CHED MEMORANDUM ORDER (CMO)
NO. 53;
Series of 2006

SUBJECT   :   **POLICIES AND STANDARDS FOR INFORMATION**
                    TECHNOLOGY EDUCATION (ITE) PROGRAMS

x- -x

In accordance with pertinent provisions of Republic Act (RA) No. 7722, otherwise known as the "Higher Education Act of 1994," and pursuant to Commission En Banc (CEB) Resolution **No. 798 - 2006** to rationalize Information Technology Education (ITE) in the country and keep pace with the demands of global competitiveness, the following Policies and Standards   (PS) for ITE are hereby adopted and promulgated by the Commission, thus:

ARTICLE I
INTRODUCTION

Section I. Rationale and Background

The field of Information Technology (IT) is ever dynamic; its advancement and development had been rapid and its evolvement is a continuous process. To face the challenges of advancement, the Commission recognizes the need to be responsive according to the current needs of the country. Hence, it is essential and important that the country's IT capability should be continually developed and strengthened to be at par globally.

It is the objective of the Commission to develop and promote the Policies and Standards (PS) for Information Technology Education to provide a minimum standard for Higher Education Institutions (HEIs) offering or intending to offer quality ITE programs. The PS is developed with consultations from all stakeholders, from the academe to industry.

The PS contains provisions that cultivate the culture of excellence in offering the ITE programs. This is in line with the vision of the Commission to have HEIs produce competent graduates that shall cater to the needs of the IT industry. The PS is also designed for all HEIs to exercise their innovativeness and creativity in the development of its curriculum for the offering of ITE programs.

ARTICLE II
AUTHORITY TO OPERATE

Section 2.   Authority to Operate. All Private Higher Education Institutions (PHEIs) intending to offer degree programs in Computer Science, Information Technology and Information Systems must first secure proper authority from the Commission in accordance with existing rules and regulations.   State universities and colleges (SUCs), and local colleges and universities should likewise strictly adhere to the provisions in this policies and standards.

ARTICLE III
PROGRAM SPECIFICATIONS

Section 3.   Degree Programs. - The degree programs corresponding respectively to these specific areas are the following:

3.1   **Bachelor of Science in Computer Science (BSCS)** - the study of concepts and theories, algorithmic foundations, implementation and application of information and computing solutions.

3.2   **Bachelor of Science in Information Technology (BSIT)** - the study of utilization of computers and computer software to plan, install, customize, operate, manage, administer and maintain information technology infrastructure.

3.3   **Bachelor of Science in Information Systems (BSIS)** – the study of design and implementation of solutions that integrate information technology with business processes. The BSIS shall replace the Bachelor of Science in Information Management (BSIM) program.

Section 4.   Program description.
        The objectives of the three (3) programs in ITE are as follows:

4.1.1   The Bachelor of Science in Computer Science (BSCS) program prepares students to be IT professionals and researchers, and to be proficient in designing and developing computing solutions.

4.1.2   The Bachelor of Science in Information Technology (BSIT) program prepares students to be IT professionals, be well versed on application installation, operation, development, maintenance and administration, and familiar with hardware installation, operation, and maintenance.

4.1.3   The Bachelor of Science in Information Systems (BSIS) program prepares students to be IT professionals and be expert on design and implementation of IS for business processes.

4.2   Specific professions/careers/occupations or trades that the graduates of these programs may pursue. – After satisfactorily completing all the requirements leading to a BSCS, BSIT, or BSIS degree, students may qualify for but not limited to the following entry level positions:

4.2.1 Bachelor of Science in Computer Science (BSCS)

- Applications Developer
- Computer Science Instructor
- Database Programmer / Designer
- Information Security Engineer
- Quality Assurance Engineer
- Researcher
- Systems Developer
- Systems Analyst

4.2.2 Bachelor of Science in Information Technology (BSIT)

- Applications developer
- Database Administrator
- Entrepreneur in IT Industry
- Information Security Administrator
- Information Technology Instructor
- Network Administrator
- Network Engineer
- Systems Analyst
- Technical Support Specialist
- Test Engineer
- Web Administrator / Web Master
- Web Developer

4.2.3 Bachelor of Science in Information Systems (BSIS)

- Business Process Analyst
- Data Quality Specialist
- Entrepreneur in IT industry
- IS Instructor
- Systems Auditor
- Quality Assurance Analyst
- Systems Implementation Officer
- Technical Support Specialist

Section 5. **Allied Programs. –** These are programs that may be considered as equivalent to ITE programs for the purpose of determining qualifications of faculty members and for students cross enrolling to other department.

For the BSCS Program:

- BS Mathematics
- BS Computer Engineering
- BS in Electronics and Communications Engineering
- BS Applied Mathematics

For the BSIT Program:

- BS Computer Engineering
- BS Electronics and Communications Engineering
- BS Statistics
- BS in Information Management

For the BSIS Program:

- BS Information Management
- BS Statistics
- BS Industrial Engineering

ARTICLE IV
COMPETENCY STANDARDS

Section 6.   Competency Standards – Competency refers to specific skills, knowledge and attitude that may be demonstrated through performance, while standards are common set of expectations. Graduates of either BSCS, BSIT, or BSIS programs, are expected to have acquired but not limited to the following competencies:

6.1   Personal Skills

- Personal-discipline skills
- Critical-thinking skills
- Inter and intra person motivation skills
- Problem solving skills
- Planning and organizing skills
- Ethical thinking
- Entrepreneurial thinking
- Innovative
- Perseverance in pursuing goals and continuous improvement

6.2   Interpersonal Skills

- Team work and collaborative skills
- Oral and written communication skills
- Conflict resolution skills

6.3   Technical Understanding

6.3.1   Bachelor of Science in Computer Science (BSCS)

- Application of fundamental computer concepts as problem solving skills
- Design and implementation of computer-based solutions
- Recognition and application of technical standards and interoperability

- Research in Computer Science related areas
- Integration of knowledge learned in different areas of Computer Science

6.3.2 Bachelor of Science in Information Technology (BSIT)

- Systems analysis and design
- Operation of database, networks and multimedia systems
- Software integration, testing and documentation
- Systems management and administration
- Principles of accounting

6.3.3 Bachelor of Science in Information Systems (BSIS)

- Information abstraction, representation and organization
- Computing architectures and delivery systems
- Concepts of information and system distribution
- Information management and system development
- Computing tools in knowledge application

ARTICLE V
CURRICULUM

Section 7.   Curriculum Description. -   ITE shall be built upon a core of courses and a series of professional courses leading to one or more of the three programs. The New General Education Curriculum as mandated by the Commission shall form part of the requirements for ITE. The required natural science courses in the GE curriculum should include a laboratory component.

