Department of Computer Science and Engineering

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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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 to render 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 two 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 one digital electronics lab equipped with modern personal computers and electronic devices in the department for conducting regular sessional (practical) classes. These labs have been named as Network & Data Communication (NDC) Lab (7B01), Web Application & Multimedia (WAM) Lab (7B03), Data & Knowledge Engineering (DKE) Lab (7B05), Software Engineering (SE) Lab (7B06),

Microprocessor & Interfacing (MI) Lab (7B07), Operating System (OS) Lab (7B08) and Digital Electronics & Design (DED) Lab (9A05) respectively. There is 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 department also organizes chess, football and cricket tournaments among the students. The most common extra-curricular activities are reception parties for welcoming the newly entered students and also for biding farewell to the outgoing students.

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, GPA REQUIREMENTS AND UPDATES IN COURSE CODES 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/class tests and/or assignments etc.).

(ii) Semester Final Examination.

(iii) Clearance Examination (for clearance of the courses in which the students fail 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) Continuous assessment and Semester Final Examination will form the Regular Examination while the Clearance Examination, Carry Over Examination and Improvement Examination will provide additional opportunities to the students.

(3) The distribution of marks after 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/class tests and/or assignments…… 20%

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

Total: 100%

(4) The number of quizzes/class tests 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/class tests and/or assignments.

** These rules are subject to change from semester to semester.

(5) The performance of a student in a sessional/practical course will be evaluated on the basis of class attendance, class performance, quizzes/class tests, assignments, reports, practical examinations, jury viva voce etc. The distribution of marks in the course will be determined by the teachers concerned.

(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 provisions 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 other letter grades for having 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 course(s) the students have 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 will help measure the performance of the student. Calculation of Grade Point Average (GPA) can be explained as follows:

$$\text{GPA} = \frac{\sum C_i G_i}{\sum C_t}$$

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

Where:

C_i = Credit hours in a course

G_i = Grade points earned in that course

C_t = Total number of credit hours completed

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

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

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

$$= 3.52$$

(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/class tests and/or assignments etc.) and the Semester Final/Clearance/Improvement Examination are 30 & 70 respectively.
However the full marks (100) of a Carry Over course will be allotted to the Carry Over Examination only and the final performance of a student in the Carry Over course be evaluated only on the basis of the marks obtained in the Carry Over Examination.

(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 be promoted to the next higher class 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 backlog of the carryover course(s) in the Carryover Examinations of the relevant semester. Such examinations will be held 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 class. In such a 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 of 4 & 2 to be promoted to the next higher semester.

(15) If the cumulative number of failed courses including the number of carry over courses of a student enrolled in 4th year 2nd semester of 4-year bachelor degree programme or in 5th year 2nd semester of 5-year bachelor degree programme 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 course(s) (both theoretical & practical) in which they have 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 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 duly filled in application form must be submitted within the notified time.

(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 of a 4-year degree programme can appear in the improvement examination in a maximum of 4 (four) courses while a student of a 5-year degree programme can do the same in a maximum of 5 (five) courses in his/her student career at AUST.

(21) A student failing in any sessional/practical course will have to repeat the semester. But a student failing in the Surveying Practical course may be

promoted to the next higher class, if otherwise eligible. A student who remains absent in the classes of the Surveying Practical course due to a reason acceptable to the administration of the University, will get another chance to attend the classes & pass the course along with students of other batches in the next relevant 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) Students of all bachelor degree programmes are 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 University may condone the shortage of requisite percentage of class attendance on grounds acceptable to the authority.

(24) All 4-year degree programmes at AUST require completion of all degree requirements within a maximum period of 7 years while a 5-year degree programme requires completion of all degree requirements within a maximum period of 8 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 (Cumulative Grade Point Average) 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 Cumulative GPA (CGPA) of 2.20 on a scale of 4.00 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 an overall GPA 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) As per Private University Act, 5% of the students promoted to every class of a semester will be offered the **Tuition Fee Waiver** on the basis of the earned Grade Point Average (GPA) of all courses of the immediate previous semester except the courses Project/Thesis & Surveying Practical. 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 bonafide students, who are promoted, get admitted and continue their studies at AUST are eligible for Tuition Fee Waiver on the basis of merit and other rules and regulations of the University.

(iii) There are also provisions for financial help to the distressed students from the Fund for Welfare of the Distressed Students.

(iv) If two or more students of the same parents study concurrently as regular students in this University, one of them may get Half Free Tuition Award on application as per the rules of the University.

(v) In addition, 1% of the promoted students may be awarded Full Free Tuition Award on the recommendation of the sponsor.

(27) Updates in Course Codes

Previously, a course code, for example CSE303, standing for the course titled Database included 3 digits following an acronym (CSE) for the department offering the course. The first digit (3) stood for year (third) and the next two digits (03) represented the code for the course. In the proposed syllabus, an extra second digit standing for the semester serial number has been introduced. For example, the above 3rd year 1st semester course has the course code CSE3103 where the first digit (3) stands for year (third), the second digit (1) stands for semester (first) and the next digits (03) represent the code for the course, as before.


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BRIEF OUTLINE OF THE UNDERGRADUATE PROGRAM IN COMPUTER SCIENCE AND ENGINEERING

YEAR-1, SEMESTER-1

Course no.	Course Title	Hours/Week Theory-Lab	Credits	[1]Prerequisite	Contents on page
HUM1107	Critical Thinking and Communication	3-0	3		45
HUM1108	English Language Sessional	0-3	1.5		45
MATH1115	Mathematics-I	3-0	3		45
PHY1115	Physics	3-0	3		46
PHY1116	Physics Lab	0-3/2	0.75		47
CHEM1115	Chemistry	3-0	3		47
CSE1101	Elementary Structured Programming	3-0	3		20
CSE1102	Elementary Structured Programming Lab	0-3	1.5		20
CSE1108	Introduction to Computer Systems	0-3	1.5		20
	Total:	15-10.5	20.25		

Total Contact Hours (nominal): [2](15+10.5) x 15 = 382.5

YEAR-1, SEMESTER-2

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
MATH1219	Mathematics-II	3-0	3	MATH1115	47
ME1211	Basic Mechanical Engineering	3-0	3		48
ME1214	Engineering Drawing	0-3/2	0.75		48
EEE1241	Basic Electrical Engineering	3-0	3		48
EEE1242	Basic Electrical Engineering Lab	0-3	1.5		48
CSE1200	Software Development-I	0-3	1.5		21
CSE1203	Discrete Mathematics	3-0	3		21
CSE1205	Object Oriented Programming	3-0	3	CSE1101	21
CSE1206	Object Oriented Programming Lab	0-3	1.5		21
	Total:	15-10.5	20.25		

Total Contact Hours (nominal): 382.5

[1] Refers to a course that should be offered in an earlier semester

[2] Contact hours per week = 15 + 10.5 = 25.5, nominal semester duration = 15 weeks

YEAR-2, SEMESTER-1

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
HUM2109	Society, Ethics and Technology	3-0	3		49
MATH2101	Mathematics-III	3-0	3	MATH1219	49
EEE2141	Electronic Devices and Circuits	3-0	3	EEE1241	50
EEE2142	Electronic Devices and Circuits Lab	0-3	1.5		50
CSE2100	Software Development-II	0-3/2	0.75		22
CSE2103	Data Structures	3-0	3	CSE1101	22
CSE2104	Data Structures Lab	0-3	1.5		22
CSE2105	Digital Logic Design	3-0	3		22
CSE2106	Digital Logic Design Lab	0-3	1.5		22
	Total:	15-10.5	20.25		

Total Contact Hours (nominal): 382.5

YEAR-2, SEMESTER-2

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
MATH2203	Mathematics- IV	3-0	3	MATH1115	50
CSE2200	Software Development-III	0-3/2	0.75		23
CSE2201	Numerical Methods	3-0	3		23
CSE2202	Numerical Methods Lab	0-3/2	0.75		23
CSE2207	Algorithms	3-0	3	CSE2103	23
CSE2208	Algorithms Lab	0-3	1.5		24
CSE2211	Data Communication	3-0	3		24
CSE2213	Computer Architecture	3-0	3		24
CSE2214	Assembly Language Programming	0-3	1.5		24
	Total:	15-9	19.5		

