University of Delhi

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY

CHOICE BASED CREDIT SYSTEM

SCHEME OF COURSES

FOR

Bachelor of Engineering

In

Information Technology

Passed in the meeting of Standing Committee on Academic matters, University of Delhi, held on June 03, 2016

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

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PREAMBLE

I.   INTRODUCTION

Higher education is very important for the growth and development of any country. It is a living organ and requires continuous changes to ensure the quality of education. National Knowledge Commission and University Grants Commission have recommended many academic reforms to address the challenges of today's networked globalized world. People are coming together with the help of new technologies which is resulting towards new aspirations, expectations, collaborations and associations. The concept of "work in isolation" may not be relevant and significant anymore. The UGC guidelines on adoption of Choice Based Credit System may be an important step to revamp the processes, systems and methodologies of Higher Educational Institutions (HEIs). The teacher centric mode be changed to learner centric mode. Class room teaching and learning be made effective; relevant and interesting. Concepts and theories be explained with examples, experimentation and related applications.

A culture of discussions, arguments, interpretations, counter-interpretations, re-interpretations, and opposing interpretations must be established. Research should not only be confined to redefinition, extension and incremental change. Innovation & creativity should become an epicenter for all research initiatives. The most important capital is the human capital and thus the ultimate objective is to develop good human beings with utmost integrity & professionalism for this new world.

The Choice Based Credit System supports the grading system which is considered to be better than conventional marks system. It is followed in many reputed institutions in India and abroad. The uniform grading system facilitates student mobility across the institutions within and across the countries and also enable potential employers to assess the performance of the students. The Choice Based Credit System makes the curriculum interdisciplinary and bridge the gap between professional and liberal education.

II.   CHOICE BASED CREDIT SYSTEM

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The Indian Higher Education Institutions have been moving from the conventional annual system to semester system. Currently many of the institutions have already introduced the choice based credit system. The semester system accelerates the teaching-learning process and enables vertical and horizontal mobility in learning. The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. It is desirable that the HEIs move to CBCS and implement the grading system.

A. Programme Educational Objectives (PEOs)

This scheme and courses are related to four year Information Technology programme with following Programme Educational Objectives (PEO).

1. To provide in-depth knowledge and fundamentals to make IT professionals and in pursuit of higher studies.
2. To equip students with analytical and technical knowledge for solving real life problems with reliable IT solutions
3. To promote and enrich students through participation in various technical, non-technical and socio-economic events.
4. To make students aware of social issues, professional ethics and make them adaptable to different cultures.

B. Types of Courses

Courses are the subjects that comprise the Information Technology programme.

1. A course may be designed to comprise lectures, tutorials, laboratory work, field work, outreach activities, project work, vocational training, viva, seminars, term papers, assignments, presentations, self-study etc. or a combination of some of these components.

2. The learning objectives and learning outcomes of each course will be defined before the start of a semester.

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3. Courses are of three kinds: Core, Elective and Foundation.

   i. **Core Course (CC)**: This is a course which is to be compulsorily studied by a student as a core requirement to complete the requirement of B.E. in Information Technology.

   ii. **Elective Course**: An elective course is a course which can be chosen from a pool of subjects. It is intended to support the discipline of study by providing an expanded scope, enabling exposure to another discipline/ domain and nurturing a student's proficiency/skill. An elective may be of following types:

      a) **Discipline Centric Elective (ED)**: It is an elective course that adds proficiency to the students in the discipline.

      b) **Generic Elective (EG):** It is an elective course taken from other Engineering disciplines and enhances the generic proficiency and interdisciplinary perspective of students.

      c) **Open Elective (EO):** It is an elective course taken from non-engineering disciplines that broadens the perspective of an Engineering student.

   iii. **Foundation Course**: A Foundation course leads to knowledge enhancement and provides value based training. The Foundation Courses may be of two kinds:

      a) **Compulsory Foundation (FC):** It is based upon content that leads to fundamental knowledge enhancement in sciences, humanities, social sciences and basic Engineering principles. They are mandatory for all disciplines.

      b) **Elective Foundation (FE):** It can be taken from among a pool of foundation courses which aim at value-based education. They may provide hands-on-training to improve competencies and skills or provide education on human, societal, environmental and national values.

4. Each course contributes certain credits to the programme. A course can be offered either as a full course (4 credits) or as a half course (2 credits). A full

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course is conducted with 3 hours of lectures and either 1 hour of tutorial or 2 hours of practical work per week. A half course is conducted with 2 hours of lectures.

5. A student of undergraduate programme has to accumulate about 50% credits from the Core Courses; about 20% credits from the Foundation Courses; and the remaining credits from the Elective Courses to become eligible for the award of degree.

6. A course (full/half) may also be designed without lectures or tutorials. However, such courses may comprise Field work, Outreach activities, Sports, Project work, Vocational Training, Seminars, Self-study etc. or a combination of some of these.

7. A project work/dissertation is considered as a special course involving application of the knowledge gained during the course of study in exploring, analyzing and solving complex problems in real life applications. A candidate completes such a course with an advisory support by a faculty member.

8. Apart from the above courses, audit courses may be offered. They do not carry credits but aim at expanding knowledge or bridging deficiency in knowledge or skill.

C. Examination and Assessment

The following system will be implemented in awarding grades and CGPA under the CBCS system.

1. **Letter Grades and Grade Points:** A 10-point grading system shall be used with the letter grades as given in Table 1:

Table1: Grades and Grade Points

Letter Grade	Grade point
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above average)	6
C (Average)	5
P (Pass)	4
F (Fail)	0
Ab (Absent)	0

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2. **Fail grade:** A student obtaining Grade F shall be considered fail and will be required to reappear in the examination. If the student does not want to reappear in an **elective course** (that is, EG, ED, EO, FE *but not* CC or FC courses) then he/she can re-register afresh for a new elective course

3. **Audit course:** For audit courses, 'Satisfactory' or 'Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

4. **Fairness in Assessment:** The CBCS promotes continuous evaluation system where the weightage of end semester examinations should not be more than 60%. The departments shall design its own methods for continuous evaluation. It shall have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching-learning methods. In this regard, checks and balances will be implemented to ensure fair and effective assessment and examination process.

5. **Computation of SGPA and CGPA:** The following procedure shall be used to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

   i. The SGPA is the ratio of sum of the product of the number of credits and the grade points scored in all the courses of a semester to the sum of the number of credits of all the courses taken by a student:

   $$SGPA(S_i) = \frac{\sum (C_i \times G_i)}{\sum C_i}$$

   Where C_i is the number of credits of the ith course and G_i is the grade point scored by the student in the ith course.

   ii. The CGPA is also calculated in the same manner taking into account all the courses taken by a student over all the semesters of a programme:

   $$CGPA = \frac{\sum (C_i \times S_i)}{\sum C_i}$$

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where S_i is the SGPA of the ith semester and C_i is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. CGPA shall be converted into percentage of marks, if required by multiplying CGPA with 10.

III.   PROGRAMME STRUCTURE

1. The B.E. Information Technology programme consists of 8 semesters, normally completed in 4 years. The total span period cannot exceed 7 years.

2. The courses offered in each semester are given in the *Semester-wise Course Allocation* scheme of B.E. Information Technology.

3. The courses under FC and common pool of electives offered for students of all disciplines under FE, EG and EO categories are listed under separate tables in the scheme. The discipline centric courses under CC and ED categories are listed separately.

4. A course may have pre-requisite course(s) that are given in the *Semester-wise Course Allocation scheme.*

5. A student can opt for a course only if he/she has successfully passed its pre-requisite(s).

6. A student has to register for all courses before the start of a semester.

7. After second year a student may register for courses leading to a minimum number of credits as prescribed in the scheme and a maximum of 28 credits. Normally a student registers for courses leading to 22 credits.

8. B.E. Information Technology programme consists of 176 credits. A student shall be awarded the degree if he / she has earned 168 or more credits.

IV.   COURSE CODIFICATION

1. Programme Codes

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The codes for various Undergraduate programmes are as follows:

    i.   Biotechnology: BT

    ii.   Computer Engineering: CE

    iii.   Electronics and Communication Engineering: EC

    iv.   Instrumentation and Control Engineering: IC

    v.   Information Technology: IT

    vi.   Manufacturing processes and Automation Engineering: MA

    vii.   Mechanical Engineering: ME

2. Departmental Course Codes

The codes for departmental core courses and discipline-specific electives are specific to each discipline. The first two characters are derived from departmental codes listed above. The third character is 'C' for core courses and 'D' for discipline-specific courses. This is followed by a 2-digit sequence number:

    i.   ITCyy: Core Course

    ii.   ITDyy: Discipline-centric Elective Course

3. Common Course Codes

The list for courses offered under Compulsory Foundation (FC), Foundation Electives (FE) and Open Electives (EO) will follow a common code as shown below. The 3-digit sequence number 'yyy' is taken from the respective tables of different types of courses.

    iii.   FCyyy: Foundation Compulsory Course

    iv.   FEyyy: Foundation Elective Course

    v.   EOyyy: Open Elective Course

4. Generic Electives

A student may take a course under the category of generic elective(EG) offered by any other department of the institute under the category of core course and discipline centric elective(ED). However, such options shall be offered to a student as per prescribed guidelines of the institute.

V.   EVALUATION SCHEME

The courses are evaluated on the basis of continuous assessment, mid-semester examinations and end-semester examinations. The weightage of each of these modes of evaluation for the different types of courses are as follows:

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Type of Course	Continuous Assessment (CA), Theory	Mid-Semester Exam (MS), Theory	End-Semester Exam (ES), Theory	Continuous Assessment (CA), Lab	End-Semester Exam (ES), Lab
FE courses	As specified in Table 3 of Foundation Electives				
CC/FC/ED/EG/EO Theory with Tutorial	25	25	50	Nil	Nil
CC/FC/ED/EG/EO Theory with Practical	15	15	40	15	15
Project I and Project II	Nil	Nil	Nil	40	60
Training	Nil	Nil	Nil	40	60
Audit Courses 1*	-	-	-	-	-
1*: The distribution of marks and the minimum marks required for getting "Satisfactory" for Audit courses will be determined by the Department.					

VI.   EVALUATION AND REVIEW COMMITTEE

The Committee of Courses and Studies in each department shall appoint one or more Evaluation-cum-Review Committees (ERC), each committee dealing with one course or a group of courses. This ERC consists of all faculty members who are likely to teach such course(s) in the group.

The ERC has the following functions-

(i)   To recommend appointment of paper setters/examiners of various examinations at the start of each semester.

(ii)   To prepare quizzes, assignments, test papers etc. for Continuous Assessment (CA), Mid-Semester examination (MS) and End Semester (ES) examination and to evaluate them. Normally, each concerned faculty member, who is also a member of ERC, will do this job for his/her class. However, in exceptional circumstances any part of the work may be entrusted to some other member of the ERC.

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(iii)   To consider the individual representation of students about evaluation and take remedial action if needed. After scrutinizing, ERC may alter the grades awarded upward/downward. The decision of the ERC shall be final.

(iv)   To moderate assignments, quizzes etc. for courses given by each of the concerned faculty members for his/her class with a view to maintain uniformity of standards.

(v)   To review and moderate the MS and ES results of each course with a view to maintain uniformity of standards.

(vi)   To lay guidelines for teaching a course.

(vii)

VII.   ATTENDANCE, PROMOTION AND DETENTION RULES

1. A student should normally attend all the classes. However, a student will be allowed to appear in the examination if he/ she has put in a minimum of 75% attendance separately in each course for which he / she has registered. A relaxation up to a maximum of 25% may be given on the production of satisfactory evidence that (a) the student was busy in authorized activities, (b) the student was ill.

2. A student should submit the evidence to the fact 1(a) and / or 1(b) above within seven working days of resuming the studies. Certificates submitted later will not be considered.

3. No relaxation in attendance beyond 25% is permitted in any case.

4. A student with satisfactory attendance will be promoted to the even semester irrespective of his/ her results in the odd semester examinations.

5. If a student fails to secure a minimum of 22 credits after the completion of second semester, he/ she will not be allowed to register in the third semester till he / she secures a minimum of 22 credits.

6. If a student fails to secure a minimum of 44 credits after the completion of fourth semester, he / she will not be allowed to register in the fifth semester till he / she secures a minimum of 44 credits.

7. There shall be no supplementary examinations. A student who has failed in a course will have to re-register for the course in a subsequent year.