Section 8.   Curriculum Outline. – The curriculum outline is divided into five (5) components namely: General Education, Basic ITE Core Courses, ITE Professional Courses, ITE electives and free electives with a minimum requirement of 140 units. The outline is as follows:

a) **GENERAL EDUCATION**	Units	Total Units
Languages and Humanities		24
English	9	
Filipino	6	
Humanities (Literature, Arts, Philosophy, etc.)	9	
Mathematics, Natural Sciences and Technology		15
Mathematics	6	
Natural Sciences	6	
Electives (Math, Natural Science, Technology etc.)	3	
Social Sciences & Communications		15
Social Sciences & Communications	15	
Psychology, Sociology, Anthropology, Economics (w/ Taxation & Agrarian Reform Integrated), Philippine History & Culture, Life & Works of Rizal, Asian/Western Civilization, Mass Comm., Society and Culture (with Family		

Planning), Politics & Governance (with Philippine Constitution)

b)	**BASIC ITE CORE COURSES**	**18**
c)	**ITE PROFESSIONAL COURSES**	**33**
d)	**ITE ELECTIVES**	**12**
e)	**FREE ELECTIVES**	**9**
	PE	**8**
	NSTP	**6**
	TOTAL UNITS	**140**

Section 9.   Sample program of study. - Below are sample curricula for the BSCS, BSIT and BSIS.

Sample Curriculum for the Bachelor of Science in Computer Science (BSCS) Program

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
CS Fundamentals	CS101	3	2	1	None	None	5
Computer Programming 1	CS102	3	2	1	None	None	5
Algebra	GE101	3	3	0	None	None	3
English 1	GE201	3	3	0	None	None	3
Social Science 1	GE301	3	3	0	None	None	3
Natural Science 1	GE111	3	3	0	None	None	3
PE 1		2	2				2
NSTP 1		3	3				3
TOTAL		**23**	**21**	**2**			**27**

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Computer Programming 2	CS103	3	2	1	None	CS102	5
Data Structures	CS201	3	3	0	None	CS102	3
Trigonometry	GE102	3	3	0	None	GE101	3
English 2 (Communications for IT)	GE202	3	3	0	None	GE201	3
Filipino 1	GE206	3	3	0	None	GE201	3
Natural Science 2	GE112	3	3	0	None	GE111	3
PE 2		2	2				2
NSTP 2		3	3				3
TOTAL		**23**	**22**	**1**			**25**

SECOND YEAR

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Object Oriented Programming	CS211	3	2	1	None	CS103	5
Design and Analysis of Algorithm	CS202	3	3	0	None	CS201	3
Discrete Structures	CS104	3	3	0	None	GE101	3
Calculus	CS210	3	3	0	None	GE102	3
English 3	GE203	3	3	0	None	GE202	3
Filipino 2	GE207	3	3	0	None	GE206	3
PE 3		2	2				2
TOTAL		**20**	**19**	**1**			**22**

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Database Systems	CS212	3	2	1	None	CS103	5
Programming Languages	CS203	3	2	1	None	CS103	5
Automata and Language Theory	CS204	3	3	0	None	CS103	3
Digital Design	CS206	3	3	0	None	GE102	3
Probability and Statistics	GE103	3	3	0	None	GE102	3
Humanities 1	GE401	3	3	0	None	None	3
PE 4		2	2				2
TOTAL		**20**	**18**	**2**			**24**

THIRD YEAR

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Web Programming	CS213	3	2	1	None	CS212	5
Modelling and Simulation	CS205	3	3	0	None	GE101	3
Computer Organization and Assembly Language	CS105	3	2	1	None	CS206	5
CS Elective 1	CS301	3	2	1	None	3rd Yr	5
Social Science 2	GE302	3	3	0	None	None	3
Humanities 2	GE402	3	3	0	None	None	3
TOTAL		**18**	**15**	**3**			**24**

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Software Engineering	CS214	3	2	1	None	CS211	5
Operating Systems	CS207	3	2	1	None	CS105	5
CS Elective 2	CS302	3	2	1	None	3rd Yr	5
Free Elective 1	CS401	3	2	1	None	None	5
Social Science 3	GE303	3	3	0	None	None	3
Humanities 3	GE403	3	3	0	None	None	3
TOTAL		**18**	**14**	**4**			**26**

Summer

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Internship/OJT/Practicum	CS500	3	0	3	None	None	
TOTAL		**3**	**0**	**3**			**162**

FOURTH YEAR

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Thesis 1	CS501	3	3	0	None	CS214	3
Network Principles and Programming	CS208	3	2	1	None	CS207	5
Professional Ethics	CS106	3	3	0	None	CS101	3
CS Elective 3	CS302	3	2	1	None	None	5
Social Science 4	GE304	3	3	0	None	None	3
Social Science 5	GE405	3	3	0	None	None	3
TOTAL		**18**	**16**	**2**			**22**

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Thesis 2	CS502	3	3	0	None	CS501	3
CS Elective 4	CS304	3	2	1	None	None	5
Free Elective 2	CS402	3	3	0	None	None	3
Free Elective 3	CS403	3	3	0	None	None	3
TOTAL		12	11	1			14

BSCS TOTALS	152/155	136	19	

Sample Curriculum for the Bachelor of Science in Information Technology (BSIT) Program

<p style="background-color:#cdeccd">**FIRST YEAR**</p>

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
IT Fundamentals	IT101	3	2	1	None	None	5
Programming 1	IT102	3	2	1	None	None	5
Algebra	GE101	3	3	0	None	None	3
English 1	GE201	3	3	0	None	None	3
Social Science 1	GE301	3	3	0	None	None	3
Natural Science 1	GE111	3	3	0	None	None	3
TOTAL		18	16	2			22

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Programming 2	IT103	3	2	1	None	IT102	5
Trigonometry	GE102	3	3	0	None	GE101	3
English 2 (Communications for IT)	GE202	3	3	0	None	GE201	3
Filipino 1	GE206	3	3	0	None	GE201	3
Natural Science 2	GE112	3	3	0	None	GE111	3
Humanities 1	GE401	3	3	0	None	None	3
PE 1		2	2	0			2
NSTP 1		3	3	0			3
TOTAL		23	22	1			25

SECOND YEAR

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Computer Organization	IT105	3	2	1	None	IT103	5
Object Oriented Programming	IT211	3	2	1	None	IT103	5
Discrete Structures	IT104	3	3	0	None	GE101	3
Accounting Principles	IT201	3	3	0	None	GE102	3
English 3	GE203	3	3	0	None	GE202	3
Filipino 2	GE207	3	3	0	None	GE206	3
PE 2		2	2				2
NSTP 2		3	3				3
TOTAL		**23**	**21**	**2**			**27**

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Database Management System 1	IT212	3	2	1	None	IT211	5
Operating System Applications	IT202	3	3	0	None	IT105	3
Network Management	IT203	3	2	1	None	IT105	5
Probability and Statistics	GE103	3	3	0	None	GE101	3
Social Science 2	GE302	3	3	0	None	None	3
Humanities 2	GE402	3	3	0	None	None	3
PE 3		2	2				2
TOTAL		**20**	**18**	**2**			**24**