Total Contact Hours (nominal): 360

YEAR-3, SEMESTER-1

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
HUM3115	Economics and Accounting	3-0	3		51
CSE3100	Software Development-IV	0-3/2	0.75		25
CSE3101	Mathematical Analysis for Computer Science	3-0	3	CSE1203, MATH2101	25
CSE3103	Database	3-0	3	CSE1203	25
CSE3104	Database Lab	0-3	1.5		25
CSE3109	Digital System Design	3-0	3	CSE2105, CSE2213	26
CSE3110	Digital System Design Lab	0-3/2	0.75		26
CSE3117	Microprocessors and Microcontrollers	3-0	3	CSE2105, CSE2213, CSE2214	26
CSE3118	Microprocessors and Microcontrollers Lab	0-3/2	0.75		27
	Total:	15-7.5	18.75		

Total Contact Hours (nominal): 337.5

YEAR-3, SEMESTER-2

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
HUM3207	Industrial Law and Safety Management	3-0	3		52
CSE3200	Software Development-V	0-3/2	0.75		27
CSE3201	Introduction to Computer Networks	3-0	3	CSE2211	27
CSE3202	Introduction to Computer Networks Lab	0-3/2	0.75		27
CSE3207	Introduction to Artificial Intelligence	3-0	3	CSE1203, CSE2207, CSE3101	27
CSE3208	Introduction to Artificial Intelligence Lab	0-3/2	0.75		28
CSE3213	Operating System	3-0	3		28
CSE3214	Operating System Lab	0-3/2	0.75		28
CSE3223	Information System Design and Software Engineering	3-0	3	CSE3103	28
CSE3224	Information System Design and Software Engineering Lab	0-3/2	0.75		29
	Total:	15-7.5	18.75		

Total Contact Hours (nominal): 337.5

YEAR-4, SEMESTER-1

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
IPE4111	Industrial Management	3-0	3		52
CSE4100	Project and Thesis-I	0-6	3		29
CSE4113	Pattern Recognition and Machine Learning	3-0	3	MATH2203, CSE3207	29
CSE4114	Pattern Recognition and Machine Learning Lab	0-3/2	0.75		30
CSE4129	Formal Languages and Compilers	3-0	3	CSE1203	30
CSE4130	Formal Languages and Compilers Lab	0-3/2	0.75		30
CSE….	Option-I	3-0	3		31-36
CSE….	Option-I Lab	0-3/2	0.75		31-36
CSE….	Option-II	3-0	3		31-36
CSE….	Option-II Lab	0-3/2	0.75		31-36
		Total: 15-12	21		

Total Contact Hours (nominal): 405

YEAR-4, SEMESTER-2

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
CSE4203	Computer Graphics	3-0	3	MATH2203	30
CSE4204	Computer Graphics Lab	0-3/2	0.75		31
CSE4250	Project and Thesis-II	0-6	3		31
CSE….	Option-III	3-0	3		36-40
CSE….	Option-III Lab	0-3/2	0.75		36-40
CSE….	Option-IV	3-0	3		36-40
CSE….	Option-IV Lab	0-3/2	0.75		36-40
CSE….	Option-V	3-0	3		41-44
		Total: 12-10.5	17.25		

Total Contact Hours (nominal): 337.5

OPTIONS AVAILABLE

OPTIONS-I and OPTIONS-II

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
CSE4131	Multimedia Computing	3-0	3	CSE3103	31
CSE4132	Multimedia Computing Lab	0-3/2	0.75		32
CSE4137	Soft Computing	3-0	3	CSE3101	32
CSE4138	Soft Computing Lab	0-3/2	0.75		32
CSE4139	Advanced Database Systems	3-0	3	CSE3103	32
CSE4140	Advanced Database Systems Lab	0-3/2	0.75		33
CSE4141	Data Warehousing and Mining	3-0	3	CSE3103	33
CSE4142	Data Warehousing and Mining Lab	0-3/2	0.75		33
CSE4143	Expert and Decision Support System	3-0	3	CSE3207	34
CSE4144	Expert and Decision Support System Lab	0-3/2	0.75		34
CSE4147	Artificial Neural Networks	3-0	3	CSE3207	34
CSE4148	Artificial Neural Networks Lab	0-3/2	0.75		34
CSE4173	Cyber Security	3-0	3	CSE2211, CSE3201	34
CSE4174	Cyber Security Lab	0-3/2	0.75		35
CSE4175	Natural Language Processing	3-0	3	CSE1203, CSE3101	35
CSE4176	Natural Language Processing Lab	0-3/2	0.75		36
CSE4181	Web Computing	3-0	3	CSE3201	36
CSE4182	Web Computing Lab	0-3/2	0.75		36

OPTIONS-III and OPTIONS-IV

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
CSE4209	Computer Vision	3-0	3	MATH2203	36
CSE4210	Computer Vision Lab	0-3/2	0.75		37
CSE4211	Simulation of Products, Processes and Services	3-0	3	CSE3101, MATH2101	37
CSE4212	Simulation of Products, Processes and Services Lab	0-3/2	0.75		37
CSE4225	Network Programming	3-0	3	CSE3211, CSE4101	37
CSE4226	Network Programming Lab	0-3/2	0.75		38
CSE4227	Digital Image Processing	3-0	3	CSE4203	38
CSE4228	Digital Image Processing Lab	0-3/2	0.75		38
CSE4257	Robotics	3-0	3	ME1211, CSE3109, CSE3117	38
CSE4258	Robotics Lab	0-3/2	0.75		38
CSE4261	Data Analytics	3-0	3	CSE3103	39
CSE4262	Data Analytics Lab	0-3/2	0.75		39
CSE4263	Internet of Things	3-0	3	CSE3211	39
CSE4264	Internet of Things Lab	0-3/2	0.75		39
CSE4283	Advanced Algorithms	3-0	3	CSE2103, CSE2207	40
CSE4284	Advanced Algorithms Lab	0-3/2	0.75		40
CSE4285	High Performance Computing	3-0	3	CSE2207, CSE2213, CSE3213	40
CSE4286	High Performance Computing Lab	0-3/2	0.75		40

OPTIONS-V

Course no.	Course Title	Hours/Week Theory-Lab	Credits	Prerequisite	Contents on page
CSE4215	Advanced Computer Architecture	3-0	3	CSE2213	41
CSE4217	VLSI Design	3-0	3	CSE3109	41
CSE4219	Computational Geometry	3-0	3	MATH2203	41
CSE4221	Graph Theory	3-0	3	CSE1203	41
CSE4223	Computational Complexity Theory	3-0	3	CSE3101, CSE4129	42
CSE4233	Advanced Microprocessor Architecture	3-0	3	CSE3117	42
CSE4235	Advanced Data Communications and Wireless Networks	3-0	3	CSE2211, CSE3201	42
CSE4245	Parallel Processing	3-0	3	CSE2213, CSE3213	42
CSE4255	Telecommunication	3-0	3	CSE3201, CSE2211	43
CSE4265	Bioinformatics	3-0	3	CSE3101, CSE3207	43
CSE4267	Cloud Computing	3-0	3	CSE3207	44

SEMESTER-WISE DISTRIBUTION OF CONTACT HOURS/WEEK AND CREDITS

Year	Semester	Theory Hours/Week	Laboratory Hours/Week	Credits
1	1	15	10.5	20.25
1	2	15	10.5	20.25
2	1	15	10.5	20.25
2	2	15	9	19.5
3	1	15	7.5	18.75
3	2	15	7.5	18.75
4	1	15	12	21
4	2	12	10.5	17.25
	Total:	117	78	156

Total Contact Hours (nominal): $(117 + 78) \times 15 = 2925$

Total Credits: 156

DETAILED OUTLINE OF UNDERGRADUATE DEPARTMENTAL COURSES FOR CSE PROGRAM

YEAR-1, SEMESTER-1

CSE1101 **3 hours per week, 3 Cr.**
Elementary Structured Programming **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, Pointers, Structures and Linked lists.

