DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
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Department of Computer Science and Engineering

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INTRODUCTION

The department of Computer Science and Engineering, abbreviated CSE, is offering an undergraduate engineering degree program since the establishment of the university in the year 1995 with a view to offer quality higher education to numerous worthy young fellows as well as to meet the huge demand of highly qualified specialists in the field. The 4-year program is spread over eight semesters with two semesters per academic year. Each semester is of around 20 working weeks containing classes for 15 weeks and preparatory leave with semester final examination for 5 weeks. Apart from the 20 working weeks per semester, the department remains open for clearance/improvement/carryover examinations, result and admission of students in the 1st semester of 1st year and for works related to industrial training etc.

Entry qualification for the program is Higher Secondary Certificate (H.S.C.) with good academic background or A-Level with comparable results or equivalent. Usual intake of students in the department is twice in an academic year. Theory classes are held with approximately 50 students per class and each class is divided into three subsections for practical classes. Students graduated from this department are employed in different prestigious institutions and organizations home and abroad. Some of them have already completed, and some are getting admitted every year to postgraduate studies at well reputed universities all over the world. Also a number of students of the department have taken transfer to foreign universities.

The department has a good number of full-time faculty members with best available exposure to ever-growing horizon of computer science and engineering. Besides, a number of part-time faculties also teach in each semester from other universities, research organizations and industrial establishments for extending experience-rich education.

The program follows an intensive course curriculum containing well-organized courses on basic sciences, computer science, electrical and electronic engineering, computer engineering, management and humanities. Of course, computer science and engineering courses are most emphasized and constitute the bulk of the program (about 70%).

We have seven computer labs and two digital electronics labs equipped with modern personal computers and electronic devices in the department for conducting regular sessional (practical) classes. Besides, there is a lab for the teachers and there is also a server center equipped with various PC-server systems for providing network facilities to

the labs. The department provides email and internet facilities to teachers and students. It also maintains a web site under the address 'www.aust.edu'.

The department organizes various co-curricular and extra-curricular activities to develop important social and professional faculties in the students. Most common co-curricular activity is the programming contest, which has become regular by this time. The Literary and Debating Club comprising teachers and students organizes various competitions that uphold its objectives, and occasionally publishes journals and souvenirs. The department also runs a CISCO networking academy program for the students of the university as well as outsiders with a special attention towards female participation.

In this booklet semester-wise brief and detailed outlines of the departmental and non-departmental courses have been given. A few other courses may also be offered in addition to the courses shown here. Optional courses described here are offered depending on the availability of teachers and the number of students in the class. Requirements of contact hours and credits have also been summarized. A semester-wise list of suggested text & reference books has been added at the end and, besides, a brief description of the up-to-date rules and regulations regarding examinations, grading system and grade points has been incorporated at the beginning.

EXAMINATION, GRADING SYSTEM AND GPA REQUIREMENTS FOR THE UNDERGRADUATE PROGRAM

(1) The performance of a student in a theoretical course of study will be evaluated on the basis of the following criteria:

(i) Continuous assessment (assessment of class attendance, class performance, quizzes and/or assignments etc.).

(ii) Semester Final Examination.

(iii) Clearance Examination (for clearance of the courses in which the students failed in the Regular Examination, if any).

(iv) Carry Over Examination (for clearance of back log of the course(s) of previous semester(s), if any).

(v) Improvement Examination (for improvement of the grade(s) obtained in the Regular Examinations, if any).

(2) The continuous assessment and the Semester Final Examination will form Regular Examination while the Clearance Examination, Carry Over Examination and Improvement Examination will provide additional opportunities to the students.

(3) The distribution of marks in the continuous assessment and in the Semester Final/Clearance/Carry Over/Improvement Examination will be as follows:

(i) Class participation (i.e. class attendance, class performance etc.).10%

(ii) Quizzes and/or assignments.....20%

(iii) Semester Final/Clearance/Carry Over/Improvement Examination .70%

Total:.....100%

(4) The number of quizzes and/or assignments in a theoretical course of study shall ordinarily be (n + 1), where 'n' is the number of credit hours of the course. Evaluation of the performance will be on the basis of the best 'n' quizzes and/or assignments.

(5) The performance of a student in a sessional/practical course will be evaluated on the basis of class attendance, class performance, quiz, assignment, report, practical examination, jury viva voce etc. The teachers concerned will determine the distribution of marks in the sessional/practical course.

(6) The letter grades and the corresponding grade-points will be awarded for the theoretical courses in the Regular Examination and for the practical/sessional courses in accordance with the provision shown below:

NUMERICAL GRADE	LETTER GRADE	Grade Point
80% or above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

(7) Apart from the letter grades listed above, the students may be awarded some other letter grades for their different status in a course. The letter grade 'W' will be given for the withheld result of a student in a course. Subject to the recommendation of the concerned Head of the Department and the approval of the Vice Chancellor of the University, a student may be awarded the letter grade 'E' for exemption or waiver of a course. The letter grade 'P' will be awarded for the course(s) the students passed in previous semester(s).

Course Status	Letter Grade
Withheld	W
Exempted	E
Passed	P

Grade Point Average (GPA) of a student will be computed without the grades mentioned above.

(8) Every course has a certain number of credit hours which describes its weightage. The credit hours of a theoretical course and the credit hours of a practical/sessional course refer to contact hours per week and half of the contact hours per week of the courses respectively. The number of credit hours a student has completed satisfactorily and the weighted average of the grade points he/she has maintained measure the performance of the student. Calculation of Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA) can be explained as follows:

$$\text{GPA} = \frac{\text{Grade points earned in the semester}}{\text{Credits completed in the semester}} \ ^{*}$$

$$= \frac{\text{Summation of (Credit hours in a course x Grade point earned in that course)}}{\text{Total number of credit hours completed}}$$

$$= \frac{\sum C_i G_i}{\sum C_i}$$

Suppose, a student has completed five courses in a semester and obtained the following grades:

Course	Credit Hour	Grade	Grade Point
Course 1	3	A+	4.00
Course 2	3	B	3.00
Course 3	3	A	3.75
Course 4	2	B+	3.25
Course 5	1	A-	3.50
Course 6	3	F	0.00

Then his/her Grade Point Average (GPA) for the semester will be computed as follows:

$$\text{GPA} = \frac{3(4.00)+3(3.00)+3(3.75)+2(3.25)+1(3.50)}{(3+3+3+2+1)}$$

$$= 3.52$$

On the other hand CGPA will be computed as follows:

$$\text{CGPA} = \frac{\text{Grade points earned upto and including current semester}}{\text{Credits completed upto and including current semester}}$$

(9) The total marks assigned to a theoretical/practical course of study is 100 and the duration of Semester Final/Improvement/Clearance/Carry Over Examination of a theoretical course is 3 hours. The total marks assigned to continuous assessment (obtained on the basis of class participation, quizzes and/or assignments etc.) and the Semester Final/Clearance/Carry Over/Improvement Examination are 30 & 70 respectively.

* Courses with the grade F are not considered completed, and the credits of that course are not considered earned

(10) A student who remains absent in the Semester Final/Clearance/ Improvement/Carry Over Examination of a course of study will be given the grade 'F' for the course. The total marks and the corresponding grade of the students who are absent in the examinations of a course will be entered in the mark sheet of the course considering the mark of the examinations as zero.

(11) The Clearance Examination of a course will be held only for the students obtaining the grade 'F' (failed in the course) in the Regular Examination of the course. The Clearance/Carry Over/Improvement Examination of a semester will be held over a period of 1 to 2 weeks at the end of the Semester Final Examination of the semester.

(12) The Clearance Examination of a course will carry 70% of the total marks assigned to the course, the rest of the mark (30%) will be entered from the record of the continuous assessment secured earlier by the student when he/she attended the classes. Whatever is the total mark obtained by the student, the highest attainable grade with the Clearance Examination is 'C'.

So the grading scale for the students appearing in the Clearance Examination will be as follows :

NUMERICAL GRADE	LETTER GRADE	Grade Point
45% or above	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

(13) A student obtaining the grade 'F' in a maximum of 2 (two) theoretical courses of a semester will also be promoted to the next higher semester with carry over in the failed theoretical course(s) if the cumulative number of the courses including the number of carry over courses of the previous semester(s) of the student concerned does not exceed the highest allowable limit of 4 (four). The students can clear the back log of the carry over course(s) in the Carry Over Examinations of the relevant semester. The examination & grading system of the Carry Over Examinations will be in the same manner as the Clearance Examination.

(14) If the number of failed courses of a student in a semester exceeds the highest limit of 2 or if the cumulative number of failed courses including the number of carry over courses of the student exceeds the highest limit of 4, the student will not be promoted to the immediate higher semester. In this

case, the student must re-register for the course(s) in which he/she failed in the semester and bring down the number of failed courses including the carry over course(s) within the allowable limits mentioned above to be promoted to the next higher semester. The student will be debarred from appearing at the Carry Over Examination of any course unless he/she re-registers for the course in which he/she failed.

(15) If the cumulative number of failed courses including the number of carry over courses of a student enrolled in 4th year 2nd semester exceeds the highest limit of 4 (four), the student will have to re-register for the courses of the semester in which he/she failed. If the number of failed courses of the final semester of the programs exceeds the highest limit of 2 (two), the student will have to re-register for the courses of the semester in which he/she failed. A student can appear at the Carry Over Examination of the courses in the relevant subsequent semester if the number of failed courses does not exceed the limit of 4 & 2 as specified above.

(16) For appearing in the Carry Over Examinations, the students are required to apply for enrollment within due time in the prescribed application form available in the office of the Controller of Examinations of the University.

(17) The students who have not been promoted to the next higher semester can re-register in the subsequent semester for the theoretical & practical course(s) in which they failed. The grade(s) secured by the students in the re-registered course(s) will be considered for the result and Grade Point Average (GPA) of the students concerned for that semester. However, the grade(s) obtained by the students in the previous semester will also be recorded in the transcript/grade card and tabulation sheet of previous semester only for chronological sequence. The students are required to apply in the prescribed application form available in the office of the Registrar of the University for re-registration. The application form duly filled in is required to be submitted within 2 weeks from the commencement of the classes.

