Conversion Considerations, Adaptive MTI.

Pulse DopplerRadar: Characteristics and Applications, Pulse Doppler Clutter, Dynamic-range and Stability Requirements, Range and Doppler Ambiguity Resolution, Mode and Waveform Design, Range Performance.

Tracking Radar: Introduction, Monopulse (Simultaneous Lobing), Scanning and Lobing, Servosystems for Tracking Radar, Target Acquisition and Range Tracking, Special Monopulse Techniques, Sources of Error, Target-caused Errors (Target Noise), Other External Causes of Error.

PART-B

Satellite Communication Systems: Introduction, Kepler's law, Orbits, Geostationary and geosynchronous orbit, Power system, Altitude control, Satellite station keeping, Antenna look angles, Limits of visibility, Frequency plans and polarization, Transponders, Uplink and downlink power budget, Overall link budget.

Earth Station Technology: Earth Station Design. Earth Station Design for Low System Noise Temperature, Large Earth Station Antennas, Satellite Television Broadcasting Networks, Fixed point Satellite Network, INTELSAT, Mobile Satellite Network, INMARSAT, Low Earth Orbit and Non-Geostationary Satellite Network, VSATs, direct Broadcast Satellite Systems, Satellite Navigation and the Global Positioning System.

Satellite Communication Techniques: Multiple Access methods, Single access, Pre-assigned FDMA, Demand-assigned FDMA, Spade system, TDMA, Satellite switched TDMA, Time slot arrangement, Frame and burst synchronization, Scanning spot beam, Satellite switching and on board processing, Digital speech interpolation, Echo and delay cancellation.

Books Recommended:

1. Satellite Communications Systems: Systems, Techniques and Technology : Gerard Maral, Michel Bousquet, and Zhili Sun

2. Satellite Communications : Dr.D.C. Agarwal
3. Digital Satellite Communications Tri T. Ha
4. Satellite Communications : Dennis Roddy
5. Introduction to Radar Systems : Merrill Ivan Skolnik

ICE-4222: Biomedical Engineering

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The objectives of the course is to explore different Biomedical Engineering and other closely associated fields of study such as biomedical analysis in industrial, business and academic aspects. Upon completion of this course, students can contribute in related fields of human health issues by their applied engineering knowledge.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Have ability of identification, formulation and to solve complex engineering problems by applying principle of science, engineering and mathematics. • Apply engineering knowledge to produce solutions that meet specific needs with consideration of public health, safety and welfare as well as global, cultural, social, environmental and economic factors. • Have ability to communicate effectively with a range of audiences. • Have an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. • Apply new knowledge as needed, using appropriate learning strategies.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Biomedical signals & Physiological transducers: Source of biomedical signal, Origin of bioelectric signals, recording electrodes, Electrodes for ECG, EMG & EEG.

Physiological transducers: Pressure, Temperature, photoelectric & ultrasound Transducers.

Measurement in Respiratory system: Physiology of respiratory system, Measurement of breathing mechanics Spiro meter, Respiratory therapy equipments Inhalators ventilators & Respirators , Humidifiers , Nebulizers Aspirators, Biomedical recorders: ECG, EEG & EMG.

Patient Monitoring systems & Audiometers: Cardiac monitor, Bedside patient monitor, measurement of heart rate, blood pressure, temperature, respiration rate, Arrhythmia monitor, Methods of monitoring fatal heart rate, Monitoring labor activity.

Audiometers: Audiometers, Blood cell counters, Oximeter, Blood flow meter, cardiac output measurement, Blood gas analyzers.

PART-B

Modern Imaging systems: Introduction, Basic principle & Block diagram of x-ray machine, x- ray Computed Tomography (CT), Magnetic resonance imaging system (NMR), ultrasonic imaging system. Eco-Cardiograph, Eco Encephalography, Ophthalmic scans, MRI.

Therapeutic Equipments: Cardiac pacemakers, cardiac defibrillators, Hemodialysis machine, surgical diathermy machine.

Patients safety & Computer Applications in Biomedical field: Precaution, safety codes for electro medical equipment, Electric safety analyzer, Testing of biomedical equipment, Use of microprocessors in medical instruments, Microcontrollers, PC based medical instruments, Computerized Critical care units, Planning & designing a computerized critical care unit.

Physiotherapy: Software Diathermy, microwave diathermy, Ultrasound therapy unit. Electrotherapy Equipments, Ventilators.

Books Recommended:

1. Introduction to Biomedical Equipment Technology. : Joseph J. Carr & John M. Brown
2. Textbook of Biomedical Instrumentation System : Shakti Chatterjee
3. Hand book of Biomedical Instrumentation **:** R.S.Khandpur
4. Biomedical Instruments: Theory and Design : Walter Welko- Witiz and Sid Doutsch
5. Biomedical Instrumentation & Measurements Lesile Cromwell, Fred J. Weibell& Erich A. Pfeiffer

ICE-4223: Mobile Computing

Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100

Course Objectives	The main objective of this course is to provide an in-depth knowledge of different viewpoints such as infrastructures, principles, theories, technologies and application in versatile domains. Moreover, the course will also provide a complete overview of the man-machine interaction area such as an exploration how mobile computing can establish real-time and real-life connectivity.
Course Learning Outcomes (CLO)	After studying this course, students will be able to: • Give proper explanation on the principles and theories of mobile computing technologies. • Describe infrastructures and methodologies of mobile computing technologies. • List applications in public and private domain that mobile computing offers to the public, employees, and businesses. • Give a perfect description on the possible future of mobile computing technologies and applications. • Denote their written and oral presentations on any specific topic more clearly in Mobile Computing.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Mobile Physical Layer: Review of generation of mobile services, overview of wireless telephony, cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Mobile Computing Architecture: Issues in mobile computing, three tier architecture for mobile computing, design considerations, Mobile file systems, Mobile databases. WAP: Architecture, protocol stack, Data gram protocol, Wireless transport layer security, Wireless transaction protocol, wireless session protocol, application environment, and applications.