CSE1102 **3 hours per week, 1.5 Cr.**
Elementary Structured Programming Lab

Laboratory works based on CSE1101.

CSE1108 **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

CSE1200 **3 hours per week, 1.5 Cr.**
Software Development-I

Students will develop software in groups or individually using a structured programming language with special emphasis on higher features like strings, files, sound and graphics.

CSE1203 **3 hours per week, 3 Cr.**
Discrete Mathematics **Prereq.: Nil**

Set Theory: Laws of set operations, Sets of numbers; Mathematical logic: Propositional and predicate calculus, Laws of logic and inference, Methods of proof; Counting: Counting principles, Basics of recurrence, Countability of sets; Graph Theory: Definitions, Handshaking theorem, Classification and computer representation of graphs, Properties of trees, Application of graphs; Relations and Functions: Definitions, Types and properties of relations and functions, Discrete-valued and nonnumeric functions and their applications; Introduction to finite automata and Turing machines; Introduction to theory of groups.

CSE1205 **3 hours per week, 3 Cr.**
Object Oriented Programming **Prereq.: CSE1101**

Principles of Object-Oriented Programming (OOP); Concepts and Techniques of OOP: Classes and Objects, Methods, Constructors and destructors, Encapsulation and object reference, Polymorphism, Array of objects; Class hierarchy: Creating class hierarchy, Member access and inheritance, Overloading and overriding; OOP facilities for extensive and robust program design.

CSE1206 **3 hours per week, 1.5 Cr.**
Object Oriented Programming Lab

Laboratory works based on CSE1205.

YEAR-2, SEMESTER-1

CSE2100 **3 hours in alternate week, 0.75 Cr.**
Software Development-II

Students will develop software in groups or individually using an object oriented programming language.

CSE2103 **3 hours per week, 3 Cr.**
Data Structures **Prereq.: CSE1101**

Basic concepts: Data structure notation, search and efficiency; Elementary data objects: Logical values, Integers and Packed words; Common data structures: Arrays, Lists (Sublists and recursive lists, Circular lists and Orthogonal lists); Stacks, Queues and Graphs (Binary Tree and Threaded Tree); Applications of data structures: Sorting, Searching, Hashing; Solving Computational problems.

CSE2104 **3 hours per week, 1.5 Cr.**
Data Structures Lab

Laboratory works based on CSE2103.

CSE2105 **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.

CSE2106 **3 hours per week, 1.5 Cr.**
Digital Logic Design Lab

Laboratory works based on CSE2105.

YEAR-2, SEMESTER-2

CSE2200 **3 hours in alternate week, 0.75 Cr.**
Software Development-III

Students will work in groups or individually to produce software based on current trends and developments in the sector.

CSE2201 **3 hours per week, 3 Cr.**
Numerical Methods **Prereq.: Nil**

Methods for solving non-linear equations**:** Iterative methods, Evaluation of polynomials, Bisection method, False position method, Newton-Raphson method, Secant method, Fixed point method; Interpolation; Curve fitting methods; Numerical differentiation and integration; Solution of systems of linear equations: Solution by elimination, Iteration methods, Matrix inversion method, Basic Gauss Elimination method, Gauss Elimination with Pivoting, Gauss-Jordan method; Numerical solution of ordinary differential equations: Taylor's series method, Euler's method, Predictor-Corrector methods.

CSE2202 **3 hours in alternate week, 0.75 Cr.**
Numerical Methods Lab

Laboratory works based on CSE2201.

CSE2207 **3 hours per week, 3 Cr.**
Algorithms **Prereq.: CSE2103**

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.

CSE2208 **3 hours per week, 1.5 Cr.**
Algorithms Lab

Laboratory works based on CSE2207.

CSE2211 **3 hours per week, 3 Cr.**
Data Communication **Prereq.: Nil**

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.

CSE2213 **3 hours per week, 3 Cr.**
Computer Architecture **Prereq.: Nil**

Basic structures and concepts of computer systems: Functional units, Basic operational concepts, Bus structures, Software and Performance; Information representation and transfer; Instructions and data access methods: Registers and Addressing, Program flow control, Logic instructions, Program-controlled I/O, Stacks and subroutines; Control Unit: Hardwired control and Microprogrammed control; Memory organization; I/O systems and Interrupts; Introduction to Pipelining, Parallel processing and multiprocessor systems.

CSE2214 **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

CSE3100 **3 hours in alternate week, 0.75 Cr.**
Software Development-IV

Students will work in groups or individually to produce software based on current trends and developments in the sector.

CSE3101 **3 hours per week, 3 Cr.**
Mathematical Analysis for Computer Science **Prereq.: CSE1203, MATH2101**

Basic mathematical analysis techniques: recurrence relations, sum, integer functions, binomial coefficient and number theory. Probability Distributions and Expectations: total probability and Bayes' rule, discrete probability distributions (geometric, Poisson etc.), continuous probability distributions (exponential, Gaussian etc.); Stochastic processes: definitions and classifications, random variate generation, discrete-parameter Markov chain; Queueing systems (*M/m/1* and *M/M/m* queuing systems); Any relevant topic from, but not limited to, algorithm, machine learning, pattern recognition, simulation and modelling for mathematical analysis.

CSE3103 **3 hours per week, 3 Cr.**
Database **Prereq.: CSE1203**

Data and database systems; Database design: Data models, Data dictionary, Functional dependency, Normal forms; Query languages: Relational algebra and calculus, SQL; Query processing: Interpretation, Cost estimation, Transaction management, Optimization; Storage and retrieval: Data organization, Indexing and hashing, Directory systems; Database management: Administration, Security, Integrity; Introduction to advanced database systems.

CSE3104 **3 hours per week, 1.5 Cr.**
Database Lab

Laboratory works based on CSE3103.

CSE3109 **3 hours per week, 3 Cr.**
Digital System Design **Prereq.: CSE2105, CSE2213**

Diode logic; Transistor switches; Logic Families: RTL, DTL, TTL, ECL, MOS; Electronic circuits for flip-flops, counters and registers, memory systems, A/D and D/A converters with applications; Comparator circuits; Switching circuits; Multi vibrators; Timing circuits; 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.

CSE3110 **3 hours in alternate week, 0.75 Cr.**
Digital System Design Lab

Laboratory works based on CSE3109.

CSE3117 **3 hours per week, 3 Cr.**
Microprocessors and Microcontrollers **Prereq.: CSE2105, CSE2213, CSE2214**

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 of common origin.
Interfacing and controlling common I/O devices, measurement units, power devices and amplifiers using microprocessors; Microprocessors in data acquisition and mass storage systems, DMA and transducers; Embedded systems and computing platforms.

CSE3118 **3 hours in alternate week, 0.75 Cr.**
Microprocessors and Microcontroller Lab

Laboratory works based on CSE3117.

YEAR-3, SEMESTER-2

CSE3200 **3 hours in alternate week, 0.75 Cr.**
Software Development-V

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.

CSE3201 **3 hours per week, 3 Cr.**
Introduction to Computer Networks **Prereq.: CSE2211**

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, GSM, CDMA, IEEE standards for LANs, MANs and Wireless Networks, 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.

CSE3202 **3 hours in alternate week, 0.75 Cr.**
Introduction to Computer Networks Lab

Laboratory works based on CSE3201.

CSE3207 **3 hours per week, 3 Cr.**
Introduction to Artificial Intelligence **Prereq.: CSE1203, CSE2207, CSE3101**

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).

CSE3208 **3 hours in alternate week, 0.75 Cr.**
Introduction to Computer Networks Lab

Laboratory works based on CSE3207.