(18) For the purpose of grade improvement, a student obtaining a passing grade lower than 'B' in the Regular Examination of a theoretical course can appear at the relevant Improvement Examination of the semester by canceling the passing grade of the course secured by him/her. The highest attainable grade with the Improvement Examination is 'B' and the grade obtained with the Improvement Examination will be considered for the result and GPA of a student. But the grade obtained by the student in the Regular Examination will also be recorded in the tabulation sheet/transcript/grade card only for chronological sequence. The letter

grades will be awarded with the Improvement Examinations in accordance with the provision given below:

NUMERICAL GRADE	LETTER GRADE	Grade Point
60% or above	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

(19) The Improvement Examination of a course will carry 70% of the total mark assigned to the course and like the Semester Final/ Clearance Examinations, the rest of the mark will be entered in the mark sheet of the course from the record of the continuous assessment secured earlier by the student when he/she attended the classes of the semester. For appearing in the Improvement Examination of a course, the students are required to apply for enrollment in the prescribed application form available in the office of the Controller of Examinations at least four (4) days before the examination date of the course.

(20) A student can appear in the Improvement Examination in a maximum of 4 (four) courses in the whole program.

(21) A student failing in any sessional/practical course will have to repeat the semester.

(22) A student of a semester who fails to submit the report/thesis of the course Project/Thesis during the semester will have to enroll for the course in the subsequent semester of his/her submission of the report/thesis.

(23) A student is required to attend at least 60% of the classes held in each course of a semester. The students failing to attend the requisite percentage of classes in any course will not be allowed to appear at the Semester Final/Clearance/Improvement/Carry Over Examinations of the course in the semester. However, the authority of the University may

condone the shortage of requisite percentage of class attendance on grounds acceptable to the authority.

(24) The program requires completion of all degree requirements within a maximum period of 7 years. Failure to complete all degree requirements within the given time frame may disqualify a student from continuation of his/her study at AUST.

(25) GPA Requirements for the Bachelor Degree

(i) The students securing a CGPA of 2.20 or above on a scale of 4.00 will be considered to be making normal progress towards a degree and the students failing to attain the CGPA of 2.20 or above on a scale of 4.00 may be placed on academic probation. A minimum CGPA of 2.20 on a scale of 4 will be required for the award of the degree.

(ii) The minimum period of probation is one semester but the usual period is one academic year. The probation may be extended for additional semester(s) until the student achieves a CGPA of 2.20 or better.

(iii) A student on academic probation failing to maintain at least a CGPA of 2.20 during two consecutive academic years may be suspended from the University. This suspension may be withdrawn by the Head of the Department on receipt of an application from the student and on being satisfied that every effort to improve the grade will be made by him/her. But this can only be done after a full semester of suspension. However, the second suspension will be regarded as final and absolute.

(iv) Graduating students securing a CGPA of 3.75 or above will be included in the Dean's List of Honor.

(26) GPA requirements for Tuition Fee Waiver

(i) Grade Point Average (GPA) will be computed for the Award of Tuition Fee Waiver without the marks/grades secured by the students in the course Project/Thesis. All of the Awards of Tuition Fee Waiver are subject to good conduct & class attendance of the students concerned.

(ii) 5% of the students promoted to every class of a semester (with a minimum of one) will be offered the Full-Free Tuition Award on the basis of the earned GPA of all courses of the immediate previous semester except the course Project/Thesis. If the grade point averages of more than one student are equal, then the total marks obtained by the students in the courses will be considered for the award. The authority of the University may also offer Half-Free Tuition Award to the students whose results are considered to be equally brilliant.

(iii) If two students of the same parents study concurrently in this University, one of them may get Half-Free Tuition Award.

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SEMINAR

BRIEF OUTLINE OF THE UNDERGRADUATE PROGRAM IN COMPUTER SCIENCE AND ENGINEERING

YEAR-1, SEMESTER-1

Course no.	Course Title	Hours/Week Theory-Lab	Credits	[2]Prerequisite	Contents on page
HUM105	English	3-0	3		37
MATH115	Mathematics-I	3-0	3		37
PHY115	Physics	4-0	4		38
PHY116	Physics Lab	0-3/2	0.75		38
CHEM115	Chemistry	3-0	3		39
CHEM116	Chemistry Lab	0-3/2	0.75		39
CSE101	Programming Language-I	3-0	3		19
CSE102	Programming Language-I Lab	0-3	1.5		19
CSE108	Introduction to Computer Systems	0-3	1.5		19
		Total: 16-9	20.5		

Total Contact Hours (nominal): [3](16 + 9) × 15 = 375

YEAR-1, SEMESTER-2

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
MATH119	Mathematics-II	3-0	3	MATH115	39
ME111	Basic Mechanical Engineering	3-0	3		40
ME114	Engineering Drawing	0-3/2	0.75		40
EEE107	Basic Electrical Engineering	3-0	3		40
EEE108	Basic Electrical Engineering Lab	0-3	1.5		40
CSE100	Software Development-I	0-3/2	0.75		20
CSE103	Discrete Mathematics	3-0	3		20
CSE105	Programming Language-II	4-0	4	CSE101	20
CSE106	Programming Language-II Lab	0-3	1.5		20
	Total:	16-9	20.5		

Total Contact Hours (nominal): 375

[2] Refers to a course that should be offered in an earlier semester
[3] Contact hours per week = 16 + 9 = 25, nominal semester duration = 15 weeks

YEAR-2, SEMESTER-1

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
MATH201	Mathematics-III	4-0	4	MATH119	41
EEE211	Electronic Devices & Circuits	3-0	3	EEE107	41
EEE212	Electronic Devices & Circuits Lab	0-3	1.5		42
CSE200	Software Development-II	0-3/2	0.75		21
CSE203	Data Structures	3-0	3	CSE101	21
CSE204	Data Structures Lab	0-3	1.5		21
CSE205	Digital Logic Design	3-0	3		21
CSE206	Digital Logic Design Lab	0-3	1.5		21
CSE213	Computer Architecture	3-0	3		22
	Total:	16-10.5	21.25		

Total Contact Hours (nominal): 397.5

YEAR-2, SEMESTER-2

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
MATH203	Mathematics- IV	3-0	3	MATH115	42
EEE209	Electrical Drives & Instrumentation	3-0	3	EEE107	42
EEE210	Electrical Drives & Instrumentation Lab	0-3	1.5		43
CSE201	Numerical Methods	3-0	3		22
CSE202	Numerical Methods Lab	0-3/2	0.75		22
CSE207	Algorithms	3-0	3	CSE203	22
CSE208	Algorithms Lab	0-3	1.5		22
CSE209	Digital Electronics and Pulse Techniques	3-0	3	CSE205 EEE211	23
CSE210	Digital Electronics and Pulse Techniques Lab	0-3	1.5		23
CSE214	Assembly Language Programming	0-3	1.5		23
	Total:	15-13.5	21.75		

Total Contact Hours (nominal): 427.5

YEAR-3, SEMESTER-1

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
HUM315	Economics and Accounting	4-0	4		43
CSE301	Mathematical Analysis for Computer Science	3-0	3	CSE103 MATH201	23
CSE303	Database	3-0	3	CSE103	24
CSE304	Database Lab	0-3	1.5		24
CSE307	Microprocessors	3-0	3	CSE205 CSE213	24
CSE308	Microprocessors Lab	0-3	1.5		24
CSE309	Digital System Design	4-0	4	CSE205 CSE213	25
CSE310	Digital System Design Lab	0-3	1.5		25
	Total:	17-9	21.5		

Total Contact Hours (nominal): 390

YEAR-3, SEMESTER-2

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
CSE300	Software Development-III	0-3	1.5		25
CSE311	Data Communication	3-0	3	MATH203	25
CSE313	Operating System	3-0	3		26
CSE314	Operating System Lab	0-3	1.5		26
CSE315	Microprocessor based System Design	3-0	3	CSE307	26
CSE316	Microprocessor based System Design Lab	0-3	1.5		26
CSE321	Theory of Formal Languages & Automata	2-0	2	CSE103	26
CSE323	Information System Design and Software Engineering	4-0	4	CSE303	27
CSE324	Information System Design and Software Engineering Lab	0-3	1.5		27
	Total:	15-12	21.0		

Total Contact Hours (nominal): 405

YEAR-4, SEMESTER-1

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
HUM415	Sociology	2-0	2		44
[4]IPE411	Industrial Management	3-0	3		44
CSE400	Project & Thesis-I	0-6	3		27
CSE401	Computer Networks	4-0	4	CSE311	28
CSE402	Computer Networks Lab	0-3	1.5		28
CSE407	Artificial Intelligence	3-0	3	CSE103, CSE207 CSE301, CSE321	28
CSE408	Artificial Intelligence Lab	0-3	1.5		28
CSE429	Compiler Design	3-0	3	CSE321	29
CSE430	Compiler Design Lab	0-3/2	0.75		29
	Total:	15-13.5	21.75		

Total Contact Hours (nominal): 427.5

YEAR-4, SEMESTER-2

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
CSE403	Computer Graphics	3-0	3	MATH203	29
CSE404	Computer Graphics Lab	0-3/2	0.75		29
CSE450	Project and Thesis-II	0-6	3		29
CSE….	Option-I	3-0	3		30-31
CSE….	Option-I Lab	0-3	1.5		30-31
CSE….	Option-II	3-0	3		31-32
CSE….	Option-II Lab	0-3/2	0.75		31-32
CSE….	Option-III	3-0	3		33-34
CSE….	Option-III Lab	0-3/2	0.75		33-34
CSE….	Option-IV	3-0	3		34-36
	Total:	15-13.5	21.75		

Total Contact Hours (nominal): 427.5

[4] New form of the earlier course number HUM411

OPTIONS AVAILABLE

OPTIONS-I

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
CSE411	Simulation and Modeling	3-0	3	CSE301 MATH201	30
CSE412	Simulation and Modeling Lab	0-3	1.5		30
CSE427	Digital Image Processing	3-0	3	CSE403	30
CSE428	Digital Image Processing Lab	0-3	1.5		30
CSE439	Advanced Database	3-0	3	CSE303	30
CSE440	Advanced Database Lab	0-3	1.5		31