8. If a student fails in any core course during the first four semesters (without repeating a year), he/she will have to re-register for such courses after the fourth semester.

9. If the student does not want to reappear in an **elective course** (that is, EG, ED, EO, FE *but not* CC or FC courses) then he/she can re-register afresh for a new elective course.

10. After second year a student may register for courses leading to a minimum number of credits as prescribed in the scheme and a maximum of 28 credits. Normally a student registers for courses leading to 22 credits.

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VIII.   DECLARATION OF RESULTS

1. The B.E. Information Technology programme consists of 176 credits. A student will be awarded the degree if he/she has earned 168 or more credits.

2. CGPA will be calculated on the basis of the best 168 credits earned by the student.

3. The candidate seeking re-evaluation of a course shall apply for the same on a prescribed pro-forma along with the evaluation fee prescribed by the University from time to time only for the End Semester Examination within seven days from the date of declaration of result.

4. The Institution/University may cancel the registration of all the courses in a given semester if

     i. The student has not cleared the dues to the institution/hostel.

     ii. A punishment is awarded leading to cancellation of the student's registration.

IX.   CURRICULUM MODIFICATION

The curriculum will be updated regularly within a period of 5 to 10 years since last revision, to keep pace with the advancements in the field of Information Technology.

X.   CENTRAL ADVISORY COMMITTEE

There shall be a Central Advisory Committee consisting of the following—

   a) Dean, Faculty of Technology, Chairman
   b) Head of Institution
   c) Dean Undergraduate Studies
   d) Dean Post Graduate Studies
   e) Heads of Departments

This Committee shall have the following functions-

1. Lay guidelines for executing all the provisions and stipulations of the programme.
2. Give an interpretation of the rules in case of differences of opinion, which shall be binding on all.

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PROGRAMME OUTCOMES

At the completion of the program the student will achieve the following:

PO1: Ability to understand the fundamental concepts of mathematics for IT

PO2: Ability to design and implement programming language concepts

PO3: Ability to design efficient data structure pertaining to optimal solutions

PO4: Ability to design and analyze various algorithm design techniques

PO5: Ability to understand computer architecture and working of operating system

PO6: Ability to deal with security issues in databases and networks

PO7: Ability to provide innovative solutions to real time problems

PO8: Ability to design and develop software solutions

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SCHEME SEMESTER-WISE COURSE ALLOCATION

| | | | | | | | Evaluation Scheme (Percentage weights) | |
| B.E. INFORMATION TECHNOLOGY -SEMESTER I | | | | | | | | | | | | |

Course Code	Type	Subject	L	T	P	Credits	Theory			Practical		Pre-requisites
							CA	MS	ES	CA	ES	
FC001	FC	Mathematics-I	3	1	0	4	25	25	50	-	-	None
FC002	FC	Computer Programming	3	0	2	4	15	15	40	15	15	None
FC003	FC	Electrical & Electronics Engineering	3	0	2	4	15	15	40	15	15	None
FC004	FC	Physics	3	0	2	4	15	15	40	15	15	None
FC005	FC	English-I	2	0	0	2	25	25	50	-	-	None
FExxx 1*	FE	Foundation Elective	-	-	-	2	-	-	-	-	-	-
			\multicolumn{3}{c}{23/25 2*}	20						

1*: The course codes, LTP distribution and Evaluation Scheme for Foundation Electives are given in Table 2.

2*: The actual weekly load depends upon the elective chosen by the student under FE (Refer Table 2)

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Course Code	Type	Subject	L	T	P	Credits	Theory CA	Theory MS	Theory ES	Practical CA	Practical ES	Pre-requisites
							\<\<B.E. INFORMATION TECHNOLOGY -SEMESTER II\>\>					
FC006	FC	Mathematics-II	3	1	0	4	25	25	50	-	-	None
FC007	FC	English-II	2	0	0	2	25	25	50	-	-	None
ITC01	CC	Chemistry	3	0	2	4	15	15	40	15	15	None
ITC02	CC	Object Oriented Techniques	3	0	2	4	15	15	40	15	15	None
ITC03	CC	Analog and Digital Communication	3	1	0	4	25	25	50	-	-	None
ITC04	CC	Discrete Structure	3	1	0	4	25	25	50	-	-	None
FExxx 1*	FE	Elective Foundation	-	-	-	2	-	-	-	-	-	-
			26/28 2*			24						

1*: The course codes, LTP distribution and Evaluation Scheme for Foundation Electives are given in Table 2.

2*: The actual weekly load depends upon the elective chosen by the student under FE (Refer Table 2)

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B.E. INFORMATION TECHNOLOGY - AUDIT COURSES AFTER II SEMESTER					Evaluation Scheme	
Course Code	Type	Course	LTP	Credits	Theory CA	Practical CA-ES
AC001	Audit	Audit Courses can be floated during summer break after 2nd semester on: (I) Courses for improvement: These will not be shown on the degree. (II) Courses on new themes: These will be shown on the degree.	-	NIL	The evaluation scheme and minimum grades for getting "Satisfactory" level will be decided by the Department. Student has to achieve the minimum grades prescribed for getting "Satisfactory" level.	

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Course No.	Type	Subject	L	T	P	Credits	Theory CA	Theory MS	Theory ES	Practical CA	Practical ES	Pre-requisites
B.E. INFORMATION TECHNOLOGY –SEMESTER III												
ITC05	CC	Mathematics-III	3	1	0	4	25	25	50			None
ITC06	CC	Data Structure and Algorithm	3	0	2	4	15	15	40	15	15	None
ITC07	CC	Digital Circuits and Systems	3	0	2	4	15	15	40	15	15	None
ITC08	CC	Database Management System	3	0	2	4	15	15	40	15	15	None
ITC09	CC	Computer Graphics	3	0	2	4	15	15	40	15	15	None
FExxx 1*	FE	Elective Foundation	-	-	-	2	-	-	-	-	-	-
			26/28 2*			**22**						

1*: The course codes, LTP distribution and Evaluation Scheme for Foundation Electives are given in Table 2.

2*: The actual weekly load depends upon the elective chosen by the student under FE (Refer Table 2).

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B.E. INFORMATION TECHNOLOGY -SEMESTER IV												
Course No.	Type	Subject	L	T	P	Credits	Theory			Practical		Pre-requisites
							CA	MS	ES	CA	ES	
ITC10	CC	Probability and Stochastic Processes	3	1	0	4	15	15	40	15	15	None
ITC11	CC	Operating Systems	3	0	2	4	15	15	40	15	15	None
ITC12	CC	Computer System Architecture	3	1	0	4	25	25	50			None
ITC13	CC	Computer Networks	3	0	2	4	15	15	40	15	15	None
ITC14	CC	Software Engineering	3	0	2	4	15	15	40	15	15	None
FExxx 1*	FE	Elective Foundation	-	-	-	2	-	-	-	-	-	-
			25/27 2*			22						

1*: The course codes, LTP distribution and Evaluation Scheme for Foundation Electives are given in Table 2.

2*: The actual weekly load depends upon the elective chosen by the student under FE (Refer Table 2).

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B.E. INFORMATION TECHNOLOGY - AUDIT COURSES AFTER IV SEMESTER					Evaluation Scheme	
Course Code	Type	Course	LTP	Credits	Theory CA	Practical CA-ES
AC002	Audit	Audit Courses can be floated during summer break after 4th semester on: (III) Courses for improvement: These will not be shown on the degree. (IV) Courses on new themes: These will be shown on the degree.	-	NIL	The evaluation scheme and minimum grades for getting "Satisfactory" level will be decided by the Department. Student has to achieve the minimum grades prescribed for getting "Satisfactory" level.	

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Course No.	Type	Subject	L	T	P	Credits	Theory			Practical		Pre-requisites
B.E. INFORMATION TECHNOLOGY -SEMESTER V							**Evaluation Scheme (Percentage weights)**					
							CA	MS	ES	CA	ES	
ITC15	CC	Multimedia & Applications	3	0	2	4	15	15	40	15	15	None
ITC16	CC	Theory of Computation	3	1	0	4	25	25	50	-	-	None
ITC17	CC	Design and Analysis of Algorithm	3	0	2	4	15	15	40	15	15	None
ITC18	CC	Linux/Unix Lab	0	0	4	2	-	-	-	50	50	None
1*	EO/EG/ED	Elective(s)	-	-	-	4	-	-	-	-	-	-
				2*		**16/28 3***						

1*: The LTP allocation, Evaluation Scheme and Pre-requisites for Electives are given in Tables 3-5. The course code will depend upon student's choice of elective(s).

2*: The actual weekly load will depend upon the elective chosen by the student.

3*: A student may register for elective(s) courses leading to a minimum of 16 credits and a maximum of 28 credits. Normally a student registers for courses leading to 22 credits.

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B.E. INFORMATION TECHNOLOGY -SEMESTER VI												
Course No.	**Type**	**Subject**	**L**	**T**	**P**	**Credits**	**Evaluation Scheme (Percentage weights)**					**Pre-requisites**
							Theory			**Practical**		
							CA	**MS**	**ES**	**CA**	**ES**	
ITC19	CC	Internet and Web Engineering	3	1	0	4	25	25	50	-	-	None
ITC20	CC	Compiler and Translator Design	3	1	0	4	25	25	50	-	-	None
ITC21	CC	Modeling and Simulation	3	0	2	4	15	15	40	15	15	None
1*	EO/EG/ED	Elective(s)	-	-	-	4	-	-	-	-	-	-
				2*		**16/28 3***						

1*: The LTP allocation, Evaluation Scheme and Pre-requisites for Electives are given in Tables 3-5. The course code will depend upon student's choice of elective(s).

2*: The actual weekly load will depend upon the elective chosen by the student.

3*: A student may register for elective(s) courses leading to a minimum of 16 credits and a maximum of 28 credits. Normally a student registers for courses leading to 22 credits.

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Course No.	Type	Subject	L	T	P	Credits	Evaluation Scheme (Percentage weights)					Pre-requisites
							Theory			Practical		
							CA	MS	ES	CA	ES	
ITC22 1*	CC	Training	--	-	-	2	-	-	-	40	60	None

B.E. INFORMATION TECHNOLOGY - TRAINING AFTER VI SEMESTER

1*: Students will undergo Training in the industry, research organization and reputed institutions after VI semester. This will be evaluated as a VII Semester subject during end-semester examination.

Training gives exposure to students on the working of the industry, on research direction and practical applications of Information Technology and on work ethics.

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Course No.	Type	Subject	L	T	P	Credits	Theory CA	Theory MS	Theory ES	Practical CA	Practical ES	Pre-requisites
B.E. INFORMATION TECHNOLOGY -SEMESTER VII												
ITC22 **1***	CC	Training(6 -8 weeks)	-	-	-	2	-	-	-	40	60	None
ITC23 **2***	CC	Project-I	-	-	-	4	0	0	0	40	60	None
-	EO/EG/ ED	Elective(s)	-	-	-	4	-	-	-	-	-	-
			3*			**6/28 4***						

1*: The Training undertaken by students during the Summer vacation after VI Semester will be evaluated as a VII Semester subject during end-semester examination.

2*: Project work is based on the student`s ability to understand, design and implement the fundamental concepts of the basic sciences, mathematics, engineering subjects and human values.

3*: The LTP allocation, Evaluation Scheme and Pre-requisites for Electives are given in Tables 3-5.

4*: The actual weekly load will depend upon the elective chosen by the student.

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Course No.	Type	Subject	L	T	P	Credits	Theory			Practical		Pre-requisites
							CA	MS	ES	CA	ES	
ITC24 1*	CC	Project-II	-	-	-	4	0	0	0	40	60	None
-	EO/EG/ ED	Elective(s)	-	-	-	4	-	-	-	-	-	-
				2*		4/28 3*						

B.E. INFORMATION TECHNOLOGY -SEMESTER VIII (table title)

Evaluation Scheme (Percentage weights) (spanning header over Theory/Practical)

1*: Project work is based on the students' ability to understand, design and implement the fundamental concepts of various basic sciences, mathematics, human values and engineering subjects.

2*: The LTP allocation, Evaluation Scheme and Pre-requisites for Electives are given in Tables 3-5.

3*: The actual weekly load will depend upon the elective chosen by the student.