CSE3213 **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.

CSE3214 **3 hours per week, 1.5 Cr.**
Operating System Lab

Laboratory works based on CSE3213.

CSE3223 **3 hours per week, 3 Cr.**
Information System Design and Software Engineering **Prereq.: CSE3103**

Information System Design

Information and System; Systems Analysis and Systems Analyst; Information gathering techniques; Structured analysis of systems; Feasibility Study: Concepts (abstraction, refinement, modularity and hierarchy) and classification, Introduction to modeling language (Use case diagram, Sequence diagram and Activity

diagram), Cost benefit analysis; Project scheduling; System design techniques; User interface design.

Software Engineering

Introduction to system engineering and software engineering; Software requirements analysis, modeling and specification; Software Designing: principles, models, design patterns 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.

CSE3224 **3 hours in alternate week, 0.75 Cr.**
Information System Design and Software Engineering Lab

Laboratory works based on CSE3223.

YEAR-4, SEMESTER-1

CSE4100 **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.

CSE4113 **3 hours per week, 3 Cr.**
Pattern Recognition and Machine Learning **Prereq.: MATH2203, CSE3207**

Introduction: Object similarity measures, feature selection and pattern discovery in data; Types of object classification and machine learning. Object recognition and learning methods: Regression analysis; Bayesian classifiers and probabilistic decision models; Neural networks and deep learning algorithms; Decision trees and random forests; Support vector machines; Sequential pattern recognition;

Reinforcement learning; Cluster analysis. Applications of pattern recognition and machine learning methods.

CSE4114 **3 hours in alternate week, 0.75 Cr.**
Pattern Recognition and Machine Learning Lab

Laboratory works based on CSE4113.

CSE4129 **3 hours per week, 3 Cr.**
Formal Languages and Compilers **Prereq.: CSE1203**

Formal Languages

Basic elements of formal languages, Finite automata, Context-free grammars, Push down automata, Turing machines, Hierarchy of formal languages and grammars.

Compilers

Compiler structure and phases, Lexical analysis, Top down and bottom up parsing, Symbol table, Syntax-directed translation, Type checking, Run time environment, Intermediate code generation, Code optimization.

CSE4130 **3 hours in alternate week, 0.75 Cr.**
Formal Languages and Compilers Lab

Laboratory works based on CSE4129.

YEAR-4, SEMESTER-2

CSE4203 **3 hours per week, 3 Cr.**
Computer Graphics **Prereq.: MATH2203**

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; Three-dimensional object representations: polygon surface, B-Spline curves and surfaces, BSP trees, Octrees, Fractal-Geometry methods; Hidden line algorithms; Raster graphics concepts: Architecture, algorithms and other image synthesis methods; Design of interactive graphic conversions.

CSE4204 **3 hours in alternate week, 0.75 Cr.**
Computer Graphics Lab

Laboratory works based on CSE4203.

CSE4250 **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 and II

CSE4131 **3 hours per week, 3 Cr.**
Multimedia Computing **Prereq.: CSE3103**

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.

CSE4132 **3 hours in alternate week, 0.75 Cr.**
Multimedia Computing Lab

Laboratory works based on CSE4131.

CSE4137 **3 hours per week, 3 Cr.**
Soft Computing **Prereq.: CSE3101**

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. 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.

CSE4138 **3 hours in alternate week, 0.75 Cr.**
Soft Computing Lab

Laboratory works based on CSE4137.

CSE4139 **3 hours per week, 3 Cr.**
Advanced Database System **Prereq.: CSE3103**

Introduction: Overview of advanced methods and technologies for storage, maintenance and access of large datasets with high dimensional data; Distributed database systems: Distribution transparency, Data Fragmentation, Distributed query processing and optimization, Transaction management, Concurrency control, Data recovery and Replication, Data center management; Elements of Data Warehousing: Multidimensional data models and data cubes, Granularity and

partitioning of data, Integration of large bodies of data, Knowledge discovery and pattern recognition in big datasets; Implementation of client-server DBMS and distributed systems; Security aspects for large database systems.

CSE4140 **3 hours in alternate week, 0.75 Cr.**
Advanced Database System Lab

Laboratory works based on CSE4139.

CSE4141 **3 hours per week, 3 Cr.**
Data Warehousing and Mining **Prereq.: CSE3103**

Introduction to Data Warehousing: Database and Data Warehouse (DW), Architecture and types of DW; DW modeling: Data cube and Online Analytical Processing (OLAP), Multidimensional database schemas like Stars, Snowflakes and Fact Constellations, OLAP operations such as rollup, slice and dice; DW design and implementation issues; Data generalization for data warehousing.

Introduction to Data Mining (DM): Data versus Knowledge, Searching different types of data for various patterns, Traditional and machine learning technologies for DM, Applications of DM; Mining frequent patterns and correlations: Market basket analysis, Apriori algorithm, Pattern-growth and vertical data for mining, Mining closed and maximal frequent itemsets, Mining association rules and correlation, Pattern evaluation and correlation measures and methods; Mining sequential patterns: Basics of frequent substring matching, Mining sequential patterns in biological databases, web access databases and time series databases. Introduction to machine learning approaches for classification and regression by large dataset analysis.

CSE4142 **3 hours in alternate week, 0.75 Cr.**
Data Warehousing and Mining Lab

Laboratory works based on CSE4141.

CSE4143 **3 hours per week, 3 Cr.**
Expert and Decision Support Systems **Prereq.: CSE3207**

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.

CSE4144 **3 hours in alternate week, 0.75 Cr.**
Expert and Decision Support Systems Lab

Laboratory works based on CSE4143.

CSE4147 **3 hours per week, 3 Cr.**
Artificial Neural Networks **Prereq.: CSE3207**

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.

CSE4148 **hours in alternate week, 0.75 Cr.**
Artificial Neural Networks Lab

Laboratory works based on CSE4147.

CSE4173 **3 hours per week, 3 Cr.**
Cyber Security **Prereq.: CSE2211, CSE3201**

Introduction to Cyber Security: Internet Governance - Challenges and Constraints, Cyber Threats and attacks, security principles, Cyber Security Policy; Cyber Security Vulnerabilities and Cyber Security Safeguards: vulnerabilities in software,

vulnerabilities in computer networks, Access control, Authentication, Biometrics, Denial of Service Filters, Ethical Hacking; Cryptography and Network Security: symmetric cryptography, public-key cryptography, cryptographic hash functions, digital signatures, details of AES and RSA cryptography, Types of Firewalls, VPN Security Protocols, security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec; Intrusion Detection and Prevention: Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection and prevention Systems, Host based Intrusion prevention Systems , Network Session Analysis, System Integrity Validation.

CSE4174 **hours in alternate week, 0.75 Cr.**
Cyber Security Lab

Laboratory works based on CSE4173.

CSE4175 **3 hours per week, 3 Cr.**
Natural Language Processing **Prereq.: CSE1203, CSE3101**

Introduction: Natural Language Processing (NLP) tasks in syntax, semantics, and pragmatics; Ambiguity and uncertainty in NLP. Context Free Grammar (CFG) and Syntactic Parsing: Example of syntax dealing with sentence structures; Non-probabilistic parsing; CFGs describing sentences; Words and Transducers; Probabilistic CFGs and lexicalized probabilistic CFGs. Probability and Language models: N-gram language models, Hidden Markov Models, Viterbi algorithm, Part-of-speech tagging and Statistical models of machine translation; Semantic Analysis and Pragmatics: Word sense disambiguation, shallow semantic parsing, co-reference resolution and discourse representation; Overview of important application areas of NLP such as text categorization, question answering, sentiment analysis, etc.

CSE4176 **3 hours in alternate week, 0.75 Cr.**
Natural Language Processing Lab

Laboratory works based on CSE4175.