OPTIONS-II

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
CSE425	Network Programming	3-0	3	CSE311 CSE401	31
CSE426	Network Programming Lab	0-3/2	0.75		31
CSE431	Multimedia Computing	3-0	3	CSE303	31
CSE432	Multimedia Computing Lab	0-3/2	0.75		32
CSE437	Soft Computing	3-0	3	CSE301	32
CSE438	Soft Computing Lab	0-3/2	0.75		32

OPTIONS-III

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
CSE413	Pattern Recognition	3-0	3	MATH203 CSE407	33
CSE414	Pattern Recognition Lab	0-3/2	0.75		33
CSE443	Expert & Decision Support Systems	3-0	3	CSE407	33
CSE444	Expert & Decision Support Systems Lab	0-3/2	0.75		33
CSE447	Artificial Neural Networks	3-0	3	CSE407	33
CSE448	Artificial Neural Networks Lab	0-3/2	0.75		34

OPTIONS-IV

Course no.	Course Title	Hours/Week Theory/Lab	Credits	Prerequisite	Contents on page
CSE415	Advanced Computer Architecture	3-0	3	CSE213	34
CSE417	VLSI Design	3-0	3	CSE209	34
CSE433	Advanced Microprocessor Architecture	3-0	3	CSE307	34
CSE435	Advanced Data Communication and Wireless Networks	3-0	3	CSE311 CSE401	35
CSE441	Digital Signal Processing	3-0	3	MATH201 MATH203	35
CSE419	Computational Geometry	3-0	3	MATH203	35
CSE421	Graph Theory	3-0	3	CSE103	36
CSE423	Computational Complexity Theory	3-0	3	CSE301 CSE321	36
CSE445	Parallel Processing	3-0	3	CSE213 CSE313	36

SEMESTER-WISE DISTRIBUTION OF CONTACT HOURS/WEEK AND CREDITS

Year	Semester	Theory Hours/week	Laboratory Hours/week	Credits
1	1	16	9	20.50
1	2	16	9	20.50
2	1	16	10.5	21.25
2	2	15	13.5	21.75
3	1	17	9	21.50
3	2	15	12	21.00
4	1	15	13.5	21.75
4	2	15	13.5	21.75
	Total:	125	90.0	170.50

Total Contact Hours (nominal): $(125 + 90) \times 15 = 3225$

Total Credits : 170.50

DETAILED OUTLINE OF UNDERGRADUATE DEPARTMENTAL COURSES FOR CSE PROGRAM

YEAR-1, SEMESTER-1

CSE101 **3 hours per week, 3 Cr.**
Programming Language-I **Prereq.: Nil**

Basic programming concepts and notations; Variables, Constants, Data types; Input and Output Statements; Control Structures; Functions and Subroutines; Processing structured data: Arrays, Strings, Records and Pointers.

CSE102 **3 hours per week, 1.5 Cr.**
Programming Language-I Lab

Laboratory works based on CSE101

CSE108 **3 hours per week, 1.5 Cr.**
Introduction to Computer Systems

Types of Computers; Basic principles of analog and digital computation; Brief history of digital computers; Importance of computers & their impact on Society; Application areas. Number systems, conversion of one system to another, complementation of numbers and arithmetic operations, ASCII code representation of data. Bits, Bytes, Words and memory capacity measurement. Generations of digital computer hardware and software; Types of digital computers; Functional units of a typical digital computer; I/O devices & peripherals: Printers, Monitors, Mouse, Joysticks, VDU, Modems, Optical & magnetic document readers. Main memory systems: types of ROMs and RAMs. Backing memory systems: Moveable devices and hard disks, CDROMs and Flash memory devices. Processing units and bus systems. Types of software: Systems software and application software. Operating systems: Objectives and functions, introduction to DOS, Windows and Unix. Computer Security: Objectives, various security issues. Introduction to Internet and World Wide Web.

Experiments based on DOS, Windows, Unix, Word processing and Spreadsheet packages.

YEAR-1, SEMESTER-2

CSE100 **3 hours in alternate week 0.75 Cr.**
Software Development-I

Students will develop a software in group/individually using a structured programming language.

CSE103 **3 hours per week, 3 Cr.**
Discrete Mathematics **Prereq.: Nil**

Set Theory: Power set, operations on sets, and laws of set operations; Properties and laws of various sets of numbers. Mathematical logic: Propositional and predicate calculus; Methods of proof. Counting and countability: Counting principles; Basics of recurrence; Coutability of sets. Graph Theory: Definitions, classification and computer representation of graphs; Trees; Directed Graphs; Graph traversals. Relations and Functions: Definitions, types and properties of relations and functions; Composition of relations and functions; Discrete numeric functions. Introduction to theory of groups.

CSE105 **4 hours per week, 4 Cr.**
Programming Language-II **Prereq.: CSE101**

Advanced program features: Linked lists, Files, Utility functions (Graphics, Sound, Strings); Introduction to Object Oriented Programming (OOP); Concepts and Techniques of OOP: Class and objects, Polymorphism and Overloading, Class hierarchy and Inheritance; OOP facilities for extensive and robust program design.

CSE106 **3 hours per week, 1.5 Cr.**
Programming Language-II Lab

Laboratory works based on CSE105

YEAR-2, SEMESTER-1

CSE200 **3 hours in alternate week, 0.75 Cr.**
Software Development-II

Students will develop a software in group/individually using any object oriented programming language.

CSE203 **3 hours per week, 3 Cr.**
Data Structures **Prereq.: CSE101**

Concepts of data structures; Elementary data objects; Common data structures: Arrays, Lists, Stacks, Queues, Graphs and Trees; Applications of data structures: Sorting, Searching, Hashing, Solving Computational problems.

CSE204 **3 hours per week, 1.5 Cr.**
Data Structures Lab

Laboratory works based on CSE203

CSE205 **3 hours per week, 3 Cr.**
Digital Logic Design **Prereq.: Nil**

Boolean Algebra: Basic theorems and properties, Boolean functions and their simplification; Digital logic gates; Combinational Logic: Adder, Subtractor, Multiplexer and Demultiplexer, Encoder and Decoder, Comparator; Parity generator and checker; Synchronous Sequential Logic: Flip-flops, Analysis and Design of sequential circuits; Registers; Synchronous and Asynchronous counters; Basic Memory cell.

CSE206 **3 hours per week, 1.5 Cr.**
Digital Logic Design Lab

Laboratory works based on CSE205

CSE213 **3 hours per week, 3 Cr.**
Computer Architecture **Prereq.: Nil**

Basic structures of computer systems; Information representation and transfer; Instructions and data access methods; Control Unit; Memory organization; I/O systems and Interrupts; Introduction to Pipelining, Parallel processing and multiprocessor systems.

YEAR-2, SEMESTER-2

CSE201 **3 hours per week, 3 Cr.**
Numerical Methods **Prereq.: Nil**

Methods for solving non-linear equations; Interpolation; Curve fitting methods; Numerical differentiation and integration; Solution of systems of linear equations; Numerical solution of ordinary differential equations.

CSE202 **3 hours in alternate week, 0.75 Cr.**
Numerical Methods Lab

Laboratory works based on CSE201

CSE207 **3 hours per week, 3 Cr.**
Algorithms **Prereq.: CSE203**

Algorithmic Complexity Analysis; Methods for the design of efficient algorithms: Divide and Conquer, Greedy method, Dynamic programming, Backtracking, Branch and Bound, Polynomial evaluation, Lower bound theory, Intractable problems.

CSE208 **3 hours per week, 1.5 Cr.**
Algorithms Lab

Laboratory works based on CSE207

CSE209 **3 hours per week, 3 Cr.**
Digital Electronics and Pulse Techniques **Prereq.: CSE205, EEE211**

Diode logic; Transistor switches; Logic Families: RTL, DTL, DCTL, TTL, ECL, IIL, MOS, CMOS; Electronic circuits for flip-flops, counters and registers, memory systems, PLAs; A/D and D/A converters with applications; Comparator circuits; Switching circuits; Multi vibrator: monostable, bistable, astable, Schmitt trigger; Voltage and current time-based generators; Timing circuits.

CSE210 **3 hours per week, 1.5 Cr.**
Digital Electronics and Pulse Techniques Lab

Laboratory works based on CSE209

CSE214 **3 hours per week, 1.5 Cr.**
Assembly Language Programming

System Architecture for Assembly language; Assembly programming basics; Assembly instruction types and their formats: Arithmetic, Logical, Transfer control and conditional processing, String processing, Input/Output; Interrupts; Procedures; Interfacing using Assembly language.

YEAR-3, SEMESTER-1

CSE301 **3 hours per week, 3 Cr.**
Mathematical Analysis for Computer Science **Prereq.: CSE103, MATH201**

Basic mathematical analysis techniques of algorithms: sums and products, binomial coefficients, harmonic numbers, Fibonacci numbers, recurrence relations; generating functions; Probability Distributions and Expectations: total probability and Bayes' rule, discrete probability distributions (geometric, modified geometric, Poisson etc.), continuous probability distributions (exponential, Erlang and gamma, Weibull etc.); Stochastic processes: definitions and classifications,

discrete-parameter Markov chains (M/G/1 queuing system, birth-death processes), continuous-parameter Markov chains (birth-death processes, M/m/1 and M/M/m queuing systems); Networks of queues: tandem networks, open and closed queuing models.

CSE303 **3 hours per week, 3 Cr.**
Database **Prereq.: CSE103**

Basic concepts of data and database systems; Data models; Query languages: Relational algebra and calculus, SQL; Query processing: interpretation, cost estimation, optimization; Functional dependency and normalization; File organization; Data Dictionary and directory systems; Database management: database administration, security & integrity; Introduction to advanced database systems.

CSE304 **3 hours per week, 1.5 Cr.**
Database Lab

Laboratory works based on CSE303

CSE307 **3 hours per week, 3 Cr.**
Microprocessors **Prereq.: CSE205, CSE213**

Introduction to different types of microprocessors and programmable circuits; Study of a primitive microprocessor: architecture, instruction set, interrupt structure, interfacing I/O devices; Distinguishing features of some advanced microprocessors from Intel, Motorola, IBM etc.

CSE308 **3 hours per week, 1.5 Cr.**
Microprocessors Lab

Laboratory works based on CSE307

CSE309 **4 hours per week, 4 Cr.**
Digital System Design **Prereq.: CSE205, CSE213**

Design of memory subsystems using SRAM and DRAM; PLA design; Microoperations: Inter-register transfer, arithmetic operations, logic operations, shift operations; Design of various components of a computer: ALU, control unit (hardwired, microprogrammed); Computer bus standards; Design of a computer; Digital Systems in control, communication and instrumentation.