THIRD YEAR

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Web Development	IT214	3	2	1	None	IT212	5
Systems Analysis and Design	IT204	3	2	1	None	GE102	5
Database Management Systems 2	IT213	3	2	1	None	IT212	5
IT Elective 1	IT301	3	2	1	None	3rd Yr	5
Social Science 3	GE303	3	3	0	None	None	3
Humanities 3	GE403	3	3	0	None	None	3
PE 4		2	2				2
TOTAL		**20**	**16**	**4**			**28**

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Software Engineering	IT205	3	2	1	None	IT204	5
Multimedia Systems	IT215	3	2	1	None	IT214	5
Professional Ethics	IT106	3	3	0	None	IT101	3
IT Elective 2	IT302	3	2	1	None	None	5
Free Elective 1	IT401	3	3	0	None	None	3
Social Science 4	GE304	3	3	0	None	None	3
TOTAL		18	15	3			24

FOURTH YEAR

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Internship/OJT/Practicum	IT500	9	0	9	Senior Standing	IT 11	27
TOTAL		9	0	9			27

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Capstone Project (Technopreneurship)	IT206	3	3	0	4th yr	IT 13	3
IT Elective 3	IT303	3	2	1	None	None	5
IT Elective 4	IT304	3	2	1	None	None	5
Free Elective 2	IT402	3	3	0	None	None	3
Free Elective 3	IT403	3	3	0	None	None	3
Social Science 5	GE305	3	3	0	None	None	3
TOTAL		18	16	2			22

BSIT TOTALS		149	124	25

Sample Curriculum for the Bachelor of Science in Information Systems (BSIS) Program

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Fundamentals of Information Systems / Information Management	IS101	3	3	0	None	None	3
Personal Productivity using IS	IS102	3	2	1	None	None	5
Algebra	GE101	3	3	0	None	None	3
English 1	GE201	3	3	0	None	None	3
Natural Science 1	GE211	3	3	0	None	None	3
Humanities 1	GE401	3	3	0	None	None	3
PE 1		2	2	0			2
NSTP 1		3	3	0			3
TOTAL		**23**	**22**	**1**			**25**

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Human Computer Interaction	IS211	3	3	0	None	None	3
Fundamentals of Programming, Data, File and Object Structures	IS103	3	2	1	None	None	5
Introduction to the IM Profession and Ethics	IS106	3	3	0	None	None	3
Fundamentals of Business and Management	IS201	3	3	0	None	None	3
Trigonometry	GE102	3	3	0	None	GE101	3
English 2	GE202	3	3	0	None	GE201	3
Natural Science 2	GE212	3	3	0	None	GE211	3
PE 2		2	2	0			2
NSTP 2		3	3	0			3
TOTAL		**26**	**25**	**1**			**28**

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Systems Analysis and Design	IS213	3	3	0	None	IS211	3
Databases	IS212	3	2	1	None	IS103	5
System Infrastructure and Integration	IS214	3	3	0	None	IS103	3
Business Processes	IS202	3	3	0	None	IS201	3
Discrete Structure	IS104	3	3	0	None	GE101	3
Filipino 1	GE206	3	3	0	None	GE201	3
English 3	GE203	3	3	0	None	GE202	3
PE 3		2	2	0			2
TOTAL		23	22	1			25

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Applications Development	IS215	3	2	1	None	IS212-213	5
Networks and Internet Technology	IS105	3	2	1	None	IS214	5
Accounting and Financials	IS203	3	3	0	None	IS202	3
Probability and Statistics	GE103	3	3	0	None	GE101	3
Filipino 2	GE207	3	3	0	None	GE206	3
Social Science 1	GE301	3	3	0	None	None	3
Social Science 2	GE302	3	3	0	None	None	3
PE 4		2	2	0			2
TOTAL		23	21	2			27

THIRD YEAR

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Project Management and Quality Systems	IS217	3	3	0	None	IS215	3
Deployment, Maintenance and Services	IS216	3	3	0	None	IS215	3
Evaluation of Business Performance	IS204	3	3	0	None	IS203	3
IS Elective 1	IS301	3	3	0	None	3rd Yr	3
Free Elective 1	IS401	3	3	0	None	None	3
Social Science 3	IS303	3	3	0	None	None	3
Humanities 2	IS402	3	3	0	None	None	3
TOTAL		**21**	**21**	**0**			**21**

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Information Systems Planning	IS218	3	3	0	None	IS216	3
Management of Technology	IS205	3	3	0	IS218	None	3
IS Elective 2	IS302	3	3	0	None	None	3
IS Elective 3	IS303	3	3	0	None	None	3
Free Elective 2	IS402	3	3	0	None	None	3
Social Science 4	GE304	3	3	0	None	None	3
TOTAL		**18**	**18**	**0**			**18**

FOURTH YEAR

First Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Internship/OJT/Practicum	IS500	9	0	9	None	IS218	27
TOTAL		**9**	**0**	**0**			**27**

Second Semester

DESCRIPTIVE TITLE	COURSE CODE	TOTAL UNITS	LEC UNITS	LAB UNITS	Co-REQ	Pre-REQ.	TOTAL HRS/WK
Capstone Project	IS501	3	3	0	None	IS500	3
IS Elective 4	IS304	3	3	0	None	None	3
Free Elective 2	IS402	3	3	0	None	None	3
Free Elective 3	IS403	3	3	0	None	None	3
Social Science 5	GE305	3	3	0	None	None	3
Humanities 3	GE403	3	3	0	None	None	3
TOTAL		18	18	0			18

BSIS TOTALS	161	147	14

Section 10.   Thesis/capstone project

Thesis is a requirement for the BSCS program. Contents must be focussed on the theories and concepts of computing and it should be in the form of scientific work that may be presented in a public forum.

Capstone project is required for the BSIT and BSIS programs. It should be in the form of a systems application or an enterprise resource plan.

Section 11.   Internship/On-the-job-training/Practicum. Internship/OJT/Practicum is an immersion program wherein the students will have the chance and opportunity to be with the IT industry. This program is important because the students will have the chance to apply the skills, knowledge and attitude learned in the school and at the same time the opportunity to experience the corporate environment. Learning expectations in the IT related field should be established between the HEI and the industry in the form of a Memorandum of Agreement (MOA) or Memorandum of Understanding (MOU).

Internship is a requirement for the BSIT and BSIS program but optional for the BSCS program. Students are eligible to enrol the internship program after completing the 80% of the total number of units in the curriculum. The minimum number of internship hours for the BSIT and BSIS programs are 486 and 162 for the BSCS program.

ARTICLE VI
COURSE SPECIFICATIONS

Section 12.   All courses for the three (3) programs should have the following components:

- Course name
- Course Description
- Course objectives

- Number of units for lecture and laboratory
- Number of contact hours per week
- Prerequisites
- Course outline
- Laboratory
- Equipment
- Texts and References

Annex A contains the course specification for the three (3) ITE programs (core and professional courses).