Mobile Data Link Layer: Wireless LAN over view, IEEE 802.11, Motivation for a specialized MAC, Near & far terminals, Multiple access techniques for wireless LANs such as collision avoidance, polling, Inhibit sense, spread spectrum, CDMA , LAN system architecture,

protocol architecture, physical layer MAC layer and management, Hiper LAN.

Blue Tooth: IEEE 802.15 Blue tooth User scenarios, physical, MAC layer and link management.

Local Area Wireless systems: WPABX, IrDA, ZigBee, RFID, WiMax.

PART-B

MOBILE IP Network Layer: IP and Mobile IP Network Layer- Packet delivery and Handover Management-Location Management-Registration- Tunnelling and Encapsulation-Route Optimization-Dynamic Host Configuration Protocol, Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), VoIP –IPSec.

Mobile Transport Layer: Traditional TCP/IP, Transport Layer Protocols-Indirect, Snooping, Mobile TCP.

Support for Mobility: Data bases, data hoarding, Data dissemination, UA Prof and Caching, Service discovery, Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, Mobile devices and File systems, Data Synchronization, Sync ML.

Introduction to Wireless Devices and Operating systems: Palm OS, Windows CE, Symbion OS, Android, Mobile Agents. Introduction to Mobile application languages and tool kits.

Books Recommended:

1. Mobile Communications : J. Schiller
2. Mobile Computing : Raj Kamal
3. Introduction to Wireless and Mobile Systems : DharamprakashAgrawal and Qing-An Zeng
4. Mobile Computing : Asoke K Talukder, Hasan Ahmed,Roopa R Yavagal
5. Wireless Networking Complete : Pei Zheng, Larry L. Peterson, Bruce S. Davie, Adrian Farrell
6. Understanding WAP : M. V. D. Heijden, M. Taylor
7. Mobile IP : Charles Perkins
8. Ad hoc Networks : Charles Perkins
9. Principles of Mobile Computing : UweHansmann, LotharMerk, Martin S. Nicklous, Thomas Stober,

ICE-4224:AdvancedRobotics	
Credit: 3.00; Contact Hours: 3.00 Hours/Week; Lecturers: 42; Exam Time: 3 Hours; Marks: 100	
Course Objectives	This course covers advanced programming and hardware concepts in robotics. In this course, several robots are programmed to work together aiming to the increment of efficiency and throughput in industrial automation process. Moreover, Robots safety procedures will be emphasized throughout this course.
Course Learning Outcomes (CLO)	After studying this course, students should be able to: • Design and build a robotic work cell satisfying required safety requirements including standard industrial interlocks. • Design and build a pneumatically controlled pick-and-place or Line-follower robot (LFR), and program its operation using microcontroller. • Specify and install various types of sensors including micro switches, reed switches, proximity detectors, and optical sensors. • Assemble, calibrate, program, and operate a machine vision system. • Program industrial robots to perform complex motions and paths. • Program robots to interact with external peripherals and systems also specify industrial motors for motion.
Assessment Methods	Total marks of the course is distributed as: 70% Examination, 20% Class Test/Quizzes/Presentation, and 10% Attendance.

PART-A

Fundamentals of Robot Technology: Robot definition, automation and robotics, Robot anatomy, Work volume, Drive systems. Control systems and dynamic performance. Accuracy and repeatability. Sensors and actuators used in robotics. Machine Vision, Robot configurations, Path control.Introduction to robot languages. Applications; Types (Mobile, Parallel); Serial: Cartesian, Cylindrical, etc.; Social Issues.

Robot Kinematics: Mapping, Homogeneous transformations, Rotation matrix, Forward Kinematics (DH Notation) and inverse kinematics: Closed form solution.

Robot Differential Motion: Linear and Angular velocity of rigid link, Velocity along link, Maipulatorjacobian, Statics: Use of jacobian.

PART-B

Robot Dynamics: Lagrangian Mechanics, LagrangianFormulationandnumericals. Dynamics, Newton-Euler Recursive Algorithm, Simulation.Euler-Lagrange Equations of motion/Any one other formulation like using Decoupled Natural Orthogonal Complements (DeNOC)

End effectors: Mechanical and other types of grippers. Tools as end effectors. Robot and effector interface. Gripper selection and design.

Applications for Manufacturing: Flexible automation.Robot cell layouts. Machine interference. Other considerations in work cell design. Work cell control, interlocks. Robot cycle time analysis. Mechanical design of robot links.Typical applications of robots in material transfer, machine loading/unloading; processing operations; assembly and inspection.

Books Recommended:

1.	Robotics & Control	:	R.K. Mittal, I.J. Nagrath
2.	Industrial Robotics :Technology, Programming and Application	:	Mikell P Groover , Mitchell Weiss
3.	Introduction to Robotics	:	Saha, S.K.
4.	Introduction to Robotics Mechanics & Control	:	John J.Craig
5.	Fundamentals of Robotics, analysis & Control	:	Robert J. Schilling
6.	Robot Modeling and Control	:	Mark W. Spong, Seth Hutchinson, M. Vidyasagar
7.	Robotics: Fundamental Concepts and Analysis	:	Ghosal, Ashitava

The End