CSE310 **3 hours per week, 1.5 Cr.**
Digital System Design Lab

Laboratory works based on CSE309

YEAR-3, SEMESTER-2

CSE300 **3 hours per week, 1.5 Cr.**
Software Development-III

Students will work in groups or individually to produce high quality software using state of the art software development tools. Students will have to prepare proper documentation as well to the software developed.

CSE311 **3 hours per week, 3 Cr.**
Data Communication **Prereq.: MATH203**

Data: data representation, signal encoding and signal analysis; Data Transmission Channel: channel capacity, transmission line characteristics, Baseband and Broadband transmission; Guided and unguided transmission media; Transmission networks; Transmission modulation techniques, modems and interfaces; Multiplexing techniques; Introduction to error handling and switching techniques.

CSE313 **3 hours per week, 3 Cr.**
Operating System **Prereq.: Nil**

Introduction to operating system concepts; Process management: Inter process communication, concurrency and scheduling; Memory management: addressing, virtual memory techniques (paging, segmentation); File systems: implementation, security and protection; Management of I/O; Deadlock handling; Distributed operating systems: Hardware/Software concepts, communication and synchronization.

CSE314 **3 hours per week, 1.5 Cr.**
Operating System Lab

Laboratory works based on CSE313

CSE315 **3 hours per week, 3 Cr.**
Microprocessor based System Design **Prereq.: CSE307**

Review of 80x86 microprocessors; System connections and timing; Interrupts; Digital interfacing: programmable ports and Handshake I/O, interfacing alphanumeric and power devices, keyboards; Analog interfacing techniques and applications; Bus organization and arbitration; Maximum mode and DMA; Coprocessors; Peripherals: Displays, mass storage systems, printers, touch screens, digitizers etc.

CSE316 **3 hours per week, 1.5 Cr.**
Microprocessor based System Design Lab

Laboratory works based on CSE315

CSE321 **2 hours per week, 2 Cr.**
Theory of Formal Languages & Automata **Prereq.: CSE103**

Basic elements of formal languages and computability; Regular languages and finite automata; Context-free grammars, languages and pushdown automata; Turing Machines, recursive languages and functions; Hierarchy of formal grammars and languages.

CSE323 **4 hours per week, 4 Cr.**
Information System Design and Software Engineering **Prereq.: CSE303**

Information System Design

Information and System; Systems Analysis and Systems Analyst; Information gathering techniques; Structured analysis of systems; Feasibility Study: concepts and classification, cost benefit analysis, operational feasibility; Project scheduling; System design techniques; User interface design; Security and ethical issues.

Software Engineering

Introduction to system engineering and software engineering; Software requirements analysis, modeling and specification; Software Designing: principles, concepts (abstraction, refinement, modularity, hierarchy etc.), models and specification; Software testing: objectives and principles, testability, testing design and implementation models and documentations, verification, validation and debugging; Quality factors and metrics for different software engineering phases; Software project management issues.

CSE324 **3 hours per week, 1.5 Cr.**
Information System Design and Software Engineering Lab

Laboratory works based on CSE323

YEAR-4, SEMESTER-1

CSE400 **6 hours per week, 3 Cr.**
Project and Thesis-I

Students are required to engage themselves in groups in research and innovative works with a view to develop computer systems of practical importance.

CSE401 **4 hours per week, 4 Cr.**
Computer Networks **Prereq.: CSE 311**

Introduction to computer networks, LAN, MAN and WAN; OSI reference model; TCP/IP Reference Model; Data Link Layer: Sliding window protocol, HDLC, SLIP, PPP, ALOHA, CSMA/CD, IEEE standards for LANs and MANs, Bridges; Network Layer: Routing algorithms, Internetworking, IP Protocol, Network layer in ATM network; Transport Layer: Transport services, TCP and UDP, ATM Adaptation layer; Application Layer: Network Security, SNMP, DNS, Electronic mail, WWW.

CSE402 **3 hours per week, 1.5 Cr.**
Computer Networks Lab

Laboratory works based on CSE 401

CSE407 **3 hours per week, 3 Cr.**
Artificial Intelligence **Prereq.: CSE103, CSE207, CSE301, CSE321**

Survey of basic AI concepts and controversies; Knowledge Representation and Reasoning: Propositional and first order predicate logic, inconsistencies and uncertainties, structured representation; Knowledge Organization and Manipulation: search and control strategies, game playing, planning, decision making; Perception and Communication: natural language processing, visual image understanding; Knowledge acquisition (Machine learning); Introduction to knowledge-based systems (Expert systems).

CSE408 **3 hours per week, 1.5 Cr.**
Artificial Intelligence Lab

Laboratory works based on CSE407

CSE429 **3 hours per week, 3 Cr.**
Compiler Design **Prereq.: CSE321**

Compiler structure, lexical analysis, symbol tables, parsing, syntax-directed translation, type checking, run-time organization, intermediate code generation, code optimization, error management.

CSE430 **3 hours in alternate week, 0.75 Cr.**
Compiler Design Lab

Laboratory works based on CSE429

YEAR-4, SEMESTER-2

CSE403 **3 hours per week, 3 Cr.**
Computer Graphics **Prereq.: MATH203**

Introduction to Graphical data processing; Scan conversion and its side-effects; Implementation of graphics concepts of two-dimensional and three-dimensional viewing, clipping and transformations; Hidden line algorithms; Raster graphics concepts: Architecture, algorithms and other image synthesis methods; Design of interactive graphic conversions.

CSE404 **3 hours in alternate week, 0.75 Cr.**
Computer Graphics Lab

Laboratory works based on CSE403

CSE450 **6 hours per week, 3 Cr.**
Project and Thesis-II

Students are required to engage themselves in groups in research and innovative works with a view to develop computer systems of practical importance.

OPTIONAL COURSES

OPTIONS-I

CSE411 **3 hours per week, 3 Cr.**
Simulation and Modeling **Prereq.: CSE301, MATH201**

Simulation methods and model building; Introduction to simulation packages; Random number generation; Random variate generation; Queuing systems: Characteristics of queuing systems, Steady state behavior of infinite population Markovian models (M/M/1/N, M/M/C/C, M/M/α, Stages-Erlang, M/E/1, E/M/1, bulk arrival and service systems), Steady state behavior of finite population models (M/M/1/M, M/M/α/M, M/M/C/K/M, M/M/C/K/K); Input modeling; Validation and verification of simulation models; Output analysis for simulation models.

CSE412 **3 hours per week, 1.5 Cr.**
Simulation and Modeling Lab

Laboratory works based on CSE411

CSE427 **3 hours per week, 3 Cr.**
Digital Image Processing **Prereq.: CSE403**

Digital image representation and acquisition; Survey of modern techniques for image analysis, processing and enhancement. Two dimensional system and transform theory; Sampling, linear and non-linear filtering, feature extraction, compression and coding, imaging systems.

CSE428 **3 hours per week, 1.5 Cr.**
Digital Image Processing Lab

Laboratory works based on CSE427

CSE439 **3 hours per week, 3 Cr.**
Advanced Database **Prereq.: CSE303**

Query optimization: Catalog information for cost estimation; Estimation of costs for different operations; Evaluation of query expressions. Distributed databases

and systems: Distribution transparency; Data fragmentation; Distributed query processing and optimization; Transaction management, concurrency control and data recovery. Data warehousing and mining: Multidimensional data models and data cubes; Granularity and partitioning of data; Integration of large bodies of data; OLAP and data mining; Mining class comparisons and statistical measures; Association rule mining in transactional databases. Introduction to spatial and geographic databases: Representation of geometric data; 3D design data repositories; Repositories of raster and vector data. Introduction to multimedia databases: indexing and storing multimedia data; Disk placement, scheduling and searching for multimedia data.

CSE440 **3 hours per week, 1.5 Cr.**
Advanced Database Lab

Laboratory works based on CSE439

OPTIONS-II

CSE425 **3 hours per week, 3 Cr.**
Network Programming **Prereq.: CSE313, CSE401**

Overview of networking tools; Internetwork-Process Communication (IPC) facilities for distributed applications; IPC user interfaces: pipes, shared memory, message queues, semaphores, sockets, system V Transport Layer Interface (TLI) and Remote Procedure Calls (RPC); Network protocols: TCP/IP, XNS, SNA, and NetBIOS.

CSE426 **3 hours in alternate week, 0.75 Cr.**
Network Programming Lab

Laboratory works based on CSE425

CSE431 **3 hours per week, 3 Cr.**
Multimedia Computing **Prereq.: CSE303**

Introduction to multimedia systems: Coding and compression standards; Architectural issues; Operating systems for multimedia computing. Multimedia

databases: indexing and storing multimedia data; Disk placement, scheduling and searching for multimedia data; Networking issues in multimedia computing: Resource reservation, traffic specification, shaping, and monitoring; Admission control; Multicasting issues; Session directories; Protocols for controlling sessions. Security issues in multimedia: Digital water-marking; Partial encryption schemes for video streams. Multimedia applications: Audio and video conferencing; Video on demand; Voice over IP.

CSE432 **3 hours in alternate week, 0.75 Cr.**
Multimedia Computing Lab

Laboratory works based on CSE431

CSE437 **3 hours per week, 3 Cr.**
Soft Computing **Prereq.: CSE301**

Aims and constituents of soft computing. Fuzzy sets and logic: Concepts and properties of fuzzy sets; Mathematical & logical implications of fuzzy sets; Fuzzy relations; Applications of fuzzy sets in information processing, decision making and control systems. Artificial neural networks: Underlying ideas and concepts of artificial neural networks; Feed-Forward, Recurrent and other types of artificial neural networks; Rules and methodologies of training artificial neural networks; Error backpropagation, recurrent backpropagation and other learning algorithms for neural networks. Probabilistic reasoning: Bayesian inference models and Bayesian networks; Dempster – Shafer theory; Probabilistic decision support systems. Genetic algorithms: Underlying principles and fundamental operators of genetic algorithms; Searching based on genetic algorithms; Genetic algorithm based optimization, learning and control. Introduction to various neuro-fuzzy-probabilistic-genetic combined approaches to computing applications.