ARTICLE VII
OTHER REQUIREMENTS

Section 13. Administration

13.1 Composition - A well-organized and competent staff and faculty shall administer the implementation of an ITE program and should meet the requirements set by the Commission.

13.2 A Higher Education Institution (HEI) offering an ITE program shall have a full-time administrator that will administer the program. This administrator can be a Dean, Department Head, Director, Coordinator or equivalent depending on the organizational structure of the HEI.

13.2.1 For one (1) program offering, the program administrator may also serve as the program head for the specific program being offered. For two (2) or more program offerings, there should be one program head for each program offered. If the programs offered are under a larger unit like a college, an administrator, who maybe one of the program heads, is still required.

13.2.2 There should be three (3) full-time ITE faculty members per program offered, one of whom can be the program head. A full-time faculty should render at least twenty-four (24) hours in residence per week and have a minimum contract of one (1) year in the college/department.

13.2.3 The department must also ensure that sixty percent 60% of all ITE courses in each program are handled by a full-time faculty members.

13.2.4 At least twenty percent (20%) of the ITE faculty must have IT industry experience within the last 5 years. Industry experience may be full-time work or part-time consultancies in an IT Industry as evidenced by a contract, certification or MOA/MOU. The involvements are in the form of technical administration, systems design, applications programming, research, project management or equivalent.

13.2.5 At least sixty percent (60%) of the ITE faculty members must have completed a minimum of eighteen (18) units of master's study in ITE or

three (3) years of IT-related industry experience within the last five (5) years.

13.2.6 At least 30% of the faculty members handling ITE courses must have master's degrees in each program offered by the department.

13.3 General Qualifications of the Dean - The Dean of an ITE program must possess any one of the following:

13.3.1 Master's degree in an ITE program, at least three (3) years of IT work/consultancy experience, and at least three (3) years of ITE teaching experience beyond computer literacy both of which must be within the last five (5) years.

13.3.2 A master's degree in an ITE allied program plus at least one of the following:

13.3.2.1 Completion of coursework requirements for a master's degree in any ITE programs;

13.3.2.2 Five (5) years experience in systems design, applications programming, IT project management, or information technology research within the last eight (8)years;

13.3.3 Doctorate in an ITE program and at least three (3) years of IT work/consultancy experience within the least five (5) years.

13.3.4 Doctorate in an ITE allied program, at least three (3) years of work/consultancy experience, at least five (5) years of ITE teaching experience beyond computer literacy both of which must be within the last five (5) years.

13.4 **General Qualifications of the Program Head**

13.4.1 Bachelor of Science in Computer Science (BSCS) - The head of BSCS program should posses any of the following qualifications:

13.4.1.1 A master's degree in CS;

13.4.1.2 A master's degree in IT or IS provided that his bachelor's degree is in CS;

13.4.1.3 A master's degree in an ITE allied program plus at least one of the following:

13.4.1.3.1 Completion of coursework requirements for a master's degree in Computer Science;

        13.4.1.3.2   Five (5) years experience in systems design, applications programming, IT project management, or computer science research within the last eight (8) years.

    13.4.1.4   A doctorate in an ITE allied program plus five (5) years experience teaching ITE (beyond computer literacy courses) within the last eight (8) years.

13.4.2 Bachelor of Science in Information Technology (BSIT)
Bachelor of Science in Information System (BSIS)

the head should posses any of the following qualifications:

    13.4.2.1   A master's degree in any ITE program;

    13.4.2.2   A master's degree in an ITE allied program plus at least one of the following:

        13.4.2.2.1   Completion of coursework requirements for a master's degree in any of the ITE programs;

        13.4.2.2.2   Five (5) years experience in systems design, applications programming, IT project management, or information technology research within the last eight (8) years;

    13.4.2.3   A doctorate in an ITE allied program plus five (5) years experience teaching ITE courses (beyond computer literacy courses) within the last eight (8) years.

13.5   General Functions and Responsibilities of the Dean - The general functions and/or responsibilities of the Dean should be as follows, thus:

13.5.1 To assist in the formulation of institutional policies;

13.5.2 To exercise overall supervision of all academic and non-academic personnel of the IT college or department;

13.5.3 To coordinate with the office concerned with student services;

13.5.4 To encourage research and extension activities among faculty and students;

13.5.5 To oversee the formation, implementation and evaluation of plans and programs for development and the supervision/coordination of activities and services for the advancement of goals and objectives of the ITE program;

13.5.6   To help enforce the concerned HEI's rules and the laws affecting education, and the procedures, policies, rules and regulations promulgated under authority of or as adopted by the Commission and/or the HEI;

13.6   General Functions and Responsibilities of the Program Head - The general functions and/or responsibilities of the Program Head should be as follows:

13.6.1   To exercise educational leadership among the concerned faculty members by:

13.6.1.1   recommending faculty and staff development programs;

13.6.1.2   preparing and assigning the teaching load of the faculty members and directing them to advise students in their program of studies; and

13.6.1.3   evaluating and recommending the appointment, promotion, retirement, termination of and disciplinary actions against faculty members and non-teaching personnel, subject to the HEI's policies and procedures;

13.6.2   To undertake periodic curriculum review, revision, and development with the assistance of the faculty members in the degree program concerned; and

13.6.3   To prepare course offerings, institute methodologies of instruction, adopt proper textbooks and recommend books to add to the collection of the library.

Section 14.   ITE Faculty. -   An ITE faculty should posses the following qualifications:

14.1   **Qualifications.**

14.1.1   A baccalaureate degree in any ITE or its allied programs.

14.1.2   A baccalaureate degree in a field other than ITE or its allied programs plus any of the following:

14.1.2.1   completion of coursework requirements for a master's degree in any of the ITE programs;

14.1.2.2   at least three (3) years experience in the IT profession such as technical administration, systems design, applications programming or equivalent within the last 5 years.

14.1.2.3   proficiency in teaching ITE courses as proven by a certification issued by a certifying body such as the Philippine National IT Standards (PhilNITS), Brainbench, Oracle or Microsoft etc., provided that the teaching load assigned to him/her is aligned with the area of the certification.

14.1.3 A master's degree in an ITE program.

14.1.4 A master's degree in an ITE allied program plus at least one of the following:

14.1.4.1 One (1) IT related research published and presented in national or international conference. The IT related research should contribute to the field of IT and not in social science.

14.1.4.2 Three (3) years experience in the IT profession such as technical administration, systems design, applications programming or equivalent within the last 5 years.

14.1.4.3 Proficiency in teaching ITE courses as proven by a certification issued by a certifying body such as JITSE or Microsoft etc., provided that the teaching load assigned is aligned with the area of the certification.

