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: 2018-2019

Examinations

2019[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]

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 $1^{st}/2^{nd}$ 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 $1^{st}/2^{nd}$ 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	**20 weeks**

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.
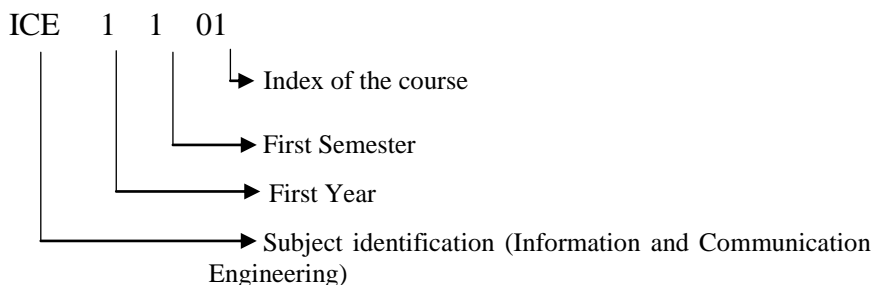
9. Structure of Courses

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:

ICE   1   1   01

→ Index of the course

→ First Semester

→ First Year

→ 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) years B. 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) A student 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 of marks 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 as follows.

Class Attendance	10%
Class Tests/Assignments/Quizzes	20%
Final Examination (3 hours)	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 as follows:

Sessional/Laboratory Attendance	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% and above	10
85% to less than 90%	9
80% to less than 85%	8
75% to less than 80%	7
70% to less than 75%	6
60% to less than 70%	5
Below 60%	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:

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

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

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:

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

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

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:

The Cumulative 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:

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

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	Credits (C_i)	Grade	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**			**48.00**

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		**81.50**		**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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Courses requirements for the undergraduate students of the Department of
Information and Communication Engineering (ICE)
SUMMARY OF COURSES

Sl.	Course Code	Course Title	Contact Hrs/week	Credits
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	Prerequisite Course	Contact Hrs/week	Credits
1.	**ICE-1201**	Analog Electronics	ICE-1103	3.00	3.00
2.	**ICE-1202**	Analog Electronics Sessional		3.00	1.50
3.	**ICE-1203**	Programming with C	ICE-1101	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**	Prerequisite Course	**Contact Hrs/week**	**Credits**
1.	**ICE-2101**	Digital Electronics	ICE-1201	3.00	3.00
2.	**ICE-2102**	Digital Electronics Sessional		3.00	1.50
3.	**ICE-2103**	Object Oriented Programming	ICE-1203	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**	Prerequisite Course	**Contact Hrs/week**	**Credits**
1	**ICE-2201**	Data Structure and Algorithm	ICE-2103	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	Math-2101	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	Stat-2101	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	Prerequisite Course	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	ICE-2103	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	ICE-2205	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	Prerequisite Course	**Contact Hrs/week**	**Credits**
1	**ICE-3201**	Network Programming with Java	ICE-2103	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	ICE-3109	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**

Sl.	Course Code	Course Title	Prerequisite Course	Contact Hrs/week	Credits
1	**ICE-4101**	Data Communication and Networking	ICE-3205	3.00	3.00
2	**ICE-4102**	Data Communication and Networking Sessional		1.50	0.75
3	**ICE-4103**	Cellular and Mobile Communication	ICE-3209	3.00	3.00
4	**ICE-4104**	Cellular and Mobile Communication Sessional		1.50	0.75
5	**ICE-4105**	Information Theory and Coding	Stat-2201	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**

Table caption above: **B.Sc. (Engineering) courses for 4th year 1st semester**

Sl.	Course Code	Course Title	Prerequisite Course	Contact Hrs/week	Credits
1.	**ICE-4201**	Wireless Communication	ICE-4103	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	ICE-3101	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**

Table caption above: **B.Sc. (Engineering) courses for 4th year 2nd semester**

List of Optional Courses

Optional-I

Optional-I should be selected from the following courses:

Sl.	Course Code	Course Title	Contact Hrs./week	Credit
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	Credit
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

Department of Information and Communication Engineering

Pabna University of Science and Technology

Summary of Undergraduate Course Plan for 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**

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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

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 : E 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**

Laboratory based on Fundamentals of ICT

ICE-1103: Basic Electronics	
Credit: 3.00	**Contact Hours: 3.00 Hours/Week**

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, L Nashelsky
2. A Textbook of Electrical Technology Vol-I to IV : 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: 3.00Hours/Week**

Laboratory based on Basic Electronics.