CSE438 **3 hours in alternate week, 0.75 Cr.**
Soft Computing Lab

Laboratory works based on CSE437

OPTIONS-III

CSE413 **3 hours per week, 3 Cr.**
Pattern Recognition **Prereq.: MATH203, CSE407**

Introduction to pattern recognition: features, classifications and learning. Statistical, structural and hybrid methods. Learning algorithms. Introduction to pattern grammars and languages. Parsing techniques. Applications to speech recognition, remote sensing, biomedical area and computer aided design.

CSE414 **3 hours in alternate week, 0.75 Cr.**
Pattern Recognition Lab

Laboratory works based on CSE413

CSE443 **3 hours per week, 3 Cr.**
Expert and Decision Support Systems **Prereq.: CSE407**

Decision making and expert decision support fundamentals; The knowledge base; Expert-knowledge acquisition; The inference engine; Modeling of uncertain reasoning; Coherence and validation; ES shells, environments and existing ES.

CSE444 **3 hours in alternate week, 0.75 Cr.**
Expert and Decision Support Systems Lab

Laboratory works based on CSE443

CSE447 **3 hours per week, 3 Cr.**
Artificial Neural networks **Prereq.: CSE407**

Elementary neurophysiological principles; Artificial neuron models; Single-layer networks (perceptrons); Multi-layer feed forward networks and backpropagation; Cascade correlation (correlation training); Recurrent networks (Hopfield); Self-organizing maps (Kohonen maps); Bi-directional associative memory; Counter propagation networks; Adaptive resonance theory; Spatiotemporal sequences; Hardware realization of neural networks.

CSE448 **3 hours in alternate week, 0.75 Cr.**
Artificial Neural Networks Lab

Laboratory works based on CSE447

OPTIONS-IV

CSE415 **3 hours per week, 3 Cr.**
Advanced Computer Architecture **Prereq.: CSE213**

Pipelined machines, interleaved memory systems, caches. Hardware and architectural issues of parallel machines. Array processors, associative processors, multiprocessors, systolic processors, data-flow computers and interconnection networks. High level language concept of computer architecture.

CSE417 **3 hours per week, 3 Cr.**
VLSI Design **Prereq.: CSE209**

VLSI Technology: MOS transistor and inverter characteristics, complex CMOS gates and functional circuits. Design and operation of large fan-out and fan-in circuits; Clocking methodologies; Techniques for data path and data control design. VLSI layout partitioning, placement routine, and writing in VLSI. Reliability aspects and testing of VLSI.

CSE433 **3 hours per week, 3 Cr.**
Advanced Microprocessor Architecture **Prereq.: CSE307**

Advanced microprocessors: Intel 80x86 and beyond, Motorola 6800, RISC processors, SPARC, MIPS; Special and advanced features in microprocessor architectures.

CSE435 **3 hours per week, 3 Cr.**
Advanced Data Communication and Wireless Networks **Prereq.: CSE311**

Digital switching: space and time division switching; Data communication services: SMDS, ATM; Basic concepts of wireless communication; Antenna types; Satellite communication: types of satellites, parameters and configuration, capacity allocation; Cellular wireless networks: frequency reuse, cell capacity, radio propagation model, power control, GSM, CDMA, TDMA, 3G. Mobile IP and wireless application protocols; Wireless LAN; IEEE 802.11 standard: protocols, architecture, physical layer and media access control; Bluetooth: overview, radio specification and baseband specification; Introduction to Wi-Fi technology.

CSE441 **3 hours per week, 3 Cr.**
Digital Signal Processing **Prereq.: MATH201, MATH203**

Introduction to speech, image & data processing; Discrete time signals, sequences; Linear Constant Coefficient difference equation; Sampling continuous time signals; Two dimensional sequences and systems; Z-transform, Inverse Z-transform, H-transform; Frequency domain representation, discrete time systems and signals; Fourier series and Fourier Transform; Parseval's theorem; Equivalent noise definition of bandwidth; Convolution, Correlation and method of numerical integration; Computation of the DFT: Goertzel FFT, Chirp Z transform algorithms.

CSE419 **3 hours per week, 3 Cr.**
Computational Geometry **Prereq.: MATH203**

Drawing fundamental geometric objects: Basic concepts, algorithms and their complexity; Polygon triangulations and polygon partitioning; Convex hulls in two-dimensional and three-dimensional spaces; Proximity analysis: Voronoi diagrams and Delaunay triangulations. Drawing Graphs: Styles and applications of graph drawing; Drawing of rooted trees and planar graphs.

CSE421 **3 hours per week, 3 Cr.**
Graph Theory **Prereq.: CSE103**

Introduction to graphs as abstract connection diagrams, Fundamental concepts and definitions, Varieties of graphs; Trees: Properties, Spanning trees, Isomorphism of trees, Trees and optimization; Planar, Eulerian and Hamiltonian graphs; Cuts and connectivity of graphs, network flow problem; Graph coloring.

CSE423 **3 hours per week, 3 Cr.**
Computational Complexity Theory **Prereq.: CSE301, CSE321**

Turing Machines, Computational complexity classes; Computable functions and recursive function theory; Unsolvable/undecidable problems; Intractable problems and NP-completeness.

CSE445 **3 hours per week, 3 Cr.**
Parallel Processing **Prereq.: CSE213,CSE313**

Introduction to Parallel Architectures: Shared memory, VLSI, Message-Passing. Relation between architectures. Introduction to multithreaded, parallel, and distributed programming. A concurrent programming language. Process and synchronization. Locks and barriers. Semaphores. Monitors. Message-Passing. RPC and Rendezvous. Paradigms for process interaction. Parallel programming for science and engineering.

DETAILED OUTLINE OF UNDERGRADUATE NON-DEPARTMENTAL COURSES FOR CSE PROGRAM

YEAR-1, SEMESTER-1

HUM105 **3 hours per week, 3 Cr.**
English **Prereq.: Nil**

Phonetics: places and manners of articulation of words; Vocabulary: correction and precise diction, affixes, level of appropriateness, colloquial and standard forms; Grammar: construction of sentences, modal auxiliaries, subject-verb agreement, conditional sentence (real and unreal), sentence structure; Comprehension: analyzing and interpreting texts, comprehension from various types of texts; Paragraph writing: types of paragraphs, linking sentences to form a paragraph; Report writing: preparation of reports, research papers, these, reviews and books, writing abstract, preface, content, bibliography and index; Business communication: formal and informal letters, quotations and tenders, prequalification notice; Short stories by well-known writers.

MATH115 **3 hours per week, 3 Cr.**
Mathematics-I **Prereq.: Nil**

Differential Calculus

Limit, Continuity and Differentiability, Successive Differentiation, Mean value theorem, Taylor's theorem, Maclaurine's series with remainder, Expansion of function, L' Hospital's rule, Partial Differentiation, Tangent & Normal, Maxima & Minima, Points of inflection, Asymptotes, Curvature.

Co-ordinate Geometry

2D Geometry: Change of axes, Transformation of Coordinates, Pair of Straight lines, System of circles, Co-axial circles & limiting points, Tangent and Normal, Chord of contact, Chord in terms of middle points, Conjugate Diameter, Director Circles.
3D Geometry: Straight lines, Planes and Equation of solid bodies.

PHY115 **4 hours per week, 4 Cr.**
Physics **Prereq. : Nil**

Electricity and Magnetism

Static electricity: Charge, Electric field, Electric dipole, Dipole in an electric field, Calculation of electric field from electric dipole. Gauss's theorem and its application. Current: Current and current density, Drift speed, EMF, RC circuit. Electromagnetism: Ampere's law, Faraday's law, Biot-Savart law, Inductance, Calculation of inductance (LR circuit). Magnetism: Intensity of magnetism, Permeability, Susceptibility, Paramagnetic, Diamagnetic and Ferromagnetic substances. States of Matter: Solid, Liquid and Gas, different types of bonds, Inter-atomic force, Conductor, Insulator and semiconductor, Properties of semiconductor, Bands in semiconductor, Energy band description of semiconductor, Effect of temperature on semiconductor, P-type and N-type semiconductor, P-N junction.

Waves and Oscillations

Oscillations: Simple harmonic motion (SHM), Damped harmonic motion, Forced oscillation, Combination and composition of simple harmonic motions, Lissajous figures. Transverse and Longitudinal nature of waves, Travelling and standing waves, Intensity of waves, Energy calculation of travelling and standing waves, Phase velocity and group velocity. Sound waves: Velocity of longitudinal wave in a gaseous medium, Doppler effect.

Physical Optics

Theories of light: Different theories of light, Huygen's principles and constructions. Interference of light: Coherent source, Relation between path difference and phase difference, Definition of interference, Young's double slit experiment, Interference in thin film, Newton's ring. Diffraction of light: Fresnel and Fraunhoffer diffraction, Diffraction by single slit, Diffraction by double slit. Polarization of light: Brewster's law, Malus law.

PHY116 **3 hours in alternate week, 0.75 Cr.**
Physics Lab

Laboratory experiments based on PHY115

CHEM115 **3 hours per week, 3 Cr.**
Chemistry **Prereq. : Nil**

Atomic structure and placement of elements in the periodic table; Properties and uses of noble gases; Different types of chemical bonds and their properties; Molecular structure of compounds; Selective organic reactions; Different types of solutions and their compositions. Phase rule and phase diagram of mono-component systems; Properties of dilute solutions; Thermo-chemistry, chemical kinetics and chemical equilibrium; Ionization of water and pH concept; Electrical properties of solutions.

CHEM116 **3 hours in alternate week, 0.75 Cr.**
Chemistry Lab

Laboratory experiments based on CHEM115

YEAR-1, SEMESTER-2

MATH119 **3 hours per week, 3 Cr.**
Mathematics-II **Prereq.: MATH115**

Integral Calculus

Definition of integration, Integration by the methods of Substitution, Integration by parts, Standard integrals, Reduction methods, Definite integrals with properties, Walli's formula, Improper integral, Beta and Gamma Function, Intrinsic equations, Determination of Area; Length, Surface and volume in Cartesian and Polar Co-ordinate Systems.