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TABLE-2	LIST OF FOUNDATION ELECTIVES									
Code	Name of Foundation Elective	LTP Alloc.			Evaluation Scheme					Pre-Requisites
		L	T	P	CA	MS	ES	CA	ES	
FE001	Sports-I	0	0	4	-	-	-	60	40	None
FE002	Sports-II	0	0	4	-	-	-	60	40	FE001
FE003	NSS	0	0	4	-	-	-	60	40	None
FE004	NCC	0	0	4	-	-	-	60	40	None
FE005	Corporate Social Responsibility	2	0	0	25	25	50	-	-	None
FE006	Environmental Sciences	2	0	0	25	25	50	-	-	None
FE007	Environment development and Society	2	0	0	25	25	50	-	-	None
FE008	Spoken Skills in English	2	0	0	25	25	50	-	-	None
FE009	Financial Literacy	2	0	0	25	25	50	-	-	None
FE010	Introduction to Indian society	2	0	0	25	25	50	-	-	None
FE011	Soft Skills and Personality Development	1	0	2	-	-	-	60	40	None
FE012	Business Communication and Presentation Skills	1	0	2	-	-	-	60	40	None
FE013	Theatre	0	0	4	-	-	-	60	40	None

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FE014	Dance	0	0	4	-	-	-	60	40	None
FE015	Yoga	0	0	4	-	-	-	60	40	None
FE016	Digital Film Making	0	0	4	-	-	-	60	40	None
FE017	Workshop (Electrical and Mechanical)	0	0	4	-	-	-	60	40	None
FE018	Music	0	0	4	-	-	-	60	40	None
FE019	Sociology of development	2	0	0	-	-	-	60	40	None
FE020	Universal Human Values 1: Self and Family	2	0	0	25	25	50	-	-	None
FE021	Universal Human Values 2: Self, Society and Nature	2	0	0	25	25	50	-	-	FE020

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TABLE 3A: LIST OF DISCIPLINE CENTRIC ELECTIVES WITH PRACTICAL							
LTP Allocation			**Evaluation Scheme**				
L	**T**	**P**	**CA**	**MS**	**ES**	**CA**	**ES**
3	**0**	**2**	**15**	**15**	**40**	**15**	**15**
Code	**Name of Elective**		**Pre-Requisites**				
ITD01	Distributed System and Computing		ITC11				
ITD02	Microprocessors and Applications		ITC12				
ITD03	Information Security		ITC13				
ITD04	Mobile Communication		ITC13				
ITD05	Artificial Intelligence		ITC04, ITC17				
ITD06	Software Testing		ITC14				
ITD07	Pattern Recognition		ITC04, ITC17				
ITD08	Data ware house and data mining		ITC08				
ITD09	Advanced Database Management		ITC08				
ITD10	Advanced Computer Networks		ITC13				
ITD11	Recent Trends in Information Technology		None				
ITD12	Image Processing		ITC09, ITC15				
ITD13	Adhoc Network		ITC13				
ITD14	Software Quality and Assurance		ITC014				
ITD15	Software Project Management		ITC014				

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TABLE 3B: LIST OF DISCIPLINE CENTRIC ELECTIVES WITH TUTORIAL							
LTP Allocation			**Evaluation Scheme**				
L	**T**	**P**	**CA**	**MS**	**ES**	**CA**	**ES**
3	**1**	**0**	**25**	**25**	**50**	**-**	**-**
Code	**Name of Elective**		**Pre-Requisites**				
ITD16	Computer Vision		ITC09, ITC15				
ITD17	Information Theory and coding		ITC04, ITC05				
ITD18	Soft Computing		ITC17				
ITD19	Wireless Communication		ITC13				
ITD20	Game Theory		ITC05				
ITD21	Operational Research		FC006,ITC05				
ITD22	E-commerce and E-governance		NONE				
ITD23	Neural Networks		ITC04, ITC17				
ITD24	Genetic Algorithms		ITC17				

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TABLE 4:   LIST OF GENERIC ELECTIVES (EG)
A student may take any course offered by any department of the institute under the categories of core course (CC) and discipline centric elective(ED). However, such options shall be offered to a student as per prescribed guidelines of the institute.

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TABLE-5 LIST OF OPEN ELECTIVES										
Code	Name of Open Elective	LTP Allocation			Evaluation Scheme					Pre-Requisites
					Theory			Practical		
		L	T	P	CA	MS	ES	CA	MS	
EO001	Technical Communication	3	1	0	25	25	50	-	-	None
EO002	Disaster Management	3	1	0	25	25	50	-	-	None
EO003	Basics of Financial Management	3	1	0	25	25	50	-	-	None
EO004	Basics of Human Resource Management	3	1	0	25	25	50	-	-	None
EO005	Project Management	3	1	0	25	25	50	-	-	None
EO006	Basics of Corporate Law	3	1	0	25	25	50	-	-	None
EO007	Biological computing	3	1	0	25	25	50	-	-	None
EO008	Basics of social sciences	3	1	0	25	25	50	-	-	None
EO009	Entrepreneurship	3	1	0	25	25	50	-	-	None
EO010	Social work	3	1	0	25	25	50	-	-	None
EO011	Intellectual Property and Patenting	3	1	0	25	25	50	-	-	None
EO012	Supply Chain Management-Planning and logistics	3	1	0	25	25	50	-	-	None
EO013	Organization Development	3	1	0	25	25	50	-	-	None
EO014	Industrial Organisation and Managerial	3	1	0	25	25	50	-	-	None

1501

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	Economics									
EO015	Global Strategies and Technology	3	1	0	25	25	50	-	-	None
EO016	Engineering System Analysis and Design	3	1	0	25	25	50	-	-	None
EO017	Biology for Engineers	3	1	0	25	25	50	-	-	None
EO018	Energy, Environment and Society	3	1	0	25	25	50	-	-	None
EO019	Public Policy and Governance	3	1	0	25	25	50	-	-	None
EO020	Numerical Methods	3	0	2	15	15	40	15	15	None
EO021	Mathematical Statistics	3	1	0	25	25	50	-	-	None
EO022	Abstract and Linear Algebra	3	1	0	25	25	50	-	-	None
EO023	Optimization Techniques	3	1	0	25	25	50	-	-	None
EO024	Introduction to Mathematical Software and Programming Languages	2	0	4	15	15	40	15	15	None
EO025	Mathematical Finance	3	0	2	15	15	40	15	15	None
EO026	Quantum Electronics	3	0	2	15	15	40	15	15	None
EO027	Laser Systems and Applications	3	0	2	15	15	40	15	15	None
EO028	Optoelectronics and Photonics	3	0	2	15	15	40	15	15	None
EO029	Electromagnetic Theory and Waveguides	3	0	2	15	15	40	15	15	None
EO030	Polymer Science and	3	0	2	15	15	40	15	15	None

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	Technology									
EO031	Semiconductor Physics and Devices	3	0	2	15	15	40	15	15	None
EO032	Elements of Fibre Optics	3	0	2	15	15	40	15	15	None
EO033	Material Physics	3	0	2	15	15	40	15	15	None
EO034	Advanced Electromagnetic Theory and Relativity	3	0	2	15	15	40	15	15	None
EO035	Fibre and Integrated Optics	3	0	2	15	15	40	15	15	None
EO036	Condensed Matter Physics	3	0	2	15	15	40	15	15	None
EO037	Microwave	3	0	2	15	15	40	15	15	None
EO038	Fundamentals of Instrumentation and experimental techniques in Physics	3	0	2	15	15	40	15	15	None
EO039	Lasers and Photonics	3	0	2	15	15	40	15	15	None

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SYLLABUS OF FOUNDATION CORE COURSES

Course No	Title of the Course	Course Structure	Pre-Requisite
FC001	Mathematics-I	3L-1T-0P	None

COURSE OUTCOMES: By the end of this course, the student will be able to
1. Analyze and test infinite series for its convergence.
2. Find Taylor's series expansion, maxima & minima of functions of one and more variables.
3. Calculate length, area, radius of curvature, surface of revolution and volume of revolution.
4. Calculate area of a given region and volume enclosed by a surface.

COURSE CONTENT:

Infinite Series: Tests for convergence of series (Comparison, Integral, Ratio's, Raabe's, Logarithmic and nth root,), Alternating series, Absolute convergence, Conditional convergence.

Function of Single Variable: Hyperbolic functions, Taylor's and Maclaurin's theorems with remainder terms, Polar Curves, Angle between tangent and radius vector, Curvature and Radius of Curvature, Asymptotes, Curve tracing, Applications of definite integral to area, arc length, surface area and volume of revolution (in Cartesian, parametric and polar co-ordinates).

Function of Several Variables: Partial Derivatives, Differentiability, Total differential, Euler's theorem, Jacobian, Taylor's theorem, Maxima and Minima for functions of two or more variables, Extreme values, Lagrange's method of undetermined multipliers, Differentiation under the integral sign.

Multiple Integrals: Evaluation of double integral (in Cartesian and polar co-ordinates) change of order of integration, integration by change of variables and its applications in area, mass, and volume. Triple integral (in Cartesian, cylindrical and spherical co-ordinates) and its application in volume.

Suggested Readings:
1. G. B. Thomas and R. L. Finney "Calculus and Analytic Geometry" , Pearson Education.
2 R. K. Jain and S. R. K. Iyenger "Advanced engineering mathematics" Narosa.
3 Erwin Kreyszig "Advanced engineering mathematics" Wiley.
4 Michael Greenberg "Advanced engineering mathematics" Pearson Education.

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

Course No	Title of the Course	Course Structure	Pre-Requisite
FC002	Computer Programming	3L-0T-2P	None

Course Outcomes:

1. To understand the basic terminology program structures used in computer programming to solve real world problems.
2. To learn the process of representing problems and writing, compiling and debugging programs.
3. To develop programming skills in using different types of data, decision structures, loops functions, pointers, data files and dynamic memory allocation/de-allocation.
4. To understand the need for continuing to learn new languages to solve complex problems in different domains.

 COURSE CONTENT:
C Programming Language
Thinking like a programmer: problem solving. Components of a problem, algorithm, checking for errors and inconsistencies, writing a pseudocode.
Boolean Logic: Binary Number systems and codes and operations.
Introduction to programming& Basics of C: Concepts of Algorithm and Flowcharts, Process of compilation, Basic features of C Language like Identifier, Keywords, Variable, data types, Operators and Expression, basic screen and keyboard I/O, Control Statements, iteration, nested loops, Enumerated data types, bitwise operators, C Preprocessor statements.
Arrays and Pointers: One and multidimensional dimensional arrays, strings arrays, operations on strings, Array and Pointers, Pointers and strings, Pointer to Pointer, other aspect of pointers,User Defined Data Types: Structures, Unions, bit fields.
Functions: Concept of modular programming, Using functions, Scope of data, Recursive functions, Pointers and functions, Command line arguments.
Linked List: Dynamic memory allocation, singly link list, traversing, searching, insertion, deletion.
Files: Types of files, working with files, usage of file management functions.
 C++ Programming Language
Moving from C to C++: Concepts of Object Orientation, Objects, classes, encapsulation, data abstraction, inheritance, delegation, software reuse. Inheritance visibility rules using public, private, protected, member functions: Constructors / destructors, operator (::),accessing member functions within a class, new, delete.
Friend functions and classes, static data and functions, function templates, pointers within a class, passing / returning objects as arguments.
Functions Polymorphism – virtual functions, function overloading, variable definition at the point of use, reference variables, strict type checking, default arguments, type conversion.
Exception handling, streams based I/O.

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Trends: Kinds of programming languages.
Guidelines for practical work based on programming concepts:
Programs for temperature conversion, area of triangle, counting frequencies of letters, words to understand the basic data types, input-output, control flags.
Programs for decision making using selection, looping, processing of arrays for sorting, searching , string manipulations, matrix operations.
Programs for parameter passing to functions, returning values, interactions among functions, pointer with arrays, strings, call by reference.
Programs using structure , pointers and files for linked lists , inventory management etc.
Program using bit wise operators to simulate the combinational circuits.
Program showing the concept of objects, access specifiers and inheritance.