CSE4181 **3 hours per week, 3 Cr.**
Web Computing **Prereq.: CSE3201**

Introduction to Internet technology: Word Wide Web (WWW), Web pages, Web servers, HTTP, HTTPs, FTP, Electronic mail, Search engines, Global databases, digital libraries, video on demand, streaming audio and video; Web page design: HTML and DHTML concepts, tags, commands, form design, table design, online request, dynamic functions, buttons, animations and multimedia, Script languages, Embedding scripts in HTML; Intranet: Usefulness of intranet, Sharing scarce resources over intranet, Network chatting and newsgroups; E-Commerce: Paying money over the network, Online shopping cart, Mobile payment system; Web Security: Privacy Policy, Encryption techniques, Network security and firewalls.

CSE4182 **3 hours in alternate week, 0.75 Cr.**
Web Computing Lab

Laboratory works based on CSE4181.

OPTIONS-III and OPTIONS-IV

CSE4209 **3 hours per week, 3 Cr.**
Computer Vision **Prereq.: MATH2203**

Introduction: State and trend of visual input to intelligent machines; Overview of image and graphical information processing techniques. Camera and Image: Image formation in modern cameras; Color, lighting, texture, distortion, reflection and shading of 3D world elements in 2D images. Object Recognition: Image segmentation, filtering and transformation; feature tracking and detection; Filling the gaps and template matching. Scenes, Structures and Optical Flow

Recognition: Stereo and multiple views; Static and dynamic parameter analysis; Motion and speed detection. Overview of some challenging application areas like biometrics, image search in internet, telemedicine and automatic cars.

CSE4210 **3 hours in alternate week, 0.75 Cr.**
Computer Vision Lab

Laboratory works based on CSE4209.

CSE4211 **3 hours per week, 3 Cr.**
Simulation of Products, Processes and Services **Prereq.: CSE3101, MATH2201**

Introduction: Modeling and Simulation Concepts, Simulation methods, Case studies of simulation, Introduction to simulation packages; Model classification: Monte Carlo simulation, Discrete-event simulation, Continuous system simulation, Mixed event simulation; Quantitative modeling paradigms: Queuing networks, Stochastic process algebras, Stochastic Petri nets, Markov model; Input and output analysis: Random numbers, Generating and analyzing random numbers, Simulation of computer networks, Object-Oriented modeling of physical systems, Process-oriented and parallel component simulation and modeling.

CSE4212 **3 hours in alternate week, 0.75 Cr.**
Simulation of Products, Processes and Services Lab

Laboratory works based on CSE4211.

CSE4225 **3 hours per week, 3 Cr.**
Network Programming **Prereq.: CSE3211, CSE4101**

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.

CSE4226 **3 hours in alternate week, 0.75 Cr.**
Network Programming Lab

Laboratory works based on CSE4225.

CSE4227 **3 hours per week, 3 Cr.**
Digital Image Processing **Prereq.: CSE4203**

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.

CSE4228 **3 hours in alternate week, 0.75 Cr.**
Digital Image Processing Lab

Laboratory works based on CSE4227.

CSE4257 **3 hours per week, 3 Cr.**
Robotics **Prereq.: ME1211, CSE3109, CSE3117**

Introduction: Definition and classification, intelligent systems and robotics, laws of robotics, applications of robots, basic components of robot systems; Design of Robots: Links and joints, kinematic chain, sensors, effectors, position, orientation and frames, homogeneous transformation, localization and mapping, robot vision, system interface, engineering tools to design robots; Manipulator: Forward and inverse kinematics of serial and parallel manipulators, Newton-Euler formulation and Lagrangian formulation of serial and parallel manipulators; Human-Robot Interaction: Overview of social robots, natural language learning; Navigation and Locomotion: Trajectory planning, dynamics, control, robot programming; Drone: structure and principles, flight control and operation, drone programming.

CSE4258 **3 hours in alternate week, 0.75 Cr.**
Robotics Lab

Laboratory works based on CSE4257.

CSE4261 **3 hours per week, 3 Cr.**
Data Analytics **Prereq.: CSE3103**

Data Collection and Preprocessing: Extracting data from rich data sources; Data quality issues; Data cleaning and integration. Data Storage: Structured versus nonstructured repositories of huge data; redundancy and conflict resolution. Data Transformation: Dimensionality reduction, sampling, correlation analysis, regression, clustering, concept hierarchy generation, histogram analysis, data visualization; Data cube and analytical processing. Introduction to knowledge discovery and data mining techniques.

CSE4262 **3 hours in alternate week, 0.75 Cr.**
Data Analytics Lab

Laboratory works based on CSE4261.

CSE4263 **3 hours per week, 3 Cr.**
Internet of Things **Prereq.: CSE3201**

Introduction to Internet of Things (IoT): IoT paradigm, smart objects and smart grids, convergence of technologies, IoT components and application domains; IoT Architecture and Platforms: Models for communication among devices in various domains, Sensor networks, Device drivers, Communication protocols, Cloud computing and Fog computing; Development and Security Issues: Building IoT with technologies like Raspberry Pi and Arduino, Big-Data Analytics and decision making, Dependability, Security and Maintainability.

CSE4264 **3 hours in alternate week, 0.75 Cr.**
Internet of Things Lab

Laboratory works based on CSE4263.

CSE4283 **3 hours per week, 3 Cr.**
Advanced Algorithms **Prereq.: CSE2103, CSE2207**

NP-completeness, Amortized analysis, Approximation algorithms and schemes, Randomized algorithms, Network optimization; Parallel algorithms; Computational geometry; Dynamic trees; Dealing with large data sets: Compression, Streaming algorithms, Compressed sensing; String matching; Pattern matching; Solving homogeneous and non-homogeneous equations.

CSE4284 **3 hours in alternate week, 0.75 Cr.**
Advanced Algorithms Lab

Laboratory works based on CSE4283

CSE4285 **3 hours per week, 3 Cr.**
High Performance Computing **Prereq.: CSE2207**

Introduction to high performance computing: motivation, applications; Levels of parallelism: instruction, transaction, task, thread, memory, function; Architectures: N-wide superscalar architectures, multi-core, multi-threaded; Models: SIMD, MIMD, SIMT, SPMD, Dataflow Models; Parallel Programming: processor architecture, communication, memory hierarchy, thread Organization and programming models in HPC, Parallel programming with OpenMP and (Posix) threads, Message passing with MPI; High performance cloud and cluster computing: MapReduce programming model, Apache Hadoop, Hadoop distributed file system(HDFS), Apache Spark.

CSE4286 **3 hours in alternate week, 0.75 Cr.**
High Performance Computing Lab

Laboratory works based on CSE4285.

OPTIONS-V

CSE4215 **3 hours per week, 3 Cr.**
Advanced Computer Architecture **Prereq.: CSE2213**

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.

CSE4217 **3 hours per week, 3 Cr.**
VLSI Design **Prereq.: CSE3109**

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.

CSE4219 **3 hours per week, 3 Cr.**
Computational Geometry **Prereq.: MATH2203**

Drawing fundamental geometric objects: Basic concepts, algorithms and their complexity; Point inclusion problems, convexity testing; 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.

CSE4221 **3 hours per week, 3 Cr.**
Graph Theory **Prereq.: CSE1203**

Introduction: Graphs as abstract connection diagrams; Fundamental concepts and definitions: Simple graphs, digraphs, subgraphs, vertex-degrees, walks, paths and cycles; 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.

CSE4223 **3 hours per week, 3 Cr.**
Computational Complexity Theory **Prereq.: CSE3101, CSE4129**

Turing Machines and Computational complexity classes: Representation of computational tasks and algorithms using Turing machines, Time and space complexity classes; Computable functions and recursive function theory; Unsolvable/undecidable problems; Intractable problems and NP-completeness: P versus NP question, polynomial-time reductions, NP-complete problems.