14.1.5 A doctorate in an ITE program.

14.1.6 A doctorate in an ITE allied program plus five (5) years experience teaching ITE courses beyond computer literacy courses within the last eight (8) years.

14.2 **Load.**

14.2.1 **Assignment.** - The regular load of an ITE faculty member is twenty-four (24) contact hours per week inclusive of lecture and laboratory. Overload should not exceed six (6) hours. There should not be more than four (4) preparations per term.

14.2.2 **Teaching Load.** - As a general rule, in case the Dean has to teach, his or her teaching load should not exceed nine (9) contact hours per week. This load takes into consideration the functions of the Dean. For the department chair, his/her teaching load should not exceed twelve (12) contact hours.

14.3 **Employment Status. -** Full-time regular faculty is defined as a faculty member receiving monthly compensation throughout the year inclusive of all other employment incentives and benefits as mandated by the Labor Code. They should render at least twenty-four (24) hours in residence per week in the college/department.

14.4 **Faculty Support**

14.4.1 **Faculty Development Program.** - The college/department should have a written comprehensive faculty development program. There shall be a specific budget allocation to implement such program. HEIs are enjoined to send full-time ITE faculty members to participate in various activities of professional organizations like Philippine Society of I.T. Educators (PSITE), Computing Society of the Philippines (CSP), Philippine Computer Society (PCS), etc. and to attend in various professional development programs in his/her field as well as graduate studies in ITE.

14.4.2 **Facilities**. The HEI should provide office space, computers with Internet connections and printers for faculty and administrators. Consultation areas for students are also required.

Section 15.   General Education Faculty. -   All faculty members handling general education subjects must have appropriate master's degree or higher degrees in their respective teaching assignments.

Section 16.   Library

16.1   **Librarian(s).** - HEIs offering ITE should have at least one (1) full-time licensed librarian. The librarian(s) shall participate in faculty meetings and activities and serve as (a) member(s) of the educational program planning committee. The librarian(s) should work closely with the Dean or Department Chair in collection development for the ITE program.

The librarian(s) should be encouraged to join recognized librarian societies and associations for professional development.

16.2   **Book Collection.** -   The library collection of the HEI should meet the following requirements, namely:

16.2.1 To support HEI's curricular needs and to provide enough books for students, its library should have at least five (5) titles per professional course and one (1) volume per course of a particular year of the curriculum for every ten (10) students enrolled in that year. At least twenty percent (20%) of the books should have been published within the last four (4) years. Book holdings should preferably include more reference books and textbooks rather than vendor specific technology books.

16.2.2 For initial offering, the minimum volumes of IT books covering first to third year courses are required to be found in the Library. For program recognition, an HEI should have the required number of books in all four-year levels.

16.2.3 The library should include significant holdings of up-to-date computer magazines, journals and periodicals that are published locally and internationally. This includes at least two (2) publications per program.

The HEI should have current subscription to the journals and magazines. Paid online / digital subscriptions to at least twenty (20) journal titles are allowed as substitute for journals and magazines provided that they can be readily accessed and printed by faculty, students and staff.

16.2.4 The library must provide students with access to manuals for programming languages and computer systems, as well as documentation materials related to the development and use of systems that were purchased by the HEIs.

16.2.5 The library must provide Internet terminals to allow faculty members and students to undertake research and other academic activities.

16.2.6 The library must provide access (with capability to read or print) to electronic library materials such as CD-ROMs and electronic subscriptions. These are considered as additional library holdings beyond the minimum requirements.

16.3 **Space Requirements.** -   The library should have a seating capacity of at least five percent (5%) of the total students enrolled.

Section 17.   Facilities and Equipment.

17.1 **Classroom Requirements**.   Classroom space should at least be 1.2 square meters per student. For a class size of 40 students, the room should be at least 48 square meters; for 50 students, 60 square meters. It should be well lighted and well ventilated and/or air-conditioned. The classroom should preferably have two exit doors opening outwards.   There should be at least one classroom per one hundred thirty-five (135) students enrolled. The maximum class size should be fifty (50) students only.

17.2 **Laboratory Requirements**.   The HEI must provide for networked computer laboratories required for hands on training of the students. The laboratory floor space should be at least 2.0 square meters per student. For the computer laboratory, there should be a ratio of one (1) student per terminal or workstation. The number of terminals or workstations should be such that a student is provided at least nine (9) hours of individual hands-on computer time per week. On the basis that each computer terminal or work station operates effectively at least ten (10) hours a day and five (5) days a week, the computer time requirement should translate to at least one computer per ten (10) students enrolled in the ITE program, the computers being exclusively for their use.   A laboratory assistant, whom at least a junior IT student and not assisting a class of the same or higher year level is required for laboratory class with more than thirty (30) students.

Networked laboratory must have one printer for every 15 computer units or be connected to at least one (1) high speed printer (at least 30 pages per minute) for students' access.

For initial offerings, the HEI should have at least two laboratories with 15 workstations each. One of the laboratories should be dedicated for the use of the IT department.

17.3 **Laboratory Equipment.** The required computer hardware and software should be able to respond to the objectives of the courses in the curriculum. They should conform to generally accepted industry standards and be capable of providing training in multiple platforms. At least thirty percent (30%) of the equipment should have been manufactured within the last three (3) years.

17.4 **Audio Visual Facilities.** - As a general rule, the HEI should provide the necessary audio-visual equipment in support of the teaching-learning process, such as overhead projectors, LCD projectors, etc.

ARTICLE VIII
TRANSITORY, REPEALING AND EFFECTIVITY CLAUSE

Section 18. **Transitory Clause.** HEIs that have been granted permit or recognition are hereby given three (3) years from the date of effectivity hereof to fully comply with all the requirements as stipulated in this CMO. Compliance to these requirements shall also be required to State Universities and Colleges (SUCs) and Local Colleges and Universities (LCUs). In the event that the HEI fails to comply, it is given a non-extendable period of two (2) years to comply.

Currently enrolled students in the program shall be allowed to graduate under the old curriculum. However, students enrolling for the ITE programs beginning school year 2007-2008 shall be covered by this CMO.

Section 19. Repealing Clause. All pertinent rules and regulations or parts thereof that are inconsistent with the provisions of theses policies and standards are hereby repealed or modified accordingly.

Section 20. Effectively Clause. This CMO shall be effective beginning SY 2007-2008 after publication in the Official Gazette or in a newspaper of general circulation.

Pasig City, Philippines, _____

FOR THE COMMISSION:

CARLITO S. PUNO
Chairman

Annex A course specification for the three (3) ITE programs (core and professional courses).