Suggested Readings:
   1. B. W. Kernighan and D.M. Ritchie," The C programming language", Prentice Hall.
   2. C: The Complete Reference, by Herbert Schildt, Publisher – Tata McGraw Hill.
   3. Yashwant Kanitkar, "Let us C", BPB Publication
   4. Byron Gottfried," Schaum's Outline of Programming with C", Schaum Series, Tata McGraw Hill
   5. Budd, "Object Oriented Programming ", Addison Wesley.
   6. D Samantha, "Object oriented Programming in C++ and Java ", PHI
   7. Stroustrup," Programming in C++", Special Edition, Addison Wesley

Course No	Title of the Course	Course Structure	Pre-Requisite
FC003	Electrical & Electronics Engineering	3L-0T-2P	None

Course Outcomes:

CO1: To understand the basic concepts of magnetic, AC & DC circuits

CO2: To learn the basics of semiconductor diodes, BJTs

CO3: Will be able to analyze basic electrical and electronic circuits

COURSE CONTENT:

D.C. Circuits and Theorems: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of dc circuits.

A.C.Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-

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Passed in the meeting of Standing Committee on Academic matters, University of Delhi, held on
June 03, 2016

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L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

Magnetic Circuits: Magnetomotive Force, Magnetic Field Strength; Permeability, Reluctance, Permeance, Analogy between Electric and Magnetic Circuits.

Semiconductor Diodes and Rectifiers: Introduction, general characteristics, energy levels, extrinsic materials n & p type, ideal diode, basic construction and characteristics, DC & AC resistance, equivalent circuits, drift & diffusion currents, transition & diffusion capacitance reverse recovery times, temperature effects, diode specifications, different types of diodes (Zener, Varactor, Schouky, Power, Tunnel, Photodiode & LED), Half wave & full wave rectifiers. Switched Mode Power Supply.

Bipolar junction transistor: Introduction, Transistor, construction, transistor operations, BIP characteristics, load line, operating point, leakage currents, saturation and cut off mode of operations, Eber-Moll's model.

Bias Stabilization: Need for stabilization, fixed bias, emitter bias, self bias, bias stability with respect to variation in I_{co} V_{BE} & β, Stabilization factors, thermal stability.

Suggested Readings:
1. Vincent Del Toro, "Electrical Engineering Fundamentals"
2. Mittle and Mittal, "Basic Electrical Engineering" TMH
3. Boylestad and Nashelsky, "Electronic Devices and Circuit Theory", Pearson
4. Millman & Grabel, "Microelectronics" TMH

Course No	Title of the Course	Course Structure	Pre-Requisite
FC004	Physics	3L-0T-2P	None

Course Outcomes:
1. Knowing important concepts and phenomena linked to relativity, waves and oscillations and be able to do analytical and numerical calculations for faithful measurements, observations and gravitational wave communications.
2. The course is helpful to the students in understanding various optical wave phenomena which are required for optical & electromagnetic wave communications and in optical devices.

Concepts of Laser and Optical Fiber for modern developments in physics which are helpful in designing and developing new devices used in optical communications, medicine, environment, industries and related physics.

COURSE CONTENT:

Relativity: Special Relativity, Lorentz Transformations, Velocity addition, Time dilation, Length Contraction, Variation of mass with velocity, Mass and energy, Relativistic momentum and relativistic energy, General theory of relativity, Einstein's theory of Gravitation, Gravitational waves, Gravity and Light.

Oscillations and Waves: Damped and forced oscillations, Sharpness of resonance, Q-factor, Application in

resonance, Acoustic waves, Pressure wave equations, Intensity pressure relation, Acoustic impedance, Reflection and transmission of acoustic waves, Impedance matching; Ultrasonics and its applications.

Optics: Interference: Interference due to thin films, Newton's rings, and determination of the wavelength of sodium light, Interference due to wedge shaped film. Diffraction: Fraunhofer diffraction due to single slit and N Slits, Plane transmission grating, Rayleigh criterion of resolution, Resolving power of a grating, Polarization: Polarization in light, Birefringence, Nicol prism, Quarter and half wave plates, Production and analysis of plane, Circularly and elliptically polarized light, Optical rotation, specific rotation, Polarimeter.

Quantum Theory of Light : Hertz's Experiments- Light as an Electromagnetic Wave, Blackbody radiation, Light Quantization, Compton Effect , X-rays.

LASERS : Absorption and emission of radiation, Main features of a laser, Spatial and temporal coherence, Einstein Coefficients, condition for light amplification, Basic requirement for Laser, Population Inversion - Threshold Condition, Line shape function , Optical Resonators , Three level and four level systems. Classification of Lasers: Solid State Laser-Ruby laser and Gas Laser- He-Ne laser (Principle, Construction and working), Optical properties of semiconductor, Semiconductor laser (Principle, Construction and working), Applications of lasers in the field of medicine, Industry, Environment and Communication.

Fibre Optics : Need for fiber Optic Communication, Physical nature of Optical fiber, Theory of Light propagation in optical fiber, Acceptance angle and numerical aperture, Step index and graded index fibers, Single mode and multimode fibers, Losses in optical fiber, Optical Fiber cables and bundles, Dispersion in optical fibers: Intermodal and Intramodal dispersion.

TERM WORK Experiments: <u>Any ten experiments</u> based on the theory course or related subject as above. For examples : Wavelength by diffraction grating, Newton's rings experiments and bi-prism assembly, resolving power of a Telescope, Nodal-Slide assembly , specific rotation of cane sugar by Polarimeter, dispersive power of Prism, Wavelength of He-Ne laser by diffraction, refractive index for O-ray and E-ray, Brewster's law, Ultrasonic interferometer, numerial aperture of an optical fibre, other experiments based on LASER and optical fiber.

Suggested Readings:
1. Arthur Beiser, Shobhit Mahajan "Concepts of Modern Physics" (McGraw Hill)
2. Serwey , Moses, Moyer "Modern Physics" (Cengage Learning)
3. D S Mathur, "Mechanics" (S Chand & co.)
4. Jenkins and White, "Fundamentals of Optics" (McGraw Hill)
5. N. Subramaniam and Brij Lal, "A Text Book of Optics" (S Chand)
6. Indu Prakash, " A Text Book of Practical Physics", Volume-1,   Kitab Mahal Publication.

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Course No	Title of the Course	Course Structure	Pre-Requisite
FC005	English-1	2L-0T-0P	None

Course Outcomes:

1. The course will focus on the four integral skills of language, improving the proficiency levels in all of them and to learn to use language as a tool for effective communication.
2. This course will widen the understanding of the learners in all genres of literature (short stories, poetry, autobiographies..) with the help of expository pieces .
3. The course will strive to equip the learner with the ability to express oneself and be understood by others with clarity and precision, in both written and spoken forms.
4. This course will encourage creative use of language through translation, paraphrasing and paragraph writing.
5. Along with the above, the course will also build confidence and encourage the students to use a standard spoken form of English in order to prepare them to face job interviews, workplace and in higher studies.

Course Objectives:

a) This course will focus on oral skills of the speaker with emphasis on speaking and reading.
b) This course will engage with different theories of personality development, personality traits, emotional quotient.
c) It will discuss and engage with topics like social practices, personal habits, interpersonal skills, leadership qualities and people management.

Course Content:

- Practice in dictation, punctuation and spellings, listening and reading comprehension.
- Practice with well formed sentences with stress on remedial grammar.
- Exercises in unseen comprehension, paraphrasing, paragraph writing & summarizing.
- Reinforcement in letter writing, preparing CVs, writing book reviews.
- Exposure to the nuances and usages of the language through newspapers and magazines as an exercise to be in line with current form of language used.
- Proficiency in spoken English with focus on confidence building and standard pronunciation through language lab sessions.

Literature

1. Sadat Hasan Manto: Toba Tek Singh,
2. Abdul Kalam: Wings of Fire (excerpts)
3. Jhumpa Lahiri: The Namesake (excerpts)
4. Khaled Hosseini: The Kite Runner (excerpts)
5. Mohan Rakesh: Halfway House

Language Skills

1. Dictation, punctuation and spellings, listening and reading comprehension.,
2. Correspondence(formal & informal)

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3. Reading editorials, columns, speeches & essays	
Suggested Readings:	
Margaret M Maison, "*Examine Your English*"	

Course No	Title of the Course	Course Structure	Pre-Requisite
FC006	Mathematics-II	3L-1T-0P	None

Course Outcomes:
By the end of this course, the student will be able to
1. Solve system of equations and know the concepts of eigenvalue and eigenvector.
2. Know the concepts of Ordinary Differential Equations and its applications.
3. Know the concepts of Special Functions.
4. Know the concepts of Laplace Transforms and its application to solve Differential Equations

Course Contents:
Matrices: Rank, inverse and normal form of a matrix using elementary transformations, consistency of linear system of equations; linear dependence/ independence, linear transformations, eigenvalues and eigenvectors of a matrix, Cayley-Hamilton theorem, diagonalization.
Ordinary Differential Equations: Second & higher order linear differential equation with constant coefficients, general solution of homogenous and non- homogenous equations, Euler-Cauchy equation, Application to mass- spring system and electrical circuits. Power series method.
Special Functions: Beta and Gamma functions, Dirichlet's Integral. Legendre equation, Legendre polynomials and its properties, Bessel equation, and Bessel function of first kind and its properties, ber and bei functions.
Laplace Transforms: Basic properties, Laplace transform of derivatives and integrals. Laplace of periodic functions. Laplace transforms solution of IVP and simultaneous linear differential equations, unit step function, Dirac-Delta function. Inverse Laplace transform, Convolution theorem.

Suggested Readings:
1. G. B. Thomas and R. L. Finney "Calculus and Analytic Geometry", Pearson Education.
2 R. K. Jain and S. R. K. Iyenger Narosa "Advanced engineering mathematics"
3 Erwin Kreyszig "Advanced engineering mathematics"; Wiley.
4 Michael Greenberg "Advanced engineering mathematics", Pearson Education.

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Course No	Title of the Course	Course Structure	Pre-Requisite
FC007	English-II	2L-0T-0P	None

Course Outcomes

1. The course will focus on the four integral skills of language, improving the proficiency levels in all of them and to learn to use language as a tool for effective communication.
2. This course will widen the understanding of the learners in all genres of literature (short stories, poetry, autobiographies..) with the help of expository pieces .
3. The course will strive to equip the learner with the ability to express oneself and be understood by others with clarity and precision, in both written and spoken forms.
4. This course will encourage creative use of language through translation, paraphrasing and paragraph writing.

Along with the above, the course will also build confidence and encourage the students to use a standard spoken form of English in order to prepare them to face job interviews, workplace and in higher studies.

Course Objectives

a) This course will focus on oral & presentation skills of students with practice sessions in the language lab.
b) This course will develop confidence building in oral skills of learners.
c) It will seek to encourage the day to day conversations/dialogues and communicative needs of learners with ample practice in the lab.
d) The theory class will boost practice in ample language exercises to encourage oral skills.
e) This will also involve practice sessions in interview skills, group discussions & pair work.
f) Basics of communication

Course Contents:

Literature

1. Anton Chekov: The Bet
2. Guy de Maupassant: The Necklace
3. D H Lawrence: Odour of Chrysanthemums
4. R K Narayan: Malgudi Days
5. Sarojini Naidu: Bangle Sellers
6. Rupert Brooke: The Soldier/Siegfried Sassoon: Suicide in the Trenches

Language Skills

1. translation, paragraph writing, paraphrasing, summarizing,
2. comprehension

Presentations/book reviews/reading exercises

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Suggested Readings:
1. *Advanced English Grammar*: Martin Hewing
2. *Technical Communication*: Meenakshi Raman & Sangeeta Sharma
3. *A Course in Academic Writing*: Renu Gupta

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SYLLABUS OF CORE COURSES

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC01	Chemistry	3L-0T-2P	None

Course Outcomes: After completion of the course the students will be able to
    CO 1: understand the basic concept of Physical, Inorganic and Organic Chemistry
    CO 2: understand the concepts of Polymers, Metals and Alloys
    CO 3: understand the concept of Thermal Methods and their applications and basic the basic
        principles of Green Technology
    CO 4: perform titrimetric analysis
    CO 5: learn different titration methods by performing experiments

Course Contents:

THEORY

Electrochemistry & Catalysis : Transport No., Nernst Equation of electrode Potential, Reference electrodes, Subsidiary Electrodes, Concentration Cell, Batteries & Fuel Cells, Kinetics of Catalysis
Phase Rule : Deduction of Phase Rule, Basic Definition and Explanation, Phase Diagram of some simple systems (Water & Sulphur), Phase transportation of Cu-Ni, Ag-Pb and some binary systems
Thermal Method of Analysis : Elementary discussions of TGA, DTA & DSC
Inorganic Chemistry : Transition Metal complexes, Crystal Field Theory, synthesis & property of Metallurgy, Ferrous & Non-Ferrous Alloys
Electronic Effects : Inductive Effect, Hyperconjugation & Resonance and their effect on physical & chemical properties of molecules, Mechanisms of some Reactions
Polymers : Effect of polymer structure on properties and production, Technical Applications and synthesis of some thermoplastic and thermoset resins, Natural Rubber, Elastomers, Inorganic Polymers, Ion-exchange Polymers, Conducting Polymers, Bio-degradable Polymers, Molecular Weight of Polymers
Spectroscopy : Infrared, Ultra-Violet and Visible and NMR Spectroscopy and their applications
Analytical Chemistry: Chromatographic Methods of Separation, Gas Chromatography, HPLC & Potentiometric methods
Green Technology : Introduction, Basic Principles of Green Technology, concept of atom economy, Tools of Green Technology, zero waste Technology

PRACTICALS
1. To find the strength (gm/lit.) of a given copper sulphate solution, iodometrically.
2. To find the strength of given potassium dichromate solution using Mohr's salt solution as an intermediate and potassium ferricyanide as an external indicator.