Differential Equations

Degree and order of ordinary differential equations, Formation of differential equations, Solution of first order differential equations by various methods, Solution of general linear differential equations of second and higher orders with constant coefficients, Solution of homogeneous linear equations, Solution of differential equations by operator methods; Applications of solution of differential equations of higher order when the dependent and independent variables are absent; Concept of partial differential equations.

ME111 **3 hours per week, 3 Cr.**
Basic Mechanical Engineering

Revision of fundamental principles of kinematics, heat and thermodynamics; Forces and Motion: Forces in trusses and frames, relative motion, transfer of motion and momentum; Introduction to internal combustion engines, refrigerating and air conditioning systems; Elements of robotics: rotational and spatial motion, geometric configurations and structural elements of arms, grippers and other manipulators.

ME114 **3 hours in alternate week, 0.75 Cr.**
Engineering Drawing

Introduction: Instruments and their uses, First and third angle projections. Orthographic drawings; Isometric views; Missing lines & views; Sectional views and conventional practices; Auxiliary views.

EEE107 **3 hours per week, 3 Cr.**
Basic Electrical Engineering **Prereq.: Nil**

Fundamental electrical concepts and measuring units; DC voltage, current, resistance and power; Laws of electrical circuits and methods of network analysis; Principles of DC measuring apparatus; Laws of magnetic fields and methods of solving simple magnetic circuits.

Alternating current: Instantaneous and rms current, voltage and power; average power for various combinations of R, L and C circuits; Phasor representation of sinusoidal quantities, Introduction to three phase circuits.

EEE108 **3 hours per week, 1.5 Cr.**
Basic Electrical Engineering Lab

Laboratory Experiments based on EEE107

YEAR-2, SEMESTER-1

MATH201 **4 hours per week, 4 Cr.**
Mathematics-III **Prereq.: MATH119**

Complex Variable

Complex Number system; General function of Complex variables, Limits and continuity of a function of complex variable, Complex differentiation and the Cauchy–Riemann equation, Mapping and conformal mapping of elementary functions, Cauchy's Integral theorem, Cauchy's Integral formula; Taylor's and Laurent's theorem; Singular points, Residues and evaluation of residues, Cauchy's Residues theorem, Contour integration.

Laplace Transform

Definition, Laplace transform of some elementary functions, Inverse Laplace transformations, The unit step function, Periodic function, Evaluation of improper integrals. Solution of some differential equations and integral equations by Laplace transform.

Statistics

Frequency distribution, Mean, Median, Mode and other measures of central tendency, Standard deviation and other measures of dispersion, Moments, Skewness and kurtosis, Elementary probability theory and discrete probability distribution e.g. Uniform, Bernoulli, Bionomial; Continuous probability distribution e.g. Uniform, Normal and Poisson; Hypothesis testing and Regression analysis.

EEE211 **3 hours per week, 3 Cr.**
Electronic Devices and Circuits **Prereq.: EEE107**

Semiconductor Diode: Junction diode characteristics; Operation and small signal models of diodes. Bipolar Transistor: Characteristics; BJT biasing and thermal stabilization; CE, CB, CC configurations; Small signal low frequency h-parameter models and hybrid-π model. Introduction to JFET, MOSFET and CMOS: Biasing and application in switching circuits. Oscillators: Hartley, Colpitts & Wine-Bridge oscillators. Power Electronic Devices: SCR, TRIAC, DIAC, UJT characteristics and application; Introduction to rectifiers, active filters, regulated power supply; Introduction to IC fabrication techniques.

EEE212 **3 hours per week, 1.5 Cr.**
Electronic Devices and Circuits Lab

Laboratory Experiments based on EEE211

YEAR-2, SEMESTER-2

MATH203 **3 hours per week, 3 Cr.**
Mathematics-IV **Prereq.: MATH115**

Matrices

Definition of Matrix, Different types of matrices, Algebra of Matrices, Adjoint and inverse of a matrix, Rank of elementary transformations of matrices; Normal and canonical forms; Solution of linear equations; Matrix polynomials, Eigen values and eigen vectors.

Vector

Scalars and vectors, Equality of vectors, Addition and subtraction of Vectors, Multiplication of vectors by scalars, Scalar and Vector products and their geometrical interpretation, Triple product and multiple product, Linear dependence and independence of vectors, Differentiation and integration of vectors, Definition of Line, Surface and Volume integrals; Gradient, divergence and curl of a point function, Gauss's theorem, Stoke's theorem and Green's theorem.

Fourier Analysis

Fourier series, real and complex form of finite transform, Fourier Integral, Fourier Transforms and their uses in solving boundary value problems.

EEE209 **3 hours per week, 3 Cr.**
Electrical Drives and Instrumentation **Prereq.: EEE107**

Single phase transformers; Principles of operation of DC, Induction and Stepper motors; Thyristor and microprocessor based speed control of motors. Introduction to amplifiers; Basic differential amplifiers; logarithmic amplifiers;

Temperature compensation of Logarithmic amplifiers; Antilog amplifier; Chopper stabilized amplifier. Frequency and voltage measurements using digital techniques: Digital frequency meter, digital voltmeter. Recorders and display devices: Oscilloscope, Spectrum analyzers and logic analyzers. Data acquisition system and interfacing to microprocessor based systems. Transducers: terminology, types, principles and application of piezoelectric, photovoltaic, thermoelectric, variable reactance and opto-electronic transducers. Noise reduction in instrumentation.

EEE210 **3 hours per week, 1.5 Cr.**
Electrical Drives and Instrumentation Lab

Laboratory Experiments based on EEE209

YEAR-3, SEMESTER-1

HUM315 **4 hours per week, 4 Cr.**
Economics and Accounting **Prereq.: Nil**

Economics

Micro-Economics: The theory of demand and supply and their elasticity, Price determination, Nature of an economics theory, Applicability of economics theories to the problems of developing countries, Indifference curve technique. Marginal analysis: Production function, Types of productivity, Rational region of production of an engineering firm, Concepts of market and market structure, Cost analysis and cost function, Small scale production and large scale production, Optimization theory of distribution.

Macro-Economics: Savings, Investments, Employment, National income analysis, Inflation, Monetary policy, Fiscal policy and trade policy with reference to Bangladesh, Economics of development and planning.

Accounting

Principles of accounting: accounts, transactions, the accounting procedures and financial statements. Cost in general: objectives and classifications, overhead

costing, Cost sheet under job costing, Operating costing and process costing. Marginal costing: Tools and techniques, cost-volume-profit analysis. Relevant costing: analyzing the profitability within the firm, guidelines for decision making. Long–run planning and control: capital budgeting.

YEAR-4, SEMESTER-1

HUM415 **2 hours per week, 2 Cr.**
Sociology **Prereq.: Nil**

Perspective: nature, scope and importance of sociology; Sociology and social thinkers; Methods and stages of social research; Primary concepts: society, community, association, institution, group; Family: types, functions and importance of family, reference to specific countries, changing pattern and new dimensions; Social stratification and differentiation: types, characteristics, functions and causes of formation of social classes, social mobility and mobilization, importance of stratification and differentiation; Social control and change: nature, types and agencies of social control and change, theories of social change, taboo; Political system: ubiquity of politics, democracy and totalitarianism, political parties, voting, dictatorship, welfare state; Effects of technological factors on social life; Current social problems: crime, deviance, juvenile delinquency, youth unrest.

IPE411 **3 hours per week, 3 Cr.**
Industrial Management **Prereq.: Nil**

Introduction to management and planning in industrial organizations; Organization: theory and structure, coordination, span of control, authority delegation, groups, committee and task force, manpower planning; Personnel management: scope, importance, need hierarchy, motivation, job redesign, leadership, participative management, training, performance appraisal, wages & incentives, informal groups, organizational change and conflict; Cost and financial management: Elements of costs of products depreciation, break-even analysis, investment analysis, benefit cost analysis; Management accounting: Cost planning and control, budget & budgetary control, development planning process; Marketing management: Concepts, strategy, sales promotion, patent laws; Technology management: Management of innovation and changes, technology life cycle, Case studies.

DETAILED OUTLINE OF UNDERGRADUATE DEPARTMENTAL COURSES OFFERED TO OTHER PROGRAMS

ARCHITECTURE

ARC 1130 **3 hours per week, 1.5 Cr.**
Computer Application I

Word processing and spreadsheet analysis using available software packages.

ARC 1230 **3 hours per week, 1.5 Cr.**
Computer Application II

Basic 2-D drawing techniques and presentation.

ARC 2130 **3 hours per week, 1.5 Cr.**
Computer Application III

Basic 3-D drawing techniques. Advanced Modeling, Rendering in Auto-CAD. Advanced rendering using 3-D studio, presentation.

CIVIL ENGINEERING

CSE 2153 **3 hours per week, 3 Cr.**
Numerical Methods and Computer Programming

Basic components of computer systems; FORTRAN/C language; numerical solution of algebraic and transcendental equations; matrices; solution of systems of linear equations; curve-fitting by least squares; finite differences; divided differences; interpolation; computer applications to Civil Engineering problems, numerical differentiation and integration; numerical solution of differential equations.

CSE 2163 **3 Hours per week, 1.5 Cr.**
Numerical Methods & Computer Programming Lab

Operating system for microcomputers; development of FORTRAN/C programs and solution of problems using a computer, solution of Civil Engineering problems using microcomputers.

ELECTRICAL & ELECTRONICS ENGINEERING

CSE 4191 **3 hours per week, 3 Cr.**
Multimedia Communications

Types of media, Multimedia signal characteristics: sampling, digital representation, signal formats. Signal coding and compression: entropy coding, transform coding, vector quantization. Coding Standards: H.26x, LPEG, MPEG. Multimedia communication networks: network topologies and layers, LAN, MAN, WAN, PSTN, ISDN, ATM, internetworking devices, the internet and access technologies, enterprise networks, wireless LANs and wireless multimedia. Entertainment networks: cables, satellite and terrestrial TV networks. ADSL and VDSL, high speed modems. Transport protocols: TCP, UDP, IP, Ipv4, Ipv6, FTP, RTP and RTCP, use of MPLS and WDMA. Multimedia synchronization, security, QOS and resource management. Multimedia applications: The www, Internet telephony, teleconferencing, HDVT, e-mail and e-commerce.