Bachelor of Science in Computer Science (BSCS) Program

COURSE NUMBER: CS101

TITLE: CS Fundamentals

- *COURSE DESCRIPTION*

This course provides an overview of computers, number systems, data types and representations, digital logic systems, assembly and machine language, compilers and translators, operating systems, and internetworking.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:
1. identify the basic components of a computer system
2. know the arithmetic operations on number systems
3. understand how different data types are represented
4. understand the basics of digital logic systems
5. identify the different levels of programming
6. know the functions of an operating system
7. know concepts of data communication, network components and protocols, the Internet issues

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE

1. History of Computers
2. Computer Hardware
3. Computer Software
4. Introduction to Number Systems
   • Number System Conversion
   • Number System Operations
   • Fixed-Point Number Representation
   • Floating-Point Number Representation
5. Digital Logic Systems
   • Logic Operations and Gates
   • Boolean Functions
   • Canonical and Standard Forms
   • Boolean Algebra Theorems and Properties
   • Simplification of Boolean Functions
   • Flip-flops, Counters, Registers, PLAs
6. Controlling the Computer
   • Assembly and Machine Language
   • Compilers and Translators
   • Programming Languages
   • Operating Systems
7. Overview of Internetworking	

• Networking: Computer Connections • Internet: A Resource for All of Us • Security and Privacy: Computers and the Internet	

COURSE NUMBER: CS102

TITLE: Computer Programming 1

- ### COURSE DESCRIPTION

This course introduces the students to the fundamentals of logic formulation together with their implementation in the C programming language. This course should serve as a foundation for students in the Computer Science program.

- ### COURSE OBJECTIVES (DESIRABLE OBJECTIVES)

At the end of this course, the student should be able to:

1 Learn the components in problem solving
2 Explore the strategies in problem solving in relation to procedural programming
3 Analyze problems
4 Design algorithms to solve problems
5 Implement algorithms in a programming language
6 Test programming solutions to problems
7 Apply recursion as a programming solution

- ### COURSE OUTLINE AND TIMEFRAME

TOPICS AND READINGS	DATE

1. Steps in Program Planning and Development
2. History/Principles of the (Programming Language used)
3. Expressions
4. Basic Program Structure
    • Variable Declaration
    • Assignment Statement
    • Input/Output Statements
5. Using Conditional Constructs
    • Single Selection Construct
    • Multiple Selection Construct
6. Using Looping Constructs
    • Event-Controlled Loop Construct
    • Count-Controlled Loop Construct
7. Using Functions
    • Concepts and Rules
    • Functions and Parameter Passing
8. Recursion	

COURSE NUMBER: CS103

TITLE: Computer Programming 2

- *COURSE DESCRIPTION*

This is an advanced course for computer programming in C. It covers the data structures like array, list, and file. This course also should serve as a foundation for students in the Computer Science program.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:

1. Learn the components in problem solving
2. Explore the strategies in problem solving in relation to procedural programming
3. Analyze problems
4. Design algorithms to solve problems
5. Implement algorithms in a programming language
6. Test programming solutions to problems
7. Understand various concepts of data structures

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE

1. Arrays
   • One-Dimensional Array
   • Sorting and Searching in an Array
   • Two-Dimensional Array
2. Strings
3. Structures
   • Structure Within a Structure
   • Array Within a Structure
4. Pointers
   • Concept of Heap, Stacks, and Memory Management
   • Pointers Within a Structure
5. File Structures
   • Text File
   • Non-Text File	

COURSE NUMBER: CS104

TITLE: Discrete Structures 1

- *COURSE DESCRIPTION*

This course introduces the foundations of discrete mathematics as they apply to computer science. Topics include functions, relations and sets, basic logic, proof techniques, basics of counting and introduction to digital logic and digital systems.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of the course, the student must be able to:

1. *Perform operations associated with sets, functions and relations*
2. *Apply formal methods of symbolic prepositional and predicate logic*
3. *Discuss which kind of proof is best for a given problem*
4. *Compute permutations and combinations of sets*

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE
1. Functions, Relations and Sets 2. Basic Logic - Propositional Logic - Logical Connectives - Truth Tables - Normal Forms - Validity - Predicate Logic - Universal and Existential Quantification - Modus Ponens and Modus Tolens - Limitations of Predicate Logic 3. Proof Techniques 4. Basics of Counting 5. Introduction to digital logic and digital systems	

COURSE NUMBER: CS105

TITLE: Computer Organization and Assembly Language

- *COURSE DESCRIPTION*

This course provides an overview of the architecture and organization of a computer, how it is built. It includes a discussion of the CPU, memory, I/O organization and peripherals.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:

1. Identify the different hierarchical views of a computer (gates, microprogram, machine language, assembly language)
2. Write code in assembly language
3. Know the different devices and components of a computer system and how these components work together

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE

1. Review: Binary Number Systems
2. Review: Fixed and Floating Point Representation
3. Review: Logic Gates and Boolean Algebra (Simplification)
4. Computer System (Von Neumann Architecture)
5. CPU
    • Single Bus Architecture
        i. Overview of Assembly Programming
        ii. Microprogramming
        iii. Gating and Control Sequencing
    • Control Unit
    • Arithmetic and Logic Unit
        i. Addition (Half, Full, Fast Adder, CLA)
        ii. Subtraction
        iii. Multiplication (Algorithmic)
        iv. Division (Algorithmic)
6. I/O Organization and Peripherals
    a. Magnetic Disk (Hard Disk)
    b. Keyboard
    c. Monitor (CRT)
7. Memory
    a. Cache Memory (L1, L2, caching techniques)
    b. Virtual Memory
    c. Memory Interleaving
Lab: Assembly Language Programming	

COURSE NUMBER: CS106

TITLE: PROFESSIONAL ETHICS

- *COURSE DESCRIPTION*

The course introduces ethics and ethical theories; provides discussions on the ethical dilemmas and issues facing IT practitioners. An appreciation and discussion of the Code of Ethics of I. T. Professionals; cybercrimes and appropriate Philippine Laws are also included.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of the term, the students should be able to:
- Understand and appreciate the meaning of ethics, values and attitudes.
- Be guided in their ethical thinking and considerations as they relate in the cyberworld.
- Be aware of the different ethical dilemma/issues in the cybeworld.
- Appreciate and internalize the code of conduct of an I. T. Professional.
- Be familiar with the various Philippine Laws that penalizes cybercrimes.

- *COURSE OUTLINE AND TIMEFRAME*

1. Ethics, values and attitudes.
2. The most common ethical theories.
2.1 Ancient Greek – Plato
2.2 Medieval – Thomas Aquinas
2.3 Immanuel Kant
2.4 Rawl Theory Justice
2.5 Egoism
2.6 Utilitarianism
3. Ethical Dilemma/ issues in the cyberworld
3.1 Privacy Invasion
3.2 Hacking
3.3 Security
3.4 Theft
3.5 Copyright Infringement
3.6 Unfair Competition
3.7 Virus
3.8 Tele/videoconferencing
3.9 Online defamation
3.10   Piracy
3.11   Fraud
4. Ethics and Law
5. Applicable Philippine Laws that penalize cybercrime
1.1. Intellectual Property Right
1.2. E-Commerce Law
1.3. Optical Law
1.4. Civil Code
1.5. Revised Penal Code
1.6. Special Criminal Law
1.7. Unfair Competition Act

1.8. Internet Pornography
2. Government Agencies Responsible in the Implementation of the Philippine I. T. Programs
   2.1. Commission on Information and Communication Technology
   2.2. National Bureau of Investigation
   2.3. Department of Justice

COURSE NUMBER: CS201

TITLE: Data Structures

- ## *COURSE DESCRIPTION*

This course introduces the students to the design and implementation of basic and advanced data structures. Topics include basic data structures, trees, graphs and hashing.