CSE4233 **3 hours per week, 3 Cr.**
Advanced Microprocessor Architecture **Prereq.: CSE3107**

Intel 80x86 and beyond: Architecture, Addressing modes and Instruction set; Motorola 6800: Programming model, Addressing structure, Addressing modes, Instruction set, Stacks, Pins and Signals, Memory interface, Programmed I/O, Interrupt I/O, DMA, Exception Handling; RISC processors: Key performance features, Registers, Data types and addresses, Instruction set, Pins and signals; SPARC and MIPS.

CSE4235 **3 hours per week, 3 Cr.**
Advanced Data Communications and Wireless Networks **Prereq.: CSE2211, CSE3201**

Introduction and overview: Ubiquitous emergence of wireless technology for communication; Revision of data communication modes, methods and technology in favor of wireless communication. Physical Layer Revised: Radio propagation modeling, digital modulation schemes, coding techniques and filtering in mobile wireless environment; Resource access and management: Radio channels and wideband equalization, Medium access control and ALOHA based medium access, WiFi and bandwidth management, scheduling for TDMA/FDMA/CSMA based wireless networks. Routing protocols: Proactive and reactive routing protocols; AODV and DSR protocols; Opportunistic, backpressure and cooperative routing. Congestion control and performance optimization issues in wireless networks.

CSE4245 **3 hours per week, 3 Cr.**
Parallel Processing **Prereq.: CSE2213, CSE3213**

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.

CSE4255 **3 hours per week, 3 Cr.**
Telecommunication **Prereq.: CSE3211, CSE4101**

Overview of Telecommunication: History, Evolution, Convergence of telecommunication and data networks, Types of telecommunication networks, Generations of wireless telecommunication system; Switching System: Blocking probability and multistage switching, Time division switching and two dimensional switching; Cellular telephony: Frequencies reuse, Frequency management channel alignment, Hand off strategies, GSM, CDMA; Mobile Radio Propagation - Large Scale Path Loss: Free space propagation model; Three basic propagation mechanisms: reflection, diffraction, scattering; Practical link budget design using path loss models; Small scale fading and multipath; Modulation Techniques for Mobile Radio; Modern Telephone Services and Network: Internet Telephony, Facsimile, ISDN, ATM and intelligent networks, Satellite communication, Optical fiber communication.

CSE4265 **3 hours per week, 3 Cr.**
Bioinformatics **Prereq.: CSE3101, CSE3207**

Foundation: RNA, DNA, proteins and genes, Genome rearrangements; DNA sequence alignments: local and global alignment, Dynamic programming; DNA sequencing, genome sequencing, protein sequencing; Combinatorial pattern matching; Genome assembly: consensus-alignment-overlap, graph-based assembly; Clustering and classification; Evolutionary trees and Phylogenetics; Statistical and machine learning methods in bioinformatics; Software development and usage in bioinformatics: Bio tools, biological databases, databanks and data mining, Biostatistics and computer techniques.

CSE4267 **3 hours per week, 3 Cr.**
Cloud Computing **Prereq.: CSE3207**

Introduction: Resource sharing and cloud computing, challenges and risks, benefits; Types and Platforms: Public, private and hybrid clouds; Enabling infrastructure, data centers and software for clouds; Cloud operating systems and cloud servers. Cloud Architecture: Static and dynamic resource provisioning; Capacity provisioning; Cloud brokers and interaction among infrastructure, business and customer; Federated clouds. Scalability, Performance, Privacy and Security issues.

DETAILED OUTLINE OF UNDERGRADUATE NON-DEPARTMENTAL COURSES FOR CSE PROGRAM

YEAR-1, SEMESTER-1

HUM1107 **3 hours per week, 3 Cr.**
Critical Thinking and Communication **Prereq.: Nil**

Objective: The aim of this foundational course is to help the second language learners acquire fluency in both spoken and written English to communicate messages with clarity, precision and confidence in the workplace. The course will have three components: Language, Speaking and Writing. The skills required in these areas will be imparted through Lectures and Sessionals. While lectures will introduce to basic concepts in communication, sessionals will provide hands-on experience.
Lecture Topics : Introduction to communication, Language and grammar skills, Speaking skills, Writing skills.

HUM1108 **3 hours per week, 1.5 Cr.**
English Language Sessional **Prereq.: Nil**

Building vocabulary, Building sentences, Grammar, Pronunciation drills, Phonetics, Vowels, Dipthongs, Consonants, Stress, Rhythm and intonation, Conversational skills, Meta Language, The Writing process, Writing with a thesis, Writing topic sentences, Writing a paragraph, Linking paragraphs.

MATH1115 **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.

PHY1115 **3 hours per week, 3 Cr.**
Physics **Prereq.: Nil**

Electromagnetism

Magnetic field, Lorentz force, Ampere's law, Faraday's Law, Biot-Savart law, Inductance, Calculation of inductance (LR circuit).

States of Matter

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, 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.

PHY1116 **3 hours in alternate week, 0.75 Cr.**
Physics Lab

Laboratory experiments based on PHY1115.

CHEM1115 **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.

YEAR-1, SEMESTER-2

MATH1219 **3 hours per week, 3 Cr.**
Mathematics-II **Prereq.: MATH1115**

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.

ME1211 **3 hours per week, 3 Cr.**
Basic Mechanical Engineering **Prereq.: Nil**

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.

ME1214 **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.

EEE1241 **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.

EEE1242 **3 hours per week, 1.5 Cr.**
Basic Electrical Engineering Lab

Laboratory Experiments based on EEE1241.

` YEAR-2, SEMESTER-1

HUM2109 **3 hours per week, 3 Cr.**
Society, Ethics and Technology **Prereq.: Nil**

Historical Perspectives of Technology, Social Perspectives of Technology, Ethical Perspectives of Technology, Globalization and Human Rights, Information Technology, Biomedical Technology, Population and the Environment.

MATH2101 **3 hours per week, 3 Cr.**
Mathematics-III **Prereq.: MATH1219**

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, Binomial; Continuous probability distribution e.g. Uniform, Normal and Poisson; Hypothesis testing and Regression analysis.

EEE2141 **3 hours per week, 3 Cr.**
Electronic Devices and Circuits **Prereq.: EEE1241**

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.

EEE2142 **3 hours per week, 1.5 Cr.**
Electronic Devices and Circuits Lab

Laboratory Experiments based on EEE2141.

YEAR-2, SEMESTER-2

MATH2203 **3 hours per week, 3 Cr.**
Mathematics-IV **Prereq.: MATH1115**

Fourier Analysis

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

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.

YEAR-3, SEMESTER-1

HUM3115 **3 hours per week, 2+1 Cr.**
Economics and Accounting **Prereq.: Nil**

Economics

Micro-Economics: The theory of demand and supply and their elasticity, Price determination, 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. Cost sheet under job costing. Cost-volume-profit analysis. Long–run planning and control: capital budgeting.

YEAR-3, SEMESTER-2

HUM3207 **3 hours per week, 3 Cr.**
Industrial Law and Safety Management **Prereq.: Nil**

Principles of law of contract; Company law: Law regarding formation, incorporation, management and winding up of companies; Labor law: Law in relation to wage hours, health, safety and other work conditions; The trade union legislation arbitration; The policy of the state in relation to labor; The Factory Act; Law of Compensation.

Safety Management: Evolution of modern safety concepts; Industrial hazard, Safety and risk management; Worker health and safety; Proactive techniques for safety management; Safety standard and regulation for engineering works.

YEAR-4, SEMESTER-1

IPE4111 **3 hours per week, 3 Cr.**
Industrial Management **Prereq.: Nil**

Introduction to Management: Organization and the need for management; Organization: Design and Structure, Coordination; Management Theory, Social Responsibility and Ethics, Globalization and Multiculturalism.

Personnel Management: Scope, Importance, Motivation, Need Hierarchy, Job Design, Leadership, Performance, Appraisal, Informal Group, Communication and Negotiation, Human Resource Management.

Production Management: Forecasting, Line Balancing, Master Production Schedule, Material Requirements Planning, Project Management, Ergonomics, Maintenance Management, Quality Management, Supply Chain Management, Information Technology and the Supply Chain.