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3. Determination of strength (gm/lit.) of a given solution of potassium dichromate with ferrous ammonium sulphate solution using N-Phenyl anthranilic acid as internal indicator.
4. To determine the strength (gm/lit.) of sulphuric acid and oxalic acid in a given solution using NaOH and $KMnO_4$ solutions.
5. To determine the percentage of sodium carbonate in a given sample of commercial caustic soda solution.
6. Argentometric Titrations (i) Volhardic Method
                                         (ii) By Mohr's method
7. Estimation of silver nitrate against potassium Thiocyanate using ferric indicator.
8. To estimate the strength of barium chloride in a given solution using sodium carbonate and hydrochloric acid solutions.
9. To determination the percentage of calcium carbonate in precipitated chalk using hydrochloric acid and NaOH solutions.
10. To determine the strength of Calcium by EDTA – Complexometric Titration
11. To determine the strength of Hydrochloric acid, conductometrically by titrating against standard sodium hydroxide solution.
12. To determine the strength of Mohr's salt against solution of potassium dichromate.

Suggested Readings:
1 K. J. Laidler "Chemical Kinetics"
2. R. T. Morrison & R. N. Boyd "Organic Chemistry"
3. J. D. Lee Concise "Inorganic Chemistry"
4. A. I. Vogel Quantitative "Inorganic Chemistry"
5. Jain and Jain "Engineering Chemistry"
6. Balram Pani "Engineering Chemistry"
7. Shashi Chawla "Engineering Chemistry"

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Course No	Title of the Course	Course Structure	Pre-Requisite
ITC02	Object Oriented Techniques	3L-0T-2P	None

Course Outcomes: At the end of the course, the student should have

CO1: An understating of the difference between OOAD and Structured Analysis.

CO2: Develop the skills to determine which processes and OOAD techniques should be applied to a given project

CO3: To prepare object-oriented design for small/medium scale problems

    CO4: Understand how to implement OO concepts using C++/Java

Course Content: **No of Hours: 40**

Concepts of Object-orientation: Encapsulation, information hiding, object identity, messages, classes, inheritance, polymorphism etc. Difference between Object oriented Analysis and Structured Analysis.

Object-oriented analysis methods:Object Model –Evolution and Elements of an object model, Classes & Objects – Nature of an object, relationships among Objects, Nature of a class relationship among classes, Classification, Key Abstractions and mechanisms

Object Oriented Design: object modeling technique by Rumbaugh,

Functional Modelling: Introduction to Process, Data flow diagram (DFD),

Unified Modeling Language: Use Case Diagram, Class diagrams, Activity Diagram, State Transition Diagram

Object Oriented Construction: Implementation in Object oriented programming Language like c++/java, basic concepts

Object oriented Testing: Unit, Integration and System testing, the testing process. Components and their management,

Suggested Readings:
1. James R Rumbaugh , "Object Oriented Modeling and Design," Prentice Hall.
2. Grady Booch, James R Rumbaugh , "Unified Modeling Language a User Guide," Prentice Hall.
3. James R Rumbaugh, M R.Blah, "Object-Oriented Modeling and Design with UML," Pearson Education
4. A Silberschatz, Henry F. korth, S. Sudarshan, "Database System Concepts", Mcgraw Hill Education
5. Yogesh Singh, "Software Testing", Cambridge : Cambridge University Press,
6. John D. McGregor, David A. Sykes, "A Practical Guide to Testing Object-Oriented Software," Addison Wesley

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Course No	Title of the Course	Course Structure	Pre-Requisite
ITC03	Analog and Digital Communication	3L-1T-0P	None

Course Outcomes:
1. To familiarize students with the fundamentals of analog and digital communication systems, to familiarize students with various techniques for amplitude modulation and demodulation of analog signals,
2. To develop the students' ability to determine the effects of receiver frequency and phase errors in synchronous modulation systems
3. To familiarize students with techniques for generating and demodulating narrow-band and wide-band frequency and phase modulated signals
4. to familiarize students with basic techniques for generating and demodulating pulse code modulated signals

Course Content: **No of Hours: 42**

Analog Modulation:Introduction to AM, FM & PM
Amplitude Modulation Generation & Demodulation of AM waves, DSBSC waves, Coherent Detec
DSBSC Signal, Quadrature-Carrier Multiplexing, Generation of SSB waves, Demodulation of SSB wav
Angle Modulation: Frequency & phase Modulation, narrow & Wide-Band FM, BW of FM waves,
Generation & Demodulation of FM waves,, S/N ratio, Comparison of AM, FM & PM.
 power spectral density, response of linear systems to random signals, Noise in wave modulation s
Noise effects in AM,FM & PM systems.
Pulse analog Modulation: Sampling theorem, Sampling of Low Pass and band pass signals, aliasing,
Aperture effect, PAM, PWM and PPM generation and demodulation, TDM, Cross talk, Spectral
analysis of PAM, PWM and PPM waves, S/N ration for different pulse modulation.
Pulse Digital Modulation: Pulse code modulation signal to quantization noise ratio, probability of
error for PCM in AWGN channel, DPCM, DM and ADM modulators and demodulators, Prediction
Filter, line coding, Inter symbol Interference.
Digital Transmission through Carrier Modulation Amplitude, Frequency and phase shift keying,
Differential phase shift keying, CPFSK, MSK QPSK and QAM modulation & detection, probability
of error calculation, Matched.
Digital Pass band transmission and reception, coherent phase shift keying PSK, frequency – shift
keying (FSK) and quadri phase –shift keying (QPSK), non-coherent FSK, quadrature amplitude
modulation (QAM), Application to Digital Cellular phones and high-speed modems. Effects of noise
 on baseband digital comm.. systems. Error probability in digital systems.
Introduction to special spectrum modulations, frequency- hopping and direct sequence, code-division
multiplexing (CDM). Application to CDMA wireless comm. systems.

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Suggested Readings:
> Haykin," **An Introduction To Analog And Digital Communications"**
> SINGAL, " **ANALOG AND DIGITAL COMMUNICATION"**
> Simon Haykins," Communication systems"
> Simon Haykins," Digital Communication"
> J. G. Proakis," Digital Communication"
> Taub & Schilling," Communication systems"

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC04	Discrete Structure	3L-1T-0P	None

Course Outcomes:
CO1: Understand the notion of mathematical thinking.
CO2: Understand the notion of mathematical proofs.
CO3: Understand the notion of algorithmic thinking**.**
CO4: apply the above in problem solving.

Course Content: **No of Hours: 40**

Set Theory: Introduction, set operations, algebra of sets, duality, Finite sets and multi sets, counting principles, power set, partitions
Mathematical Induction, Principle of inclusion and exclusion
Relations: Introduction, Cartesian product, types of relations, closure, representation and composition of relations, posets
Functions: Introduction, types of functions, recursively defined functions, Pigeonhole principle
Logic and Propositional Calculus: Propositions and compound statements, basic logical operations, truth tables, propositional functions, normal forms, tautology and contradiction, conditional and bi conditional statements, algebra of propositions, logical equivalence, arguments, quantifiers, predicate logic
Boolean Algebra: binary relations and their representations, binary operations, duality, semi groups, monoid, groups, rings, homomorphism and isomorphism, CNF and DNF
Hasse diagrams, Lattices
Combinatorics: Permutation, combinations , recurrence relations
Graph Theory: Elementary graph theory, Euclidean and Hamilton paths and circuits, shortest path algorithm
Tree: Introduction, traversal, infix to post fix conversion, construction of tree from preorder and inorder notation

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Suggested Readings:
- C. L. Liu "Elements of Distcrete Mathematics", McGraw Hill
- J.P. Trembley and R. Manohar, Discrete Mathematical Structures with Application to Computer Science, McGraw-Hill
- S. Lipschutz and M. Lipson (Schaum`s Series) "Discrete Mathematics" McGraw-Hill

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Course No	Title of the Course	Course Structure	Pre-Requisite
ITC05	Mathematics-III	3L-1T-0P	None

Course Outcomes: By the end of this course, the student will be able to
1. Know the concepts of Fourier series, Fourier transforms and Harmonic analysis and its applications.
2. Know evolution of Partial Differential Equations and its methods of solutions for real life problems.
3. Know the concepts of functions of complex variables and its applications to evaluate real integrals.
4. Know the concepts of vector calculus such as gradient, curl, divergence and integral theorems such as Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem and their applications in various fields.

Course Content: **No of Hours: 40**

Fourier Series & Transforms: Periodic functions, Fourier series, Functions of any period p. Even and odd functions, Half range series, complex form of Fourier series, Harmonic analysis. Fourier transform and its properties, Fourier cosine and sine transforms and their properties, applications to PDE.

Partial Differential Equations: Solution of first order equations- Lagrange, non linear first order, Charpit's method, higher order linear equations with constant coefficients. Separation of variables, Solution of Heat, Wave and Laplace equations.

Complex Variables: Functions of a complex variable, analytic functions, harmonic functions, Cauchy -Riemann equations (Cartesian and polar form). Linear fractional transformation, Conformal mapping, Mapping of elementary functions (exponential, trigonometric, hyperbolic and logarithm functions), Contour integration, Cauchy's integral theorem and formula, Power series and its convergence, Taylor's and Laurent series, zeroes, Singularities, Residue theorem, Evaluation of real integrals(around unit circle, no singularity on real line , and singularity on real line) .

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Vector Calculus: Differentiation of a vector function, scalar and vector fields, Gradient, Divergence, Curl, line integral, independence of path, Green's theorem and applications. Surface Integral, Stoke's theorem and applications; Volume Integrals, Gauss Divergence theorem and applications	

Suggested Readings:
1. Advanced Engineering Mathematics: Jain/Iyenger; Narosa.
2. Advanced Engineering Mathematics: Kreyszig; Wiley.
3. Advanced Engineering Mathematics: Greenberg; Pearson Education.

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC06	Data Structure and Algorithm	3L-0T-2P	None

Course Outcomes:

CO1: To design elementary data structures such as stacks, queues, linked lists, trees, graphs etc. and have practic knowledge on their applications.

CO2: To design algorithms to solve the problems and analyze the time complexity of the algorithms.

CO3: To understand various searching and sorting techniques.

CO4: To identify the appropriate data structure for given problem and perform various operations such as Insert Deletion, Traversal on these data structures.

Course Content: No of Hours: 40

Arrays, Stacks and Queues: Fundamentals and Representations, Applications of Arrays, Stacks and Queues, Sparse Matrices Linked lists: Singly/Linear Linked lists, Linked Stacks and Queues, Doubly and Circular Linked Lists, Applications. Trees: Binary Trees, B-Trees, N-ary Trees, B+-Trees, Tree Traversals and Tries, Storage of Trees, Threaded trees, Trees Applications, Hashing. Heaps Graphs: Types, Terminology and Representations, Graph Traversals, Applications of Graphs. Searching and Sorting: Sequential and Binary Searching, Search trees, Sorting Techniques.