- ## *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:

1. Choose, implement and evaluate the appropriate data structures for specific programming problems and

2. Use and manage memory effectively in data presentation.

- ## *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE

1. Basic Data Structures
   • Arrays
   • Linked Lists
   • Stacks
   • Queues
2. Trees
   • Binary Trees
   • Binary Search Trees
   • AVL
   • RB Trees
3. Graphs
   • Representations
   • Search Algorithms (BFS, DFS)
   • Shortest Path Problems
   • Spanning Trees
4. Sets
5. Hashing	

COURSE NUMBER: CS202

TITLE: Design and Analysis of Algorithms

- *COURSE DESCRIPTION*

A study on the design and analysis of algorithms, which introduces students to the techniques in basic algorithmic analysis, algorithmic strategies, sorting and searching, graph algorithms, and geometric algorithms.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:

1. Design effective, efficient, elegant, and readable algorithms for various classes of computing problems
2. Determine space and time complexity of algorithms
3. Use various algorithm design techniques (divide and conquer, backtracking, greedy, etc)

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE

1. Mathematical Tools in Analysis
   • Proof Techniques
   • Recurrence Relation
   • Generating Functions
2. Basic Algorithmic Analysis
   a. Best, average, worst case behaviors
   b. Time and Memory Complexity
3. Algorithmic Strategies
   • Brute Force algorithms
   • Greedy algorithms
   • Divide-and-Conquer strategies
   • Backtracking
   • Branch-and-bound
   • Heuristics
4. Sorting and Searching
5. Graph Algorithms
6. Geometric Algorithms
7. NP-Completeness	

COURSE NUMBER: CS203

TITLE: Programming Languages

- *COURSE DESCRIPTION*

This course provides students the fundamental features and concepts to different programming languages. Topics include overview of programming languages, Introduction to language translation, type systems, data and execution control, declaration and modularity, and syntax and semantics.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:

1. Identify features of imperative languages, and their implementation (including the use of static memory, stack and heap for implementing variables)
2. *Identify various programming paradigms (functional, declarative, imperative, object oriented), and their implementations*
3. *Describe the different phases in the language translation process.*

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE
1. Overview of Programming Languages • History of programming languages • Overview of Programming paradigms (procedural, object-oriented, functional, declarative, scripting languages) 2. Introduction to language translation • Comparison of interpreters and compilers • Language translation phases 3. Type Systems 4. Data and Execution Control 5. Declaration and Modularity 6. Syntax and Semantics 7. Object-Oriented Programming 8. Concurrent Programming Languages 9. Declarative Languages	

COURSE NUMBER: CS204

TITLE: Automata and Language Theory

- *COURSE DESCRIPTION*

This course introduces the formal models of computing and their relation to formal languages.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

> **At the end of this course, the student should be able to:**
>
> *1.* Understand the principal models of computation such as finite automata, pushdown automata and Turing machines.
> 2. Recognize the correspondence of the different language classes to the models of computation.

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE
1. Strings and Languages ▪ Sets, relations, strings and string operations ▪ Operations on languages 2. Finite State Machines ▪ Deterministic Finite Automata ▪ Non-deterministic Finite Automata ▪ Regular Expressions 3. Context-free Grammar 4. Pushdown Automata 5. Turing Machines	

COURSE NUMBER: CS205

TITLE: Modelling and Simulation

- *COURSE DESCRIPTION*

This course introduces the students to modelling and simulation concepts. Topics discussed in the course includes, system analysis and classification., abstract and simulation models, continuous, discrete, and combined models, heterogeneous models. It also covers pseudorandom number generation and testing, queuing systems, Monte Carlo method, and continuous simulation. Simulation experiment control.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:

1.	Attain generic learning outcomes and competences:
2.	Understand the principles of simulation
3.	Create simulation model of various types
4.	Verify, and validate simulation models.

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE
1. Introduction to modelling and simulation. 2. System analysis, clasification of systems. System theory basics, its relation to simulation. 3. Model classification: conceptual, abstract, and simulation models. Heterogeneous models. Methodology of model building. 4. Simulation systems and languages, means for model and experiment description. Principles of simulation system design. 5. Parallel process modelling. Using Petri nets and finite automata in simulation. 6. Models o queuing systems. Discrete simulation models. Model time, simulation experiment control. 7. Continuous systems modelling. Overview of numerical methods used for continuous simulation. 8. Combined simulation. The role of simulation in digital systems design. 9. Special model classes, models of heterogeneous systems. 10. Checking model validity, verification of models. Analysis of simulation results. 11. Simulation results visualization. Interactive simulation, virtual reality. 12. Design and control of simulation experiments. Model optimization. 13. Generating, transformation, and testing of pseudorandom numbers. Stochastic models, Monte Carlo method. 14. Overview of commonly used simulation systems.	

COURSE NUMBER: CS206

TITLE: Digital Design

- *COURSE DESCRIPTION*

This course provides an overview of the principles underlying number systems, logic gates, Fixed-Point Representation, Boolean Function, Boolean algebra, combinational and sequential logic circuits, flip-flops, registers, and PLAs.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:

1. Identify building blocks of Von Neumann machine.
2. Design simple combinational and sequential circuits.
3. Apply minimization techniques (Karnaugh maps) to Boolean expressions.

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE

1. Number Systems (Binary)
2. Fixed-Point Representation (1's and 2's complement)
3. Logic Gates
4. Boolean Function
    • Canonical and Standard Format
    • Truth Table
5. Boolean Algebra
    • Simplification using Properties
    • Simplification using K-Map
6. Combinational Logic Circuits
7. Sequential Logic Circuits
8. Flip-flops, registers, PLAs	

COURSE NUMBER: CS205

TITLE: Modelling and Simulation

- *COURSE DESCRIPTION*

This courses introduces the students to modelling and simulation concepts. Topics discussed in the course includes, system analysis and classification., abstract and simulation models, continuous, discrete, and combined models, heterogeneous models. It also covers pseudorandom number generation and testing, queuing systems, Monte Carlo method, and continuous simulation. Simulation experiment control.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:

1.	Attain generic learning outcomes and competences:
2.	Understand the principles of simulation
3.	Create simulation model of various types
4.	Verify, and validate simulation models.

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE
1. Introduction to modelling and simulation. 2. System analysis, clasification of systems. System theory basics, its relation to simulation. 3. Model classification: conceptual, abstract, and simulation models. Heterogeneous models. Methodology of model building.	