Financial Management: Time and Money, Methods of Comparing Alternatives, Concept of Depreciation, Break Even Analysis, Benefit Cost Ratio Analysis.

Marketing Management: Concept, Strategy, Sales Promotion, Patent Laws.

Technology Management: Management of Innovation and Changes, Technology Life Cycle.

DETAILED OUTLINE OF UNDERGRADUATE DEPARTMENTAL COURSES OFFERED TO OTHER PROGRAMS

ARCHITECTURE

ARC1130 **3 hours per week, 1.5 Cr.**
Computer Application I

Word processing and spreadsheet analysis using available software packages.

CIVIL ENGINEERING

CSE2153 **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.

CSE2154* **3 hours per week, 1.5 Cr.**
Numerical Methods and
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.

* Unified form of the previous course code CSE2163

TEXTILE TECHNOLOGY

CSE2146 **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.

CSE2186 **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.)

MECHANICAL AND PRODUCTION ENGINEERING

CSE1287
Computer Programming **3 hours per week, 3 Cr.**

Introduction to the Digital Computer; Introduction to Programming Variables, Assignment; Expressions; Input/Output; Conditionals and Branching; Iteration; Functions; Recursion; Arrays; Introduction to Pointers; Structures; Introduction to Data-Procedure Encapsulation; Dynamic allocation; Linked structures; Introduction to Data Structure, Stacks and Queues; Search Trees; Time and space requirements. (A programming language like C/C++ may be used as a basis language. The same language must be used for the laboratory.)

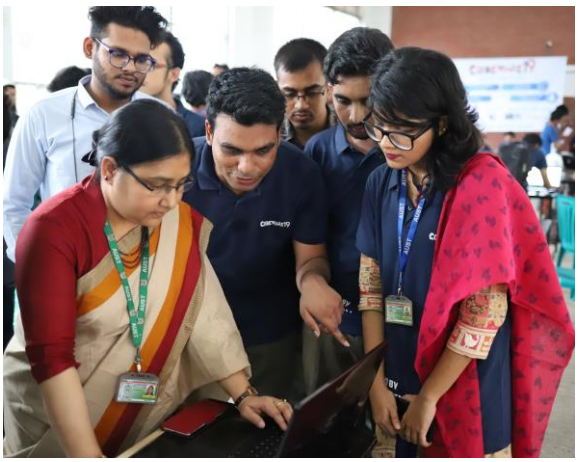
CSE1288
Computer Programming Sessional **3 hours per week, 1.5 Cr.**

Sessional works compatible to CSE1287.

Competitive Programming



Project Show, Robo Soccer, and Seminar

SUGGESTED TEXT AND REFERENCE BOOKS FOR CSE PROGRAM

YEAR-1, SEMESTER-1

1. Balagurusamy E., *Programming in ANSI C*, Tata McGraw-Hill, 7th Ed., 2017
2. Peter Prinz, Tony Crawford, *C in a Nutshell: The Definitive Reference*, O'Reilly Media, 2nd Ed., 2015
3. Schildt H., *C, The Complete Reference*, McGraw-Hill, 4th Ed., 2000
4. Schildt H., *Teach Yourself C*, McGraw-Hill, 3rd Ed., 1997
5. Kernighan B. W., Ritchie D. M., *The C Programming Language*, Prentice Hall, 2nd Ed., 1988
6. Norton P., *Introduction to Computers*, McGraw-Hill, 6th Ed., 2008
7. Resnick R., Halliday D., *Physics*: *Part II*, New Age International, 2nd Ed., 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., 24th Ed., 2010
10. Subrahmanyam N., Brijlal, *Wave and Oscillation*, Vikas Publ., 2nd Ed., 1994
11. O'Connor J.D., *Better English Pronunciation*, Cambridge University Press, 2nd Ed., 1980
12. Mohammad, Bhattacharjee, Latif, *A Text Book on Differential Calculus*, S. Tripaty, 10th Ed., 2001
13. Maniruzzaman Dr. M., *Advanced Reading and Writing Skills*, Friends Publ., 2008
14. Pyle A.M., Page M.E.M., *Cliffs TOEFL*, Cliffs, 2001
15. Rahman, Bhattacharjee, *A Text book on Co-ordinate Geometry*, S. Bhattacharjee Publ., 1st Ed., 2003
16. Howard A., *Calculus*, John Wiley & Sons, 7th Ed., 2001
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, 11th Ed., 2016

YEAR-1, SEMESTER-2

1. Schildt H., *Java: The Complete Reference*, McGraw-Hill, 11th Ed., 2018
2. Horstmann Cay S., *Big Java: Early Objects*, Wiley & Sons, 6th Ed., 2015
3. Schildt H., *C++: The Complete Reference*, McGraw-Hill Osborne Media, 5th Ed., 2012
4. Deitel H.M., Deitel P.J., *Java: How to Program (Early Objects)*, Prentice Hall, 10th Ed., 2015

5. Rosen K. H., *Discrete Mathematics and its Applications*, McGraw-Hill, 7th Ed., 2011
6. Nicodemi O., *Discrete Mathematics: A Bridge to Computer Science and Advanced Mathematics,* West, 1987 (CBS, 3rd reprint, 2002)
7. Liu C.L., *Elements of Discrete Mathematics*, McGraw-Hill, 4th Ed., 2017
8. Boylestad R.L., *Introductory Circuit Analysis*, Prentice Hall, 13th Ed., 2015
9. Nilsson W., Riedel S.A., *Electrical Circuits*, Addison-Wesley, 8th Ed., 2007
10. Mohammad, Bhattacharjee, Latif, *A Text Book on Integral Calculus*, Kanta Bhattacharjee Publ., 2003
11. Gupta J.K., Khurmi R.S., *A Textbook of Thermal Engineering (Mechanical Technology)*, S. Chand, 2006
12. Vasandani V.P., Kumar D.S., *Treatise on Heat Engineering*, Metropolitan Books, 1995
13. John J.C., *Introduction To Robotics : Mechanics and Control*, Prentice Hall, 3rd Ed., 2004

YEAR-2, SEMESTER-1

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, *Data Structures and Algorithms in Java*, 6th Edition, John Wiley & Sons, 2014
2. Frank Carrano and Timothy Henry, *Data Structures and Abstractions with Java*, Pearson, 5th Ed. 2018
3. Mark Weiss, Data Structures & Algorithm Analysis in C++, Pearson, 4th Ed. 2013
4. Kathy Sierra and Bert Bates, *Head First Java*, O'Reilly, 2005
5. Reingold M.E., Hansen J.W., *Data Structures*, CBS, 1st Ed., 1988
6. Lipscutz*, Data Structure*, Pearson, 2007
7. Tanenbaum A.M., Langsam Y., Augenstein M.J, *Data structure using C*, Pearson Education, 1998
8. Floyd T.L., *Digital Fundamentals*, Prentice Hall, 11th Ed., 2014
9. Mano M.M., *Digital Logic and Computer Design*, Prentice Hall of India Pvt. Ltd., 2008
10. Mano M.M., Ciletti M.D., *Digital Design with an Introductin to the Verilog HDL,* Prentice Hall of India Pvt. Ltd., 2012
11. Boylestad R., Nashelskey L., *Electronic Devices and Circuit Theory*, Prentice Hall, 10th Ed., 2008
12. Horenstein M.N., *Microelectronic Circuits and Devices*, Prentice Hall, 2nd Ed., 1995
13. Brown J.W., Churchill R.V., *Complex Variables and Applications*, McGraw-Hill, 8th Revised Ed., 2008
14. Spiegel M.R., *Theory and Problems on Laplace Transformations*, McGraw-Hill, 1986