ICE-1105: Applied Electricity and Magnetism

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

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   :   B.L.Theraja , A.K.Theraja
   Technology Vol-I to Vol-IV

ICE-1106: Applied Electricity and Magnetism Sessional

Credit: 0.75	Contact Hours: 1.50 Hours/Week

Laboratory based on Applied Electricity and Magnetism

Math-1101: Differential Calculus and Geometry

Credit: 3.00	Contact Hours: 3.00 Hours/Week

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's theorem, Mean value theorem, Taylor's and Maclaurin'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	:	J. Edwards
3.	Differential Calculus	:	Das and Mukherjee
4.	Analytic Geometry of Conic Sections	:	H.H. Askwith
5.	Analytic Geometry of Conic Sections	:	C Smith
6.	A Treatise on Three dimensional Geometry	:	J. T Bell
7.	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 : Rownak Jahan
2. Constitutional Development in Bangladesh : Dilara Chowdhury
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	Prerequisite Course	Contact Hrs/week	Credits
1.	**ICE-1201**	Analog Electronics	ICE-1103	3.00	3.00
2.	**ICE-1202**	Analog Electronics Sessional		3.00	1.50
3.	**ICE-1203**	Programming with C	ICE-1101	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**

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**

Laboratory based on Analog Electronics

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

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**

Laboratory based on Programming with C

ICE-1205: Circuit Theory and Analysis

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

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: 1.50 Hours/Week**

Laboratory based on Circuit Theory and Analysis

Math-1201: Integral Calculus and Differential Equations

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

PART-A

Integral Calculus:

Concepts of Integral Calculus: Anti-derivatives and 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	:	H.T.H Piaggio
7.	Differential Equations	:	B.D. Sharma
8.	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**

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.
7.	Cambridge Preparation Materials for IELTS	:	Cambridge University Press

Eng-1202: Fundamental English Sessional	
Credit: 1.00	**Contact Hours: 2.00 Hours/Week**

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**	Prerequisite Course	**Contact Hrs/week**	**Credits**
1.	**ICE-2101**	Digital Electronics	ICE-1201	3.00	3.00
2.	**ICE-2102**	Digital Electronics Sessional		3.00	1.50
3.	**ICE-2103**	Object Oriented Programming	ICE-1203	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**

DETAIL SYLLABUS

ICE-2101: Digital Electronics	
Credit: 3.00	**Contact Hours: 3.00 Hours/Week**

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**

Laboratory based on Digital Electronics.

ICE-2103: Object Oriented Programming	
Credit: 3.00	**Contact Hours: 3.00 Hours/Week**

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: 1.50   Contact Hours: 3.00 Hours/Week

Laboratory based on Object Oriented Programming

ICE-2105: Discrete Mathematics and Numerical Methods
Credit: 3.00   Contact Hours: 3.00 Hours/Week

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, Homomorphism, 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**

Laboratory based on Discrete Mathematics and Numerical Methods.

Math-2101: Vector, Matrix and Linear Algebra

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

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

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

Laboratory based on Elementary Statistics and Probability.

Sl.	Course Code	Course Title	Prerequisite Course	Contact Hrs/week	Credits
		B.Sc. (Engineering) courses for 2nd year 2nd semester			
1	**ICE-2201**	Data Structure and Algorithm	ICE-2103	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	Math-2101	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	Stat-2101	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**

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 pairs 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

Laboratory based on Data Structure and Algorithm

ICE-2203: Analog Communication

Credit: 3.00	Contact Hours: 3.00 Hours/Week

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**

Laboratory based on Analog Communication.

ICE-2205: Signals and Systems

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

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**

Laboratory based on Signals and Systems.

ICE-2207: Electromagnetic Fields and Waves

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

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**

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**

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 $r\times c$ 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: 3.00 Hours/Week**

Laboratory based on Sampling Distribution and Hypothesis Testing.

B.Sc. (Engineering) courses for 3rd year 1st semester					
Sl.	**Course Code**	**Course Title**	Prerequisite Course	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	ICE-2103	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	ICE-2205	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**

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**

Laboratory based on Artificial Intelligence and Robotics.

ICE-3103: Web Programming
Credit: 3.00   **Contact Hours: 3.00 Hours/Week**

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**

Laboratory based on Web Programming

ICE-3105: Database Management Systems	
Credit: 3.00	**Contact Hours: 3.00 Hours/Week**

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: 1.50Hours/Week**

Laboratory based on Database Management Systems

ICE-3107: Computer Architecture and Microcontroller Design

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

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.	Microcontrollers [Theory and Applications]	:	Ajay V. Deshmukh
6.	The concepts & features of microcontroller	:	Raj Kamal

ICE-3108: Computer Architecture and Microcontroller Design Sessional

Credit: 0.75   **Contact Hours: 1.50Hours/Week**

Laboratory based on Computer Architecture and Microcontroller Design

ICE-3109: Digital Signal Processing	
Credit: 3.00	**Contact Hours: 3.00 Hours/Week**

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: 1.50 Hours/Week**

Laboratory based on Design and Analysis of Signal and Systems

| | | B.Sc. (Engineering) courses for 3rd year 2nd semester | | | | |

Sl.	Course Code	Course Title	Prerequisite Course	Contact Hrs/week	Credits
1	**ICE-3201**	Network Programming with Java	ICE-2103	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	ICE-3109	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**

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.