SUGGESTED READINGS:
1. E. Horowitz and S. Sahani, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press,
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Addison- Wesley,
3. Schaum's Outline Series, "Data Structure", TMH, Special Indian Ed., Seventeenth Reprint.
4. Y. Langsam et. al., "Data Structures using C and C++", PHI
5. N. Dale and S.C. Lilly, D.C. Heath and Co., "Data Structures"
6. R. S. Salaria, Khanna, "Data Structure & Algorithms", Book Publishing Co. (P) Ltd..
7. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structure A Pseudocode Approach with C", Cengag Learning, 2nd Ed.,

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Course No	Title of the Course	Course Structure	Pre-Requisite
ITC07	Digital Circuits and Systems	3L-0T-2P	None

Course Outcomes:
CO1: To help the student in understanding the digital circuits and the principles and application of the building blocks like diodes, flip flops, registers, ROM etc.
CO2: To make students analyze and design combinational and sequential circuits.

Course Content: No of Hours: 40

Boolean Algebra, Venn diagram, switching function and minimization of switching functions with don terms etc. (Karnaugh's Map Method & Tabulation Techniques)
Introduction Logic Gates, Logic Families TTL, Tristate Logic, ECL, CMOS and T^2 L Logic, Logic parameters etc.
Bistable, Monostable, Astable and Schmitt trigger circuit.
Gated memories, M/S flipflops, Shift Registers Serial & Parallel Counters, Ring counters, Up Down counters.
Designing of combinational circuits like code converter, address, comparators, etc.
Introduction to semiconductor memories: ROM, PROM, EPROM, STATIC & DYNAMIC RAM.
Introduction to Encoders, Decoders, Multiplexer, demultiplexer, Designing combinational circuits with multiplexers and other digital logic blocks, PROM.
Concept of Digital to Analog Conversion Ladder Networks, and Concept of Analog to Digital convers Dual slope method, V-F conversion, stair-case Ramp-method/counter method, successive approximatio of A/D converters etc.
Introduction to design of synchronous & asynchronous sequential circuit flow table realization from verbal description, ASM charts, minimization of flow-table and concept of state assignments.

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC08	Database Management System	3L-0T-2P	None

Course Outcomes:
CO1: Create database with different types of integrity constraints and use the SQL commands such as DDL, DML to access data from database objects.
CO2: Write subqueries, Learn to implement SQL Join operations, create indexes and report aggregated data using group functions.

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CO3: Write SQL Query using DCL Statements to GRANT, REVOKE, and TCL statements to
    COMMIT and ROLLBACK a database structure.
CO4: Create and drop views and Simple Triggers using SQL.

Course Content:	No of Hours: 40

Introduction to database systems: Overview, File Systems Vs. a DBMS, Advantages of DBMS, Levels of Abstraction, Data Independence, Data Models and their comparison (Hierarchical, Network, Relational Model).

Relational Data models: Structure of Relational Database, Integrity Constraints over relations, Enforcing Integrity Constraints, Relational Algebra and Calculus, Introduction to SQL.

Database Design: Top down approach (ER Model), Participation Constraints, Specialization, Generalization and Aggregation, Bottom up approach (Normalization), Normal Forms Based on Primary Keys, (1NF, 2NF, 3NF & BCNF), Transformation of ER Schema to relational tables.

Transactions and File system: Transactions, Concurrency Control and Database Recovery, Database Security Introduction to File System, File Organization, File Access Methods, File Storage Devices.

Management Information system: Basic Architecture of MIS, Components of MIS –Reporting styles, frequency, targeted managerial level, software and Hardware. Targeted audience of MIS design and development of MIS for various functional areas: Marketing, finance, purchasing, production, distribution, human resource department, implementation aspects, implementation framework, basics, catalysts & change agents.

Suggested Readings:
- Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Tata McGraw Hill.
- Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson / Addision wesley.
- C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Pearson Education.
- Raghu Ramakrishnan, "Database Management Systems", McGraw Hill.
- S.K.Singh, "Database Systems Concepts, Design and Applications", Pearson Education.
- James A O'Brien, George M Marakas and Ramesh Behl, Management Information Systems, Tata McGraw Hill Education.
- Ken Laudon and Jane Laudon and Rajanish Dass, Management Information Systems, Pearson Education.

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC09	Computer Graphics	3L-0T-2P	None

Course Outcomes: After taking the course, the student will be able to

CO1: Understand contemporary graphics hardware; create interactive graphics applications in C++ using one

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or more graphics application programming interfaces.

CO2: Understand computer graphics techniques, focusing on 3D modeling, image synthesis, and Color modeling and rendering.

CO3: Write basic scan conversion algorithms and demonstrate an understanding of the use of object hierarchy in graphics applications.

CO4: Possess in-depth knowledge of display systems, image synthesis, shape modeling, and interactive control of 3D computer graphics applications.

CO5: Enhance their perspective of modern computer system with modeling, analysis and interpretation of 2D and 3D visual information.

Course Content: **No of Hours: 40**

Introduction to computer graphics: Application areas of computer graphics, Output Devices, Graphical Display Devices, Raster scan Displays, Random scan Displays, Colour Monitors/Displays: mechanism and working principle with concepts like Right handed and left handed coordinate system (RHCS & LHCS), resolution video mode, video memory, video adapter, and display processor, Graphical Printing Devices.

Scan Conversion: Point generation: Representation of an image, Line – drawing: symmetric DDA, Simple DDA, Bresenham's line algorithm, Circle Drawing: General methods, symmetric DDA, Bresenham's circle algorithm, Ellipse – Drawing methods Polygon filling

Two Dimensional Transformations and Clipping: Geometric Transformation, Coordinate system transformation, Composite transformations and Homogeneous coordinates, Viewing transformations: world coordinate system (WCS), Screen coordinate system (SCS), Window, Viewport, Aspect ratio, Two – Dimensional Clipping, Point clipping and line clipping: Sutherland Cohen algorithm, Mid-point subdivision algorithm, Cyrus-beck algorithm and other methods for clipping line against rectangular and non – rectangular windows, Other methods for clipping line against rectangular and non –rectangular windows, Polygon clipping : Sutherland –Hodgmann algorithm, Curve clipping and text clipping.

3 Dimensional object representation: point, line polygon, curve and surfaces, 3-D Transformations: Translation, Rotation, Scaling, Mirror Reflection etc, Representation of 3 –D object on 2 – D screens, 3-D WCS, Parallel and perspective projection, perspective depth, Need of 3-D screen coordinate system.

Hidden Surface Elimination and Curves & Surfaces: Z-buffer, Scan line algo, Shape description requirements, Parametric curves, Beizer Curves, B- Spline methods.   **Illumination &**
Shading: Reflection, Phong & Gourond Models, Color Models: Achromatic light RGB, CMY, YIQ, HSV, and HLS color models, Rendering, Animation Techniques.

Suggested Readings:
- Foley et. al., "Computer Graphics Principles & practice", Addison Wesley

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- D. Hearn and P. Baker, "Computer Graphics", Prentice Hall
- D. Rogers and J. Adams, "Mathematical Elements for Computer Graphics", MacGraw-Hill International Edition
- R. Plastock and G. Kalley, "Theory and Problems of Computer Graphics", Schaum's Series, McGraw Hill
- David F. Rogers, "Procedural Elements for Computer Graphics", McGraw Hill Book Company

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC10	Probability and Stochastic Processes	3L-1T-0P	None

Course Outcomes:
CO1:Students can understand the basics of probability, events, sample space and how to use them to real life problems.
CO2: They can analyze that the random variable is always a numerical quantity.
CO3: Students can understand the multiple random variables and relate through examples to real problems.
CO4:They can understand the concept of random processes in both deterministic and non deterministic types

Course Content: **No of Hours: 40**

Probability and Random Variable:
- Set, algebra of sets, event, sample space, probability, The meaning of Probability, Axioms of Probability, Dependent and Independent Events, Conditional Probability, Repeated Trials.

- Concept of Random Variable, Probability mass function and Probability density function. Function of one Random Variable, Two Random Variables, Moments and Conditional Statistics, Sequence of Random Variable, Mean and Variance of a random Variable, characteristic function and their properties,

- The Binomial, Poisson, Normal, Geometric, Gamma, Uniform Random Variables and their Properties, The Law of Large Numbers, Central Limit Theorem, application of Central Limit Theorem.

- Random Variables and Stochastic Processes, Conditional Probability and Conditional

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Expectation, Poisson Process, Markov Chains: Discrete Parameter, Markov Chains: Continuous Parameter.

Suggested Readings:
- Athanasios Papoulis, "Probability, Random Variable, and Stochastic Processes" Third Edition, McGraw hill, Inc. (Chapter 1-8)
- Emanuel Parzen, "Stochastic Processes" Society for Industrial and Applied Mathematics Philadelphia.(Chapter-1,2,4,6,7)
- L. C. Thomas, "Game Theory and applications" Dover Publication. (Chapter- 1-3)
- Sheldon Ross, "A First Course In Probability" Eighth Edition, Pearson.
- Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, "Probability & Statistics for Engineers & Scientists"9thedition, Prentice Hall.
- Martin J. Osborne, "An Introduction to Game Theory"The MIT Press Cambridge, Massachusetts London, England.
- Emanuel Parzen, "Modern Probability Theory and Its Applications" John Wiley &. Sons, Inc.

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC11	Operating System	3L-0T-2P	None

Course Outcomes: Upon completion of the course, the students should be able to:
CO1: Describe the general architecture of computers compare different structures for operating systems.
CO2: Explain the services provided by and the design of an operating system.
CO3: Understand in detail the concepts behind processes (CPU scheduling algorithms, inter- process communication, deadlock, synchronisation among processes)
CO4: Appreciate the advantages of virtual memory and different approaches to memory management techniques (paging, segmentation).
CO5: Understand the structure and organization of the file system.

Course Content: **No of Hours: 40**

INTRODUCTION: What is an Operating System, types of OS, their advantages and disadvantages
PROCESSES: Definition of process, process states, PCB, process scheduling, inter-process communication
CPU SCHEDULING: Basic concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling
DEADLOCKS: System Model, deadlock characterization, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock
PROCESS SYNCHRONIZATION: Critical-Section Problem, Solutions to synchronization-software approach, hardware approach, support from OS and complier (Semaphores), Classical Problems of Synchronization

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MEMORY MANAGEMENT: Logical versus Physical Address space, swapping, Contiguous allocation, Paging, Segmentation VIRTUAL MEMORY: Demand paging, page replacement, page replacement algorithms, demand paging, allocation of frames, thrashing FILE - SYSTEM INTERFACE: File concept, access methods, directory structure, file - system structure, allocation methods MASS STORAGE STRUCTURE: Disk structure, disk scheduling, RAID structure

SUGGESTED READINGS:
    1. Silbersachatz and Galvin, "Operating System Concepts", John Wiley, 8th Ed.
    2. Milan Kovic., "Operating Systems", Tata McGraw Hill
    3. Deitel, Deitel and Choffnes, "Operating Systems", Pearson ,3rd Edition
    4. Tannenbaum, "Operating Systems", PHI, 4th Ed.
    5. Madnick E. and Donovan J., "Operating Systems", Tata McGraw Hill
    6. Flynn McHoes, "Operating System", Cengage Learning
    7. Sibsankar Halder and Alex A. Aravind, "Operating System", Pearson
    8. William Stallings, "Operating Systems Internals & Design Principles", Pearson Education, 6th Ed

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC12	Computer System Architecture	3L-1T-0P	None

Course Outcomes:

CO1. To make students understand the relevance Computer system architecture in the software oriented course.
CO2. To introduce basic digital concepts and then use them in explaining details of computer architecture.

Course Content: No of Hours: 40

Von Newman architecture, Instruction set architecture, data-path organization, ALU design, Control Path
Microprogrammed Control, CISC and RISC architectures
Input-output organization, Serial communication, Interrupts, DMA
Memory-Organization, Cache, organization, virtual memory, content addressable memory
Arithmetic-design, binary and BCD arithmetic, floating-point arithmetic.Advanced architectures: cc classification and application
Concept of pipelined, SIMD and MIMD architectures

SUGGESTED READINGS:
    1. Mano M, "Computer System and Architecture", Pearson, 3rd Ed.
    2. Stallings W, "Computer Organization & Architecture", PHI, 8th Ed.
    3. Malvino, "Digital Computer Electronics: An Introduction to Microcomputers", McGraw Hill,
    4. Hayes, J. P. "Computer Architecture and Organization", McGraw Hill,

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5. Andrew S. Tanenbaum, "Structured Computer Organization", PHI, 5th Ed.
6. P. V. S Rao, "Computer System Architecture", PHI, 5th Ed.
7. Anthony J. Dos Reis, "Assembly Language and Computer Architecture using C++ and Java", Cengage Learning,

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC13	Computer Networks	3L-0T-2P	None

Course Outcomes: After completing this course the student must demonstrate the knowledge and ability to:

CO1: Independently understand basic computer network technology, Understand and explain Data Communications System and its components.