15. Gupta S.C., Kapoor V.K., *Fundamentals of Mathematical Statistics*, S Chand & Sons, 9th Ed., 1994
16. Giddens A., Philip W. Sutton, *Sociology,* Blackwell Publishers, 8th Edition, 2017
17. Winston M., Edelbach R., *Society, Ethics and Technology*, Wadsworth Publishing, 5th Ed., 2013
18. George W.Reynolds, *Ethics in Information Technology*, 5th Ed., Cengage Learing, 2014
19. Charles B. Fledderman*, Engineering Ethics*, 4th Ed., Pearson Education, 2012

YEAR-2, SEMESTER-2

1. Horawitz E., Sahni S., Rajasekaram S., *Computer Algorithms*, Silicon Press, 2nd Ed., 2007
2. Cormen T.H., Leiserson C.E., Rivest R.L., *Introduction to Algorithms*, McGraw-Hill, 3rd Ed.,2009
3. Forouzan B.A., *Data Communication and Networking*, McGraw-Hill, 5th Ed., 2012
4. Zaky S.G., Vranesic Z.G., Hamacher C., *Computer Organization*, McGraw-Hill, 6th Ed., 2011
5. Patterson D. A., Hennessy J. L., *Computer Organization & Design*, Morgan Kaufmann Publishers Inc, 5th Ed., 2013
6. Rao S.B., Shantha C.K, *Numerical Methods With Programs in Basic*, *Fortran, Pascal & C++ (Revised Edition),* University Press, 2004
7. Irvine K.R., *Assembly Language for the IBM PC*, Macmillan, 2nd Ed., 1993
8. Yu Y., Marut C., *Assembly Language Programming and the Organization of the IBM PC*, McGraw-Hill, International Ed., 1992
9. Bronson R., *Schaum's Outline of Theory and Problems of Matrix Operations*, McGraw-Hill, 1988
10. Grewall B.S., *Higher Engineering Mathematics*, Khanna Publ., 43th Ed., 2015
11. Anton H., *Elementary Linear Algebra*, Wiley, 11th Ed., 2013

YEAR-3, SEMESTER-1

1. Graham R.L., Knuth D.E., Patashnik O., *Concrete Mathematics*, Pearson Education, 2nd Ed., 2007
2. Ross S.M., *Introduction to Probability Models*, Elsevier, 11th Ed., 2011
3. Silberschatz A., Korth H., Sudarshan S., *Database System Concepts*, McGraw-Hill, 6th Ed., 2010
4. Elmasri R., Navathe S.B., *Fundamentals of Database Systems*, Addison-Wesley, 7th Ed., 2015
5. Date C. J., *An Intrduction to Database Systems*, Addison Wesley, 8th Ed., 2003

6. Gaonkar R.S., *Microprocessor Architecture, Programming and Application with the 8085*, PenRam International (India), 6th Ed., 2013
7. Douglas V.H., *Microprocessors and Interfacing*, McGraw-Hill, 2nd Ed., 2006
8. Barry B. Brey, *The Intel Microprocessors*, Pearson Education, 2009
9. Mohamed Rafiquzzaman, *Microprocessors and Microcomputer-Based System Design*, CRC Press, Inc., 1995.
10. Mano M. M., *Digital Logic and Computer Design,* Prentice Hall of India Pvt. Ltd., 2008
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14. Larson K.D., Wild J.J., Chaiappetta B., *Fundamentals of Accounting Principles*, McGraw-Hill, 18th Ed., 2007
15. Samuelson P.A., Nordhaus W.D., *Economics*, McGraw-Hill, 19th Ed., 2009
16. Dewett K.K., *Modern Economic Theory*, S Chand & Co., 2006

YEAR-3, SEMESTER-2

1. Russell S. J., Norvig P., *Artificial Intelligence*, Pearson Education, 4th Ed., 2020
2. Tanenbaum A.S., *Computer Networks*, Prentice Hall, 5th Ed., 2011
3. Patterson D.W., *Introduction to Artificial Intelligence and Expert Systems*, Prentice Hall, 1st Ed., 2009
4. Zed Shaw, *Learn Python the Hard Way*, Addison-Wesley, 3rd Ed., 2016
5. Leon Sterling & Ehud Shapiro, *The Art of Prolog*, MIT Press, 2nd Ed., 1994
6. Tanenbaum A.S., *Modern Operating Systems*, Prentice Hall, 4rd Ed., 2015
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8. Awad E.M., *Systems Analysis and Design*, Galgotia, 2nd Ed., 1985
9. Whitten J. L., *System Analysis and Design Methods*, McGraw-Hill, 7th Ed., 2007
10. Pressman R.S., *Software Engineering*, McGraw-Hill, International Ed., 8th Ed., 2014
11. Sommerville I., *Software Engineering*, Addison-Wesley, 9th Ed., 2010
12. Stranks J., *Health and Safety Law*, Pearson Education, 5th Ed., 2005
13. Malik P.L., *Industrial Law*, Eastern Book Company, 22nd Ed., 2010

YEAR-4, SEMESTER-1

1. Theodoridis S. and Koutroumbas K., *Pattern Recognition*, Academic Press, 4th Ed., 2009
2. Murphy, Kevin P. *Machine Learning: A Probabilistic Perspective*. MIT press, 2012
3. Aho A. V., Lam M. S., Sethi R., Ullman J. D., *Compilers: Principles, Techniques and Tools*, Pearson Education, 2nd Ed., 2007
4. Hart P.E. and Stork D., *Pattern Classification*, Wiley, 2nd Ed., 2002
5. Hopcroft J. E., Motwani R., Ullman J. D., *Introduction to Automata Theory, Languages, and Computation*, Pearson Education, 3rd Ed., 2007
6. Martin J.C., *Introduction to Languages and the Theory of Computation*, McGraw-Hill, 4th Ed., 2010
7. Kerzner H., *Project Management: A System Approach & Planning, Scheduling and Controlling*, John Wiley & Sons, 12th Ed., 2017
8. Taylor B.W., *Introduction to Management Science*, Prentice Hall, 13th Ed., 2019
9. Griffin R.W., *Management,* South-Western College Publishers, 11th Ed., 2012

YEAR-4, SEMESTER-2

1. P. Shirley, S. Marschner, *Fundamentals of Computer Graphics*, CRC Press, 4th Ed., 2015
2. J. D. Foley, A. Van Dam, S. K. Feiner, and J. F. Hughes, *Computer Graphics Principles and Practice*, Pearson Education, 2nd Ed. in C, 2003

OPTIONS-I and OPTIONS-II COURSES (for YEAR-4, SEMESTER-1)

1. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, *Dive into Deep Learning*, 2020
2. Ian Goodfellow and Yoshua Bengio and Aaron Courville, *Deep Learning*, MIT Press, 2016
3. Lefteri H. Tsoukalas and Robert E. Uhrig, *Fuzzy and Neural Approaches in Engineering*, Wiley & Sons, Inc., USA, 1st. Ed., 1996
4. Han J., Kamber M., *Data Mining: Concepts and Techniques*, Morgan Kaufman, 3rd Ed., 2011
5. Jiawei Han, Micheline Kamber, Jian Pei, *Data Mining Concepts and Techniques*, Morgan Kaufmann, 3rd Ed., 2012

6. Joseph C. Giarratano, Gary D. Riley, *Expert Systems: Principles and Programming*, 4th Ed., 2004
7. Ermine J.L., *Expert Systems: Theory and Practice*, PHI Learning, 2005
8. Turban E., Aronson J.E., *Decision Support Systems and Intelligent Systems*, Prentice Hall, 7th Ed., 2005
9. Simon O. Haykin, *Neural Networks and Learning Machines*, McMaster University, Ontario Canada, Pearson, 3rd Ed., 2009
10. Christoff Parr, Jan Pelzl*., Understanding Cryptography: A Textbook for Students and Practitioners*, Springer, 2009
11. Jurafsky and Martin, *Speech and Language Processing*, Prentice Hall, 3rd Ed., 2020
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OPTIONS-III and OPTIONS-IV COURSES (for YEAR-4, SEMESTER-2)

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