4. Simulation systems and languages, means for model and experiment description. Principles of simulation system design.
5. Parallel process modelling. Using Petri nets and finite automata in simulation.
6. Models o queuing systems. Discrete simulation models. Model time, simulation experiment control.
7. Continuous systems modelling. Overview of numerical methods used for continuous simulation.
8. Combined simulation. The role of simulation in digital systems design.
9. Special model classes, models of heterogeneous systems.
10. Checking model validity, verification of models. Analysis of simulation results.
11. Simulation results visualization. Interactive simulation, virtual reality.
12. Design and control of simulation experiments. Model optimization.
13. Generating, transformation, and testing of pseudorandom numbers. Stochastic models, Monte Carlo method.
14. Overview of commonly used simulation systems.

COURSE NUMBER: CS206

TITLE: Digital Design

- *COURSE DESCRIPTION*

This course provides an overview of the principles underlying number systems, logic gates, Fixed-Point Representation, Boolean Function, Boolean algebra, combinational and sequential logic circuits, flip-flops, registers, and PLAs.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:

1. Identify building blocks of Von Neumann machine.
2. Design simple combinational and sequential circuits.
3. Apply minimization techniques (Karnaugh maps) to Boolean expressions.

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE
1. Number Systems (Binary) 2. Fixed-Point Representation (1's and 2's complement)	

3. Logic Gates
4. Boolean Function
    • Canonical and Standard Format
    • Truth Table
5. Boolean Algebra
    • Simplification using Properties
    • Simplification using K-Map
6. Combinational Logic Circuits
7. Sequential Logic Circuits
8. Flip-flops, registers, PLAs	

COURSE NUMBER: CS207

TITLE: Operating Systems

INSTRUCTOR:

• **COURSE DESCRIPTION**

This course provides an introduction to the concepts, theories and components that serve as the bases for the design of classical and modern operating systems. Topics include process and memory management, process synchronization and deadlocks.

• **COURSE OBJECTIVES (DESIRABLE OBJECTIVES)**

At the end of this course, the student should be able to:

1. Describe relationships between system services and application software
2. Compare and contrast different design considerations for major OS components

• **COURSE OUTLINE AND TIMEFRAME**

TOPICS AND READINGS	DATE

1. Overview of Operating Systems
    ▪ History
    ▪ Functionality of a typical OS
    ▪ OS structures
2. Process Management
    ▪ Process concept
    ▪ Process scheduling
3. Memory Management
    ▪ MVT, Paging, Segmentation
4. Virtual Memory
    ▪ Demand Paging
5. File Management	

6. Deadlocks	
- Prevention	
- Avoidance	
- Detection and Recovery	
7. Concurrent Processes	
• Synchronization	
• Classical Problems (Producer-Consumer, Readers-Writers, Dining Philosophers)	

COURSE NUMBER: CS208

TITLE: NETWORKS and INTERNET TECHNOLOGY

- *COURSE DESCRIPTION*

This course provides an in-depth discussion of computer networks. It includes a detailed discussion of the different Network Models. Concepts that have a direct effect on the efficiency of a network (e.g. collision and broadcast domains, topology) are also discussed. Concepts on different network technologies, distributed computation, networking, and communication software, and security issues are also discussed.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

Towards the end of the course, students are expected to / able to:
- Be familiar with the different Network Models.
- Understand different network technologies
- Understand the effects of using different networking topologies
- Be updated with different advanced network technologies that can be used to connect different networks
- Be familiar with various hardware and software that can help protect the network
- Know the advantage of using a network management system

- *COURSE OUTLINE AND TIMEFRAME*

1. Introduction to Computer Networks	
2. Overview of Networking Models	
1. OSI	
2. TCP/IP	
3. Physical Layer	
4. Data Link Layer	
5. Network Layer	
6. Transport Layer	
7. Application Layer	
8. Network Topologies	
9. Network Security	

- *REQUIRED READINGS*

Computer Networks, 4th Edition
Andrew S. Tanenbaum

Computer Communications and Networking Technologies
Michael A. Gallo, William M. Hancock

- *SUGGESTED READINGS*

Business Data Communications and Networking, 7th Edition
Jerry FitzGerald, Alan Dennis

COURSE NUMBER: CS210

TITLE: Calculus

- *COURSE DESCRIPTION*

A course covering the real number system as a complete, ordered field; topological properties of R and R2 , limits and continuity.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:
1.	Understand properties of the number systems
2.	Perform derivatives
3.	Compute for areas under the curve and other applications

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE
1. Exponential and trigonometric Functions	
2. The determinant and the cross product	
3. Vectors and geometry.	
4. Differentiation	
5. Derivatives in higher dimensions, directional derivative and gradient.	
6. Computation of derivatives.	
7. Differentiation by rule.	
8. Vector derivatives and properties	
9. Higher derivatives and taylor series.	
10. Quadratic approximations in two dimensions.	
11. Applications of the linear approximation.	
12. Maxima and minima.	
13. Curves	
14. Complex numbers and functions.	

| 15. The antiderivative. | |
| 16. Area under a curve. | |

COURSE NUMBER: CS211

TITLE: Object-Oriented Programming

This course provides the students with the fundamental understanding of object-oriented programming using Java. It introduces the different concepts that are commonly associated with object programming.

- *COURSE OBJECTIVES (DESIRABLE OBJECTIVES)*

At the end of this course, the student should be able to:

1. design the classes needed given a problem specification;
2. implement the designed classes using the object oriented programming language
3. learn how to test, verify, and debug object-oriented programs; and
4. create program using object-oriented principles.

- *COURSE OUTLINE AND TIMEFRAME*

TOPICS AND READINGS	DATE
1. Object-Oriented Concepts • Procedural Programming vs. Object-Oriented Programming • Abstract Data Types (ADTs) • Object-Oriented Programming Concepts 2. Java Fundamentals - Anatomy of a Basic Java Program • Comments • Primitive Data Types • Expressions and Operators • Reference Types • Statements 3. Objects and Classes in Java • Classes • Access Modifiers • Methods and Attributes • Constructors • Class Methods and Class Variables 4. Object-Oriented Programming in Java • Inheritance: Superclass and Subclass • Encapsulation • Method Overriding • Polymorphism 5. Other Java Classes • Abstract Class • Interfaces	

6. *GUI Development*
   - AWT Graphical Components
   - Event Handling
   - Anonymous Classes
7. Exception Handling
   - Try, Catch, and Finally
   - Creating Exceptions
   - Exception Hierarchy
8. Thread
   - Thread Lifecycle
   - Thread Synchronization
   - Critical Sections
9. Collections Framework
   - Collection
   - Set
   - List
   - Map
10. Input and Output Streams
   - InputStream/OutputStream Classes
   - Reader/Writer Classes
   - File Handler Classes