CO2: Identify the different types of network topologies and protocols. Understand the functioning of the layers of the OSI model and TCP/IP protocol suit.

CO3: Identify the different types of network devices and their functions within a network and to understand MAC sub layer Protocols and their functioning.

CO4: To understand the network layer in the Internet and building the skills of IP addressing, sub-netting and routing mechanisms.

CO5: Understand the basic protocols of computer networks, and how they can be used to assist in network design and implementation and to get familiar with network security issues and compression techniques.

Course Content: **No of Hours: 40**

UNIT - I
Introductory Concepts: Introduction to Computer Networks, OSI Reference Model: A Layered Approach, Intro to TCP/IP Protocol Suite, Goals and Applications of Networks,
Physical Layer: The Physical Layer, Network structure and architecture, services, networks topology. Theoretical Basis for Data Communication, Transmission Media -Guided andUnguided, Multiplexing-(FDM, TDM and WDM), Switching- Circuit Switching, Packet Switching- Virtual Circuits and Datagram Approach, Message Switching, ADSL, xDSL
UNIT - II
The Data Link Layer: Data Link Layer Design Issues, Framing, Error Detection and Correction Techniques e.g Parity, CRC, Checksum, Hamming Code etc., Flow Control Protocols, Stop-and-

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wait Flow Control, Sliding – Window Flow Control, Error Control, Stop-and-wait ARQ, Go-back-N, Selective-repeat, Example of Data Link Protocols-, HDLC, LAP-B

Medium Access Sub Layer: Channel allocations, ALOHA Protocols (Pure and Slotted), Carrier Sense Multiple Access Protocols (persistent and non persistent etc.), CSMA with Collision Detection, CSMA/CA, Collision free protocols, IEEE Standards- Ethernet, Token Bus and Token Ring, ISDN

UNIT - III

Network Layer: Point-to-Point network, routing algorithms (Link state, Distant Vector etc.), congestion control, Internetworking, Quality Control, IP packet, IP addressing, subnetting, IPv4 vs IPv6,

UNIT - IV

Transport Layer: Design Issue, connection management, TCP window management, User Datagram Protocol, Transmission Control Protocol, and Performance Issues.

Application Layer: Application Layer Protocols, DNS, Electronic Mail, WWW,

Network Security: Introduction to network security**.**

SUGGESTED READINGS:

1. Forouzan, "Data Communication and Networking", TMH, 4th Edition.
2. A.S. Tanenbaum, "Computer Networks", PHI, 4th Edition.
3. W. Stallings, "Data and Computer Communication", Macmillan Press.
4. Comer, "Computer Networks and Internet", PHI.
5. Comer, "Internetworking with TCP/IP", PHI.
6. W. Stallings, "Data and Computer Communication", McMillan.
7. J. Martin, "Computer Network and Distributed Data Processing", PHI.
8. W. Stallings, "Local Networks", McMillan.
9. M.Schwertz, "Computer Communication Network Design and Analysis", PHI.
10. S. Keshav, "An Engineering Approach to Computer Networking, Pearson"

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC14	Software Engineering	3L-0T-2P	None

Course Outcomes:

CO1: To make student understand the fundamental concepts of Software engineering.

CO2: To Apply concepts of various process models for development of software applications

CO3: To implement different conceptual modeling techniques for information system design (including ERDs, DFDs and UML)

CO4: To Implement and analyze logic modeling techniques (decision tree/table, structured English),

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and address the managerial issues involved in SA&D	

Course Content: **No of Hours: 39**

Introduction to object oriented modeling and design methods.
Modeling the applications using object oriented methods by Booch, Rambagh and Unified Modeling language(UML).Software Quality assurance, Software quality metrics, software configuration management, Detailed Capability Maturity Model, Advance topics in requirements engineering, Different views of modeling with case studies, Software reuse and reengineering
Introduction to meta-modeling and its use.
Introduction to CASE tools and CASE shells, CASE Tool architectures
Latest topics in software engineering

SUGGESTED READINGS:
1. K. K. Aggarwal and Yogesh Singh, "Software Engineering", New Age   International,
2. R. S. Pressman, "Software Engineering – A Practitioner's Approach", McGraw Hill Int. , 5th Ed.
3. Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa, 3rd Ed.
4. Stephen R. Schach, "Classical & Object Oriented Software Engineering", IRWIN,
5. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John   Wiley & Sons.
6. I. Sommerville, "Software Engineering", Addison Wesley,8th Ed.
7. Frank Tsui and Orlando Karan, "Essentials of Software Engineering", Joes and Bartlett,
8. Kassem A. Saleh, "Software Engineering", Cengage Learning,
9. Rajib Mall, "Fundamrntal of Software Engineering", PHI, 3rd Ed.
10. Carlo Ghizzi , Mehdi Jazayeri and Dino Mandrioli, " Fundamental of Software Engineering", PHI
11. **Carol L. Hoover, Mel Rosso-Llopart and Gil Taran, "Evaluating Project Decision Case Studies in Software Engineering", Pearson,**

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC15	Multimedia & Applications	3L-0T-2P	None

Course Outcomes: After taking the course, the student should have a clear understanding of
CO1: Describing different multimedia tools and the way in which they are used.
CO2: Stating the properties of different media streams.
CO3: Designing and organizing multimedia projects.
CO4: Producing multimedia projects using various multimedia elements.

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Course Content:	**No of Hours: 40**

Basics of Multimedia Technology: Computers, communication and entertainment; multimedia an introduction; framework for multimedia systems; multimedia devices; CD- Audio, CD-ROM, CD-I, presentation devices and the user interface; multimedia presentation and authoring.

Image compression and Standards: Making still images; editing and capturing images; scanning images; computer color models; color palettes; vector drawing; 3D drawing and rendering; JPEG-objectives and architecture; JPEG-DCT encoding and quantization, JPEG statistical coding, JPEG predictive lossless coding; JPEG performance; overview of other image file formats as GIF, TIFF, BMP, PNG etc.

Audio and Video: Digital representation of sound; time domain sampled representation; method of encoding the analog signals; subband coding; fourier method; transmission of digital sound; digital audio signal processing; stereophonic & quadraphonic signal processing; editing sampled sound; MPEG Audio; audio compression & decompression; brief survey of speech recognition and generation; audio synthesis; musical instrument digital interface; digital video and image compression; MPEG motion video compression standard; DVI technology; time base media representation and delivery.

Multimedia Communication: Fundamentals of data communication and networking, Bandwidth requirements of different media, Real time constraints: latency, video data rate, multimedia over LAN and WAN, Multimedia Conferencing, video-on-demand broadcasting issues.

Multimedia Software: Animation Theory, Types 2D,3D, Animation Tools: Blender, Silver light, Flash, Introduction to Multimedia Software's: Creating Digital Graphics, Vector and Bitmap Graphics, Graphics Tools

Suggested Readings:
- Ranjan Parekh- "Principles of Multimedia", Tata McGraw-Hill Education
- Fred Halsall- "Multimedia Communications", Pearson Education
- Tay Vaughan –"Multimedia: Making it work, fifth edition", TMH
- Villamil & Molina,Que –"Multimedia: Production, planning and delivery"
- James E Shuman –"Multimedia in Action", Wadsworth Publ.

Course No	**Title of the Course**	**Course Structure**	**Pre-Requisite**

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

ITC16	Theory of Computation	3L-1T-0P	None

Course Outcomes:
CO1: Be able to construct finite state machines and the equivalent regular expressions.
CO2: Be able to prove the equivalence of languages described by finite state machines and regular expressions.
CO3: Be able to construct pushdown automata and the equivalent context free grammars.
CO3: Be able to prove the equivalence of languages described by pushdown automata and context free grammars.
CO4: Be able to construct Turing machines.
CO6: Be able to prove the equivalence of languages described by Turing machines.

Course Content:	**No of Hours: 42**

Finite automata: Introduction, DFA, NDFA, an application, finite automata with Epsilon-transition. **Regular expressions and languages:** Regular expressions, finite automata and regular expressions, application of regular expressions, algebraic laws for regular expressions.
Properties of regular languages: Proving languages not to be regular, closure properties of regular languages, decision properties of regular languages, equivalence and minimization of automata.
Context-free grammars and languages: Definition, parse trees, applications of context-free grammars, ambiguity in grammars and languages.
Properties of Context-Free Languages: Normal forms, pumping lemma, closure properties, decision properties.
Pushdown automata: Definition, languages of PDA, equivalence of PDA's and CFG's, Deterministic Pushdown automata.
Turing machine: Introduction, programming techniques, extension to the basic turing machine, Restricted turing machines, turing machines and computers .

Suggested Readings:
1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation"
2. John C. Martin. "Introduction to languages and the theory of computation"
3. K.L.P. Mishra, "Theory of Computer Science. Automata, Languages and Computation. Third Edition"
4. Sudkamp Thomas, "Languages and Machines: An Introduction to the Theory of Computer Science"
5. Michael Sipser, "Introduction to the Theory of Computation, Second Edition"
6. M. Moret, "The Theory of Computation by Bernard"

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC17	Design And Analysis of Algorithm	3L-0T-2P	None

Course Outcomes:

CO1: The abilitys of how to design an algorithm which solves the current problem in hand.
CO2: To Write efficient algorithms for given problems.
CO3: To focus on Deriving the complexities of any given algorithm.
CO4: Learning the programming of various algorithms through assignments.

Course Content: **No of Hours: 40**

Introduction and Mathematics for Algorithms: Introduction to the subject. Sets,
Functions and Relations, Vectors and Matrices, Linear Inequalities and Linear Equations.
Algorithm Analysis, Asymptotic Notations O Ω Θ. Computational Complexity of an algorithm.
Complexity Calculation: Recurrence Relation ,Master theorem, Recurrence Tree, Substitution
Method. Dynamic Programming Algorithms: 0/1 Knapsack Problem, All pair shortest Path
Bellman Ford Algorithm Greedy Algorithms:
Fractional Knapsack and other greedy Algorithms , Comparative study of Dynamic and greedy
algorithms. Graphs: Minimum spanning trees: Kruskal's Algorithm,
Prim's Algorithm. Dijkstra's Algorithm, Single source shortest path, BFS, DFS.
Backtracking: 8 Queen Problems, Sum of Subset Problem, Graph
Coloring Problem, Hamiltonian Cycle.
Branch & Bound: The Least cost Search, FIFO, LC branch & bound, 0/1 Knapsack Problem.
NP hard and NP complete:
NP Hard and NP complete Problems, Cooks Theorem.

Suggested Readings:
- Ellis Horowitz, Sartaj Sahani, Sanguthevar Rajashekaran - Fundamentals of Computer Algorithms 2nd Ed., Galgotia Publications
- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein- Introduction to Algorithms, 3rd Ed., MIT Press.
- S.K Basu- Design Methods and Analysis of Algorithms, 2nd Ed., PHI

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC18	Linux/Unix Lab	0L-0T-4P	NONE

Course Outcomes: After completion of the course students will be able to:
CO1: Work confidently in Unix/Linux environment.
CO2: Write shell scripts to automate various tasks**.**
CO3: Master the basics of linux administration.