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PART-B

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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

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ICE-3202: Network Programming with Java Sessional

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Credit: 0.75 **Contact Hours: 1.50 Hours/Week**

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Laboratory based on Network Programming with Java

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ICE-3203: Telecommunication Engineering

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

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PART-A

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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.

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PART-B

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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**

Laboratory based on TelecommunicationEngineering

ICE-3205: Digital Communication

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

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**

Laboratory based on Digital Communication.

ICE-3207: Digital Image and Speech Processing	
Credit: 3.00	**Contact Hours: 3.00 Hours/Week**

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: Articulatoryphonetics, 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**

Laboratory based on Digital Image and Speech Processing

ICE-3209: Antenna Engineering	
Credit: 3.00	**Contact Hours: 3.00 Hours/Week**

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**

Laboratory based on Antenna Engineering.

ICE-3211: Project Design and Development	
Credit: 1.50	**Contact Hours: 3.00 Hours/Week**

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**	Prerequisite Course	Contact Hrs/week	**Credits**
1	**ICE-4101**	Data Communication and Networking	ICE-3205	3.00	3.00
2	**ICE-4102**	Data Communication and Networking Sessional		1.50	0.75
3	**ICE-4103**	Cellular and Mobile Communication	ICE-3209	3.00	3.00
4	**ICE-4104**	Cellular and Mobile Communication Sessional		1.50	0.75
5	**ICE-4105**	Information Theory and Coding	Stat-2201	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**	**Credit**
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**

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: 1.50 Hours/Week**

Laboratory based on Data Communication and Networking.

ICE-4103: Cellular and Mobile Communication

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

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

Laboratory based on Cellular and Mobile Communication

ICE-4105: Information Theory and Coding

Credit: 3.00	Contact Hours: 3.00 Hours/Week

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: 1.50 Hours/Week

Laboratory based on Information Theory and Coding.

ICE-4107: Cryptography and Computer Security

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

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: :   William Stallings
   Principles and Practice
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**

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	Credit
5.	**ICE-4112**	Advanced Computer Networks	3	3
6.	**ICE-4113**	Management Information System	3	3
7.	**ICE-4114**	E-Commerce and E-Governance	3	3
8.	**ICE-4115**	Information Security and Cyber Laws	3	3

ICE-4112: Advanced Computer Networks

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

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**

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   :   Laudon and Laudon
and Technology

ICE-4114: E-Commerce and E-Governance

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

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   **:**   Elias M. Awad
Fulfillment
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**

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

SI.	Course Code	Course Title	Prerequisite Course	Contact Hrs/week	Credits
		B.Sc. (Engineering) courses for 4th year 2nd semester			
12.	**ICE-4201**	Wireless Communication	ICE-4103	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-4207**	Neural Networks	ICE-3101	3.00	3.00
17.	**ICE-4208**	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:

SI.	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 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:

SI.	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

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: 1.50 Hours/Week

Laboratory based on Wireless Communication.

ICE-4203: System Analysis and Software Testing

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

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**

Laboratory based on System Analysis and Software Engineering.

ICE-4205: Neural Networks

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

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,   :   Laurene V.
    Algorithms And Applications   Fausett
3. Neural Networks and Learning Machines   :   Simon Haykin

ICE-4206: Neural Networks Sessional

Credit: 0.75   **Contact Hours: 1.50 Hours/Week**

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 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

ICE-4212: Microwave and Fiber Optic Communication

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

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: 1.50 Hours/Week**

Laboratory based on Microwave and Fiber Optic Communication.

ICE-4214: Computer Vision

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

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**

Laboratory based on Computer Vision.

ICE-4216: Natural Language Processing	
Credit: 3.00	**Contact Hours: 3.00 Hours/Week**

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**

Laboratory based on Natural Language Processing.

ICE-4218: Design of VLSI Circuits and Systems	
Credit: 3.00	**Contact Hours: 3.00 Hours/Week**

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.

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PART-B

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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**

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Laboratory based on Design of VLSI Circuits and Systems.

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Optional-III

Optional-III should be selected from the following courses:

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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

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

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

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ICE-4221: Radarand Satellite Communication

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

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**

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

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ICE-4223: Mobile Computing

Credit: 3.00	Contact Hours: 3.00 Hours/Week

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,

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

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

The End