CSE 4291 **3 hours per week, 3 Cr.**
Computer Networks

Switching and multiplexing; ISO, TCP-IP and ATM reference models. Different data communication services: Physical layer-wired and wireless transmission media. Cellular radio: Communication satellites; Data link layer: Elementary protocols, sliding window protocols. Error detection and correction, HDLC, DLL of internet, DLL of ATM; Multiple Access protocols, IEEE.802 protocols for LANs and MANs, switches, Hubs and Bridges; High speed LAN; Network layer: Routing, Congestion control, internetworking. Network layer in internet: IP protocol, IP addresses, ARP; NI in ATM transport layer: transmission control protocol. UDP, ATM adaptation layer; Application layer: Network security; E-mail,

Domain name system; Simple network management protocol; HTTP and World Wide Web.

CSE 4292 **3 hours per week, 1.5 Cr.**
Computer Networks Lab

Laboratory experiments based on theory and concepts learnt in EEE 4291. Design of simple systems using the principles learned in EEE 4292.

CSE 4293 **3 hours per week, 3 Cr.**
Computer Architecture

Instructions and data access methods; Arithmetic Logic Unit (ALU) design: arithmetic and logical operations, floating point operations; Process design: data paths, single cycle and multi cycle implementations; Control Unit Design: hardware and micro programmed Pipeline-data path and control, hazards and exceptions. Memory Organization: cache, virtual memory, buses, multiprocessor, type of microprocessor performance, single bus multiprocessors, clusters.

TEXTILE TECHNOLOGY

CSE 2146 **3 hours per week, 1.5 Cr.**
Introduction to Computer Science

Types of computers, Functional units of a computer, Typical input and output devices, Auxiliary storage devices, Commonly used DOS Commands, GUI, Numerical methods, Programming techniques.

CSE 2186 **3 hours per week, 1.5 Cr.**
Basic Programming Techniques

Writing Algorithms and drawing Flowcharts, Use of different elements of C (variables, operators, input-output statements, branching and looping, library

functions, defining functions and sub-routines, arrays and subscripted variables, sequential and random data files, use of graphics and sound.)

CSE 3016 **4 hours per week, 4 Cr.**
Applications of Computer in Textile

Systems analysis & design, planning and documentation of computer based systems. Critical path analysis, linear programming, accounting, forecasting etc. Use of computers in Textile Manufacture (machine/process control, dye recipe formulations, quality control, color matching, mixing ratio formulation etc.). General programming principles used in developing business and Textile applications of computers (payroll, stock control, whole selling, retailing etc.). Advanced topics of programming language C and use of available Textile related software.

CSE 3026 **3 hours per week, 1.5 Cr.**
Applications of Computer in Textile Lab

Practical applications and practices of the topics based on CSE 3016.

INTRA-AUST PROGRAMMING CONTEST

CISCO NETWORKING ACADEMY PROGRAM

SUGGESTED TEXT AND REFERENCE BOOKS FOR CSE PROGRAM

YEAR-1, SEMESTER-1

1. Schildt H.,*C, The Complete Reference*, McGraw-Hill, 4th Ed., 2000
2. Schildt H., *Born to Code in C*, McGraw-Hill, 2nd Ed., 1999
3. Balagurusamy E., *Programming in Ansi C*, Tata–McGraw-Hill, 8th Ed., Reprint, 1999
4. Hutchinson E., Sawyer S.C., *Computers and Information Systems*, McGraw-Hill, 5th Ed., 1996
5. Sinha K.P., *Computer Fundamentals*, BPB, 4th Ed.
6. Young M.J., Halvorson M., *Microsoft Office XP, Inside Out*, Microsoft Press, 2001
7. Resnack R., Halliday D., *Physics*: *Part II*, New Age International, 1999
8. Tewary K.K., *Electricity and Magnetism with Electronics*, S. Chand & Co., 3rd Ed., 2001
9. Subrahmanyam N., Brijlal, *A Text Book of Optics*, S. Chand & Co., 22nd Ed., 1993
10. Subrahmanyam N., Brijlal, *Wave and Oscillation*, Vikas Publ., 2nd Ed., 1994
11. O'Connor J.D., *Better English Pronunciation*, Cambridge University Press
12. Maniruzzaman Dr. M., *Advanced Reading and Writing Skills*, Friends Publ., 1st Ed., 2004
13. Pyle A.M., Page M.E.M., *Cliffs TOEFL*, Cliffs, 2001
14. Mohammad, Bhattacharjee, Latif, *A Text Book on Differential Calculus*, S. Tripaty, 10th Ed., 2001
15. Rahman, Bhattacharjee, *A Text book on Co-ordinate Geometry*, S. Bhattacharjee Publ., 1st Ed., 2003
16. Howard A., *Calculus*, John Wiley & Sons, 6th Ed., 1999
17. Haider S.Z., *Introduction to Modern Inorganic Chemistry*, Friends International, 2nd Ed., 2000
18. Bahl B.S., Tuli G.D., *Essential of physical chemistry*, S. Chand, 24th Ed., 2000
19. Ebbing D., *General Chemistry*, Hauton Miffin Company, 8th Ed., 2006
20. Vogels, *Qualitative And Quantitative Analysis*, Longman Sc. & Tech., 4th Ed., 1980

YEAR-1, SEMESTER-2

1. Rosen K.H., *Discrete Mathematic and it's Applications*, McGraw-Hill, 5th Ed., 2003
2. Nicodemi O., *Discrete Mathematics: A Bridge to Computer Science and Advanced Mathematics,* West, 1987 (CBS, 3rd reprint, 2002)
3. Liu C.L., *Elements of Discrete Mathematics*, McGraw-Hill, 2nd Ed.,1985
4. Schildt H., *Java 2: The Complete Reference*, McGraw-Hill, 5th Ed., 2002
5. Deitel H.M., Deitel P.J., *Java: How to Program*, Prentice-Hall, 4th Ed., 2001
6. Boylestad R.L., *Introductory Circuit Analysis*, Prentice-Hall, 10th Ed., 2002
7. Nilsson W., Riedel S.A., *Electrical Circuits*, Addison-Wesley, 5th Ed.,
8. Mohammad, Bhattacharjee, Latif, *A Text Book on Integral Calculus*, Kanta Bhattacharjee Publ., 2003
9. Gupta,J.K., Khurmi,R.S., *A Textbook of Thermal Engineering (Mechanical Technology)*, S.CHAND, 15th Ed., 2004
10. Vasandani V.P., Kumar D.S., *Treatise on Heat Engineering*, Metropolitan Books
11. John J.C. *Introduction To Robotics : Mechanics and Control*, Prentice Hall, 3rd Ed., 2004

YEAR-2, SEMETER-1

1. Petroutsos E., *Mastering Visual Basic 6.0*, Sybex, 2nd Ed., 1999
2. Thayer R., *Visual Basic 6.0 Unleashed*, SAMS, Professional Ref. Ed., 1997
3. Reingold M.E., Hansen J.W., *Data Structures*, CBS, 1st Ed.
4. Tenenbaum A.M., Langsam Y., Augenstein M.J, *Data structure using C*, Pearson Education, 1998
5. Floyd T.L., *Digital Fundamentals*, Prentice-Hall, 8th Ed., 2002
6. Mano M. M., *Digital Logic and Computer Design*, Englewood Ciffs N.J, Prentice-Hall, 8th Ed., 13th Indian Reprint, 2003
7. Zaky S.G., Vranesic Z.G., Hamacher C., *Computer Organization*, McGraw-Hill, 4th Ed., 1996
8. Hayes J.P., *Computer Architecture and Organization*, McGraw-Hill, 2nd Ed., 1988
9. Boylestad R., Nashelskey L., *Electronic Devices and Circuit Theory*, Prentice-Hall, 8th Ed., 2001
10. Horenstein M.N., *Microelectronic Circuits and Devices*, Prentice-Hall, 2nd Ed., 1995
11. Brown J.W., Churchill R.V., *Complex Variables and Applications*, McGraw-Hill, 1996

12. Spiegel M.R., *Theory and Problems on Laplace Transformations*, McGraw-Hill, 1986
13. Gupta S.C., Kapoor V.K., *Fundamentals of Mathematical Statistics*, S Chand & Sons, 9th Ed., 1994

YEAR-2, SEMESTER-2

1. Rao S.B., Shantha C.K, *Numerical Methods*, University Press, 2000
2. Rajaramon V., *Computer Oriented Numerical Methods*, Prentice-Hall, 3rd Ed., 2002
3. Scarborough J.B., *Numerical Mathematical Analysis*, The John Hopkins Press, 6th Ed.,1966
4. Horawitz E., Sahni S., Rajasekaram S., *Computer Algorithms*, W.H. Freeman & Co., 1996
5. Cormen T.H., Leiserson C.E., Ribest R.L., *Introduction to Algorithms*, MIT Press, 2nd Ed., 1990
6. Millman J., *Microelectronics: Digital and Analogy Circuits and Systems*, McGraw-Hill, 2nd Ed., 1987
7. Taub H., *Digital Integrated Electronics*, McGraw-Hill, 1977
8. Millman J., Taub H., *Pulse Digital and Switching Waveforms*, McGraw-Hill, 1976
9. Irvin K.R., *Assembly Language for the IBM PC*, Macmillan, 1990
10. Yu Ytha, Marut C., *Assembly Language Programming and the Organization of the IBM PC*, McGraw-Hill, International Ed., 1992
11. Coughlin R.F., Driscoll F.F., *Operational Amplifier and Linear Integrated Circuits*, Prentice-Hall, 6th Ed., 2000
12. Spiegal M.R., *Theory and Problems of Matrices*, McGraw-Hill, 1974
13. Frank Ayres Jr., *Theory and Problems of Matrices*, McGraw-Hill, 1997
14. Grewall B.S., *Higher Engineering Mathematics*, Romesh Chander Khanna Publ., 34th Ed., 1994
15. Howad A., *Elementary Linear Algebra*, John Wiley & Sons, 7th Ed., 1994

YEAR-3, SEMESTER-1

1. Graham R.L., Knuth D.E., Patashnik O., *Concrete Mathematics*, Pearson Education, 2000
2. Ross S.M., *Introduction to Probability Models*, Academic Press, 6th Ed., 1997
3. Silverschatz A., Korth H., Sudarshan S., *Database System Concepts*, McGraw-Hill, 5th Ed., 2005

4. Elmasri R., Navathe S.B., *Fundamentals of Database Systems*, Addison-Wesley, 3rd Ed., 2000
5. Gaonkar R.S., *Microprocessor Architecture*, Penran International (India), 4th Ed., 2000
6. Bery B.B., *The Intel Microprocessors*, Prentice-Hall, 6th Ed., 2002
7. Mano M. M., *Digital Logic and Computer Design*, Englewood Ciffs N.J: Prentice Hall, 8th Ed., 13th Indian Reprint, 2003
8. Floyd T.L., *Digital Fundamentals*, Pearson Education Inc, 8th Ed., 2003
9. Larson K.D., Wild J.J., Chaiappetta B., *Fundamentals of Accounting Principles*, McGraw-Hill, 1999
10. Samuelson P.A., Nordhaus W.D., *Economics*, McGraw Hill, 16th Ed., 1998
11. Dewett K.K., *Modern Economic Theory*, S Chand & Co., 21st Ed., 2001

YEAR-3, SEMESTER-2

1. Stallings W., *Data And Computer Communications*, Prentice Hall, 7th Ed., 2004
2. Gupta P.C., *Data Communications*, Prentice-Hall, 3rd Ed., 1996
3. Schweber W.L., *Data Communications*, McGraw-Hill, 1995
4. Tanenbaum A.S., *Modern Operating Systems*, Prentice Hall, 2nd Ed., 2001
5. Silberschatz A., Galvin P.B., *Operating System Concepts*, John Wiley & Sons, 5th Ed., 1999
6. Douglas V.H., *Microprocessors and Interfacing*, McGraw-Hill, 2nd Ed., 2006
7. Cook B.M., White N.H., *Computer Peripherals*, E. Arnold, 1995
8. Awad E.M., *Systems Analysis and Design*, Galgotia, 2nd Ed..
9. Rajaraman V., *Analysis and Design of Information Systems*, Prentice-Hall
10. Thierauf R.J., *Systems Analysis and Design*, CBS, 2nd Ed..
11. Pressman R.S., *Software Engineering*, McGraw-Hill, International Ed., 1997
12. Sommerville I., *Software Engineering*, Addison-Wesley, 5th Ed., 1995
13. Martin J.C., *Introduction to Languages and the Theory of Computation*, McGraw-Hill, 3rd Ed., 2003
14. Hopcroft J.E., Ullman J.D. *Introduction to Automata Theory, Languages and Computation*, Addison-Wesley: Narosa P.H., 15th Indian Reprint, 1997
15. Petersen R., *Red Hat Linux: The Complete Reference*, Tata Mcgraw, 2000
16. Prata S., Advanced Unix: A programmer's Guide, The Waite Group, 1985
17. Cornel G., Morrison J., *Programming VB.NET: A guide for experienced programmers*, Apress Publications, 2001

YEAR-4, SEMESTER-1

1. Tanenbaum A.S., *Computer Networks*, Prentice-Hall, 4th Ed.
2. Forouzan B.A., *Data Communication and Networking*, McGraw-Hill, 2nd Ed.
3. Kurose J.F., Ross K.W., *Computer Networking: A Top-Down approach Featuring the Internet*, Pearson Education, 3rd Ed., 1995
4. Russell S., Norvig P., *Artificial Intelligence*, Prentice-Hall, 2nd Ed., 2002
5. Patterson D.W., *Introduction to Artificial Intelligence and Expert Systems*, Prentice-Hall, 4th Indian Reprint, 1998
6. Rich E., Knight K., *Artificial Intelligence*, McGraw-Hill, 2nd Ed., 1991
7. Shapiro E., Sterling L., *The Art of Prolog*, MIT Press, 2nd Ed., 1994
8. Clockskin W.F., Mellish C.S., *Programming in Prolog*, Springer-Verlag, 3rd Ed., 1987
9. Winston P., Horn B., *LISP*, Addison-Wesley, 3rd Ed., 1989
10. Aho A.V., Sethi R., Ullman J.D., *Compilers*, Addison-Wesley, 1986
11. Aho A.V.,Ullman J.D., *Principles of Compiler Design*, Addison-Wesley, 22nd Reprint, 1999
12. Ulrich K., Eppinger S., *Product Design and Development*, McGraw-Hill, 2nd Ed., 1999
13. Kerzner H., *Project Management: A System Approach & Planning, Scheduling and Controlling*, John Wiley & Sons, 8th Ed., 2003
14. Taylor B.W., *Introduction to Management Science*, Prentice-Hall, 7th Ed., 2001
15. Griffin R.W., *Management*, Houghton Mifflin, 7th Ed., 2001
20. Giddens A., *Sociology*, Polity Press, 2001

YEAR-4, SEMESTER-2

1. Foley J.D., Dam A.V., Ferner S.K., Hugles J.F., *Computer Graphics: Principles and Practice in C*, Pearson Education, 2nd Ed., 1995
2. Xiang Z., Plastock R., *Computer Graphics*, McGraw-Hill, 2nd Ed., 2000

OPTIONAL COURSES (for YEAR-4, SEMESTER-2):

3. Ceri S., Pelagatti G., *Distributed Database*, McGraw-Hill, International Student Ed., 1985
4. Inmon W.H., *Building the Data Warehouse, John Wiley & Sons*, 3rd Ed., 2002
5. Silverschatz A., Korth H.F., Sudarshan S., *Database System Concepts*, McGraw-Hill, 5th Ed., 2005
6. Han J., Kamber M., *Data Mining: Concepts and Techniques, Morgan Kaufman*, 2nd Ed., 2006
7. Lonek K., Koch G., *Oracle 9i: The Complete Reference*, McGraw-Hill, 2002
8. Urman S., *Oracle 9i: PL/SQL Programming*, McGraw-Hill, 2nd Ed., 2001
9. Castagnetto J., Rawat H., Schumann S., Scollo C., Veliath D., *Professional PHP Programming*, Wrox Press, 1999
10. Stevens W.R., *UNIX Network Programming*, Prentice-Hall, 2000
11. Ermine J.L., *Expert Systems: Theory and Practice*, Prentice-Hall, 1995
12. Ignizio J.P., *Introduction to Expert Systems*, McGraw-Hill, International Ed., 1991
13. Turban E., Aronson J.E., *Decision Support Systems and Intelligent Systems*, Prentice-Hall, 6th Ed., 2000.
14. Cehrotra K.M., Ranka M.S., *Elements of Artificial Neural Networks*, MIT Press, 1997
15. Fauselt L.V., *Fundamentals of Neural Networks*, Prentice-Hall, 1st Ed., 1994
16. Law A.M., Kelton W.D., *Simulation Modeling and Analysis*, McGraw-Hill, 3rd Ed., 1999
17. Banks J., Carson J.S., Nelson B.L., *Discrete-Event Systems Simulation*, Prentice-Hall, 3rd Ed., 2000
18. Kontroumbas K., *Pattern Recognition*, Academic Press, 2nd Ed., 1999
19. Gonzalez R.C., Woods R.E., *Digital Image Processing*, Addison-Wesley, 2nd Ed., 2002
20. Contanzaro B., *Multiprocessor System Architectures*, Sun Microsystems, 1996
21. Kain R.Y., *Advanced Computer Architecture*, Pearson Higher Education, 1995
22. Hwang K., Briggs F.A., *Computer Architecture and Parallel Processing*, McGraw-Hill, 1st Ed.

23. Brackenbury L.E.M., *Design of VLSI System: A Practical Introduction*, Macmillan, 2002
24. Pucknell D.A., Eshraghian K., *Basic VLSI Design*, Prentice Hall, 1995
25. Jha N.K., Kundu S., Testing and Reliable Design of CMOS Circuits, Kluwer Academic Publishers, 1990
26. Disestel R., *Graph Theory*, Springer-Verlag, 2nd Ed., February 2000
27. West D. B., *Introduction to Graph Theory*, 2nd Ed., Prentice-Hall, 2001
28. Tabak D., *Advanced Microprocessors*, McGraw-Hill, 2nd Ed., 1995
29. Stein J., *Digital Signal Processing: A Computer Science Perspective*, John Wiley & Sons, 2000
30. Xavier C., Iyengar S.S., *Introduction to Parallel Algorithms*, Wiley-Inter Science, 1998
31. Jaja J., *An Introduction to Parallel Algorithms*, Addison-Wesley, 1992
32. Aliev R., *Soft Computing and Its Application*, World Scientific, 1st Ed., 2001
33. Konar A., *Artificial Intelligence and Soft Computing: Behavioral and Cognitive Modeling of the Human Brain*, CRC Press, 1st Ed., 2000
34. Steinmetz R., Nahrstadt K. *Multimedia: Computing, Communications & Applications*, Pearson Education, 1st Ed., 1995
35. O'Rourke J., *Computational Geometry in C*, Cambridge University Press, 2nd Ed., 1998
36. deBorg M., Kreveld M. V., Overnars M., Schwarzkopf O., *Computational Geometry: Algorithms and Applications*, Springer, 2nd Ed., 2000
37. Martin J.C., *Introduction to Languages and the Theory of Computation*, McGraw-Hill, 3rd Ed., 2003
38. Papadimitriou C. H. *Computational Complexity,* Addison-Wesley, 1st Ed., 1994
39. Stallings W., *Data And Computer Communications*, Prentice Hall, 7th Ed., 2004
40. Stallings W., *Wireless Communications and Networking*, Prentice Hall, 2002

SERVER ROOM

BLOOD DONATION

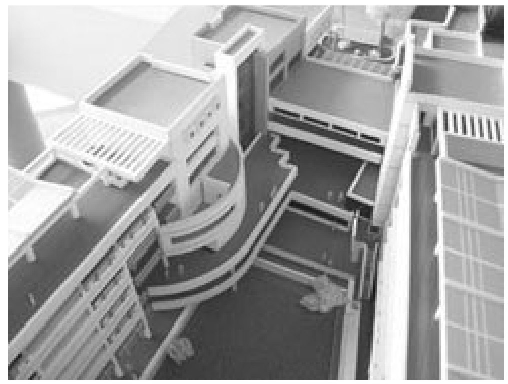
RECEPTION

PICNIC

FAREWELL

Department of Computer Science and Engineering

CAMPUS



CONVOCATION