Course Content:
Linux/Unix

- Basic overview and history of unix/linux
- Command line basics
- Commands: ssh, ls, pwd, cd, cp, rm, mv

- Accessing remote servers and files
- Editing and manipulating files
- Piping commands and saving output
- Searching in command line history
- Commands: mkdir, nano, cat, head, tail, less, clear, grep, sort, uniq, man, >, |, ssh-keygen

- OS basics, processes
- Filesystem layout
- File permissions
- Commands: chmod, find, locate

- Overview of popular Linux distributions
- Running Linux in a virtual machine
- Super user powers
- Installing applications
- Commands: make, apt-get

- Simple Bash shell scripting
- Compiling C/C++ files
- File processing: awk, sed
- Commands: gcc, sh

- Scripting

- Basic system administration
- Setting environment variables
- Listing users and processes

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

- Basics of mount and NFS
- Commands: uname, users, finger, alias, ps, top, kill, mount, df, du

- Source control with SVN
- More powerful editors: emacs, vim
- More commands: svn, tar, screen, nohup, disown, nice, cron, whereis, which, diff, scp, rsync

- Network Configuration
- Network background knowledge
- Basic Networking debugging

- IP Addressing
- Address Resolution Protocol
- Packet Sniffing
- Unsecure vs Secure Network Connections

Suggested Readings:

1. Barrett and Wagner," C and Unix": Tools for Software Design
2. Eric Foster-Johnson, John C. Welch and Micah Anderson," Beginning Shell Scripting"
3. Paul Love et al, ".Beginning Unix"
4. Naba Barkakati," Linux All-in-One Desk Reference For Dummies", 2nd Edition
5. Neil Matthew and Richard Stones, "Beginning Linux Programming", 4th Edition

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC19	Internet and Web Engineering	3L-1T-0P	None

Course Outcomes: Upon completion of the course, the students should be able to:
CO1: Explain the importance of Web development process and the continuous maintenance required by the Web project.
CO2: Apply the evolutionary web development process for creating web applications and web services.
CO3: Develop user –interfaces for web applications using HTML, DHTML, XML and their related technologies.

CO4: Understand in detail the Internet model along with its detailed functioning.

CO5: Understand different cryptographic algorithms required to secure the data over the Internet.

Course Content:	**No of Hours: 42**

Introduction to Web Engineering: Need of Web Engineering, Web Applications and their Categorization, Characteristics of Web Applications, Software Engineering v/s Web Engineering, Difference between a web application and a software, Evolutionary web development process   (6: Hours)

World Wide Web, Introduction to Internet, Intranet and Extranet, Introduction to LAN, MAN and WAN, Brief history of Internet, Introduction to Internet model   (3: Hours)

Introduction to TCP/IP, OSI model, layered architecture, functions of each layer   (5: Hours)

Session & Presentation Layer, Encryption standards, Encryption, Decryption, Data Encryption standards. (DES), 2- DES and it weaknesses, 3-DES, RSA (Public key. Pvt. Key Algorithms), Authentication, Digital Signature certification.   (8: Hours)

Introduction to different protocols: DNS, Email, FTP, SNMP, SMTP, RPC, Firewalls, Proxy Sewer, RAS, VLAN   (6: Hours)

Securing Network Systems: IP security and VPN (VPN architecture, Authentication), Firewall   (4: Hours)

Introduction to Web Design: HTML and DHTML, HTML Basic Concepts, Static and dynamic HTML, Structure of HTML documents, HTML Elements, Linking in HTML, Anchor Attributes, Image Maps, Meta Information, Image Preliminaries, Layouts, Backgrounds, Colors and Text, Fonts, Tables   (4: Hours)

Introduction to CGI PERL, JAVA SCRIPT, JSP APPLET, XML, PHP, ASP, Cookies   (6: Hours)

Suggested Readings::

Roger Pressman, "Web Engineering: A Practitioner's Approach", McGraw-Hill Higher Education

William Stallings, "Cryptography and Network Security: Principles and Practice", 5th edition, Pearson

Behrouz A. Forouzan, "Data Communications and Networking", 5th edition, McGraw-Hill Higher Education

Behrouz A. Forouzan, "Cryptography and Network Security", 2nd Edition, McGraw-Hill Higher Education

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC20	Compiler and Translator Design	3L-1T-0P	None

Course Outcomes:

1. To be familiar with compiler architecture and its phases.
2. To be familiar with lexical analyzer and parser tools like lex and yacc.
3. To be familiar with the different compiler optimization techniques.

Course Content:	**No of Hours: 42**

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

Introduction and difference between a Compiler and a Interpreter, Different phases of a Compiler

Lexical analysis: languages, Regular expressions, Regular Definitions, Finite Automata,

State M/c Driven Lexical Analyzer.

Lexical analyzer Generators : LEX,Thompson's construction

Subset Construction : Converting a NFA to DFA,DFA minimization,Regular expression to DFA

Context Free Grammars, Derivations and Sentential Forms,LL and LR Grammars, Parse Trees,

 Ambiguous Grammars, Syntax Directed Translation,Top Down parsing, LL(1) Grammars

Making the Parse Tables, Bottom Up parsing, Creating SLR, canonical LR(1) and LALR tables

Introduction to Parser Generating tools e.g. YACC, Semantic Analysis, Error Recovery in table Driven parsers,

Time Environments, Code Generation, Symbol Table Management

Code Optimization Techniques

Suggested Readings:

1. Alfred Aho, Ravi Sethi, V. Jeffery Ullman D "Compilers Principle, Techniques and Tools" Addison-Wesley.
2. Allen Holub "Compiler Design in C", Prentice Hall of India.
3. Santanu Chattopadhyay "Compiler Design", Prentice Hall of India

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC21	Modeling and Simulation	3L-0T-2P	None

Course Outcomes:

CO1: To provide an insight into how simulation modeling can aid in effective decision-making.

CO2: To familiarize he student with various simulators

Course Content: **No of Hours: 40**

Inventory Concepts: The technique of Simulation, Major application areas, concept of a System, Environment, Continuous and discrete systems, systems modeling types of models progress of a Simulation Study, Monte Carlo Method, Comparison of Simulation and Analytical Methods. Numerical Computation Technique for discrete and continuous models, Continuous System Simulation.

Probability Concepts in Simulation: Stochastic variables, Discrete and Continuous Probability Functions, Numerical evaluation of continuous probability functions, continuous uniformaly distributed random numbers, Random Number Generators - Linear congruential Generator, Mid Square Method, Multiplicative Congruential generator, rejection Method, Testing of random Numbers, Generation of Stochastic variates, Arrival patterns

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

Service times.

Discrete System Simulation and GPSS: Discrete Events, Representation of Time, generation of arrival patters, fixed time step versus next event simulation, Simulation of a Telephone System, delayed calls. Introduction to GPSS : Creating and moving transctions, queues, facilities and storages, gathering statistics, conditional transfers, program control statements, priorities and parameters, standard numerical attributes, functions, gates, logic switches and tests, Variables, Select and Count.

Simulation Languages and Practical Systems: Continuous and discrete systems languages, factors in the selection of discrete system simulation language. Computer model of queueing, inventory and scheduling systems.
Design and Evaluation of simulation Experiments: Length of simulation runs, validation, variance reduction techniques, experimental layout, analysis of simulation output, Recent trends and developments.

Suggested Readings:

Geoffrey Gordon, "System Simulation", 2nd edition, PHI

Narsingh Deo, "System Simulation with digital computer"-, PHI

Averill M. Law & W. David Kelton Simulation, "Modelling & Analysis", TMH

Banks, John, S.Carson, Barry L. Nelson, David M. Nicol, "Discrete Event System Simulation", PHI

Course No	Title of the Course		Course Structure		Pre-Requisite
ITC22	Training (6-8 weeks)		-		None

Course Outcomes: After completing this course the student must have the sound knowledge and ability to

CO1: hands on technology innovation.

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC23	Project-I	-	None

Course Outcomes: After completing this course the student must have the sound knowledge and ability to

CO1: Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

Course No	Title of the Course	Course Structure	Pre-Requisite
ITC24	Project-II	-	None

Course Outcomes: After completing this course the student must have the sound knowledge and ability to

CO1: Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

SYLLABUS OF FOUNDATION ELECTIVES

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE001	Sports-I	0L-0T-4P	None

COURSE OUTCOMES (CO):

To evolve a higher education system that is suitability blended with provision for knowledge values and skill practice where every student learns in without sacrificing his/her creativity.

COURSE CONTENT:

(Any Two out Of 4 Components)

A. **INTRODUCTION TO PHYSICAL EDUCATION IN THE CONTEMPORARY CONTEXT (Any Two)**
1. Learn and demonstrate the technique of Suryanamaskar.
2. Develop Physical Fitness through Calisthenics / Aerobics / Circuit-Training / Weight-Training and demonstrate the chosen activity.
3. Select any one game available in the college and learn different techniques involved in its play

B. **CORE PHYSICAL EDUCATION-: FITNESS, WELLNESS AND NUTRITION (Any Two)**
1. Measurement of Fitness Components – Leg-raise for Minimal Strength (Muscular Strength); Sit-ups Muscular Endurance); Harvard Step Test, Run and Walk Test (Cardiovascular Endurance); Sit and Reach Test (Flexibility)
2. Measuring height, weight, waist circumference and hip circumference, Calculation of BMI (Body Mass Index) and Waist-Hip Ratio
3. Engage in at least one wellness programme and write a report on it.

C. **CORE PHYSICAL EDUCATION-: POSTURE, ATHLETIC CARE AND FIRST AID (Any Two)**
1. Demonstrate Stretching and Strengthening Exercises for Kyphosis, Scoliosis, Lordosis, Knock Knees, Bow Legs, Flat Foot, Back Pain and Neck Pain
2. Illustration and Demonstration of Active and Passive Exercises
3. Asanas with Therapeutic Value (Any five asanas): Karnapeedasana, Padmasana, Dhanurasana, Sarvangasana, Paschimottanasana, Chakrasana, Halasana, Matsyasana, Ardhmatsyendrasana, Usthrasana, Mayurasana, Shirshasana, Vajrasana.
4. Practice P.R.I.C.E. in First Aid.

D. **SPORTS ADMINISTRATION & MANAGEMENT (Any Two)**
1. Demonstration of Supervision activities in Sports Management.
2. Demonstration of skills of Management.
3. Demonstration of fixtures of various kinds in sports competitions.
4. Demonstration of technical and non-technical purchase procedure.

Passed in the meeting of Standing Committee on Academic matters, University of Delhi, held on
June 03, 2016

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

SUGGESTED READINGS:

1. Graham, G., ``Teaching Children Physical Education : Becoming a Master Teacher. Human Kinetics,'' Champaign, Illinois, USA.
2. Corbin, C. B., G. J. Welk, W. R Corbin, K. A. Welk, ``Concepts of Physical Fitness: Active Lifestyle for Wellness,'' McGraw Hill, New York, USA.
3. Anspaugh, D.J., G. Ezell and K.N. Goodman, `` Teaching Today Health,'' Mosby Publishers
4. Beotra, Alka, ``Drug Education Handbook on Drug Abuse in Sports,'' Applied Nutrition Sciences, Mumbai.
5. Ammon,R., Southall , R.M. and Blair, D.A., ``Sports Facility Management, ''West Virginia, USA: Fitness Information Technology Publishers.

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE002	Sports-II	0L-0T-4P	FE001

COURSE OUTCOMES (CO):

To evolve a higher education system that is suitability blended with provision for knowledge values and skill practice where every student learns in without sacrificing his/her creativity.

COURSE CONTENT:

(Any Two out Of 4 Components)

A. Sports for all (Any Two)
1. To participate in any intramural Tournaments (one team game and one Individual Game) of choice.
2. To participate/ attend at least 15 hours in Fitness training at Field or at Gymnasium.
3. Participate in at least one track and one field event on Annual Sports day.
4. To participate in Inter College Tournament

B. MEDIA AND CAREERS IN PHYSICAL EDUCATION (Any Two)
1. Organize an event / intramural / tournament in your college.
2. Prepare a News Report of an observed Sports competition.
3. Create a presentation on any topic from Physical Education using an audio-visual aid.
4. Demonstrate Warming-up / Conditioning / Cooling-down exercises.

C. MANAGEMENT OF AEROBICS & GROUP TRAINING (Any Two)
1. Measurement of Fitness Components – Leg-raise for Minimal Strength (Muscular Strength); Sit-ups (Muscular Endurance); Harvard Step Test or Run and Walk Test (Cardiovascular Endurance); Sit and Reach Test (Flexibility)
2. Measurement of Pulse Rate / Heart Rate at Radial Artery and Carotid Artery, Calculation of Target Heart Rate

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Passed in the meeting of Standing Committee on Academic matters, University of Delhi, held on
June 03, 2016

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

3. Developing a 5-10 minute routine of aerobics with appropriate music for each component of health related physical fitness

D. SPORTS INDUSTRY & MARKETING (Any Two)

1. Identify an issue or a trend in the sports industry: o Players in professional or college sports o Ownership
2. Marketing Plan: Environmental Factors and Product Plan Draft, Paper bibliography/works cited.
3. Sponsorship proposal
4. Developing a budget plan for an event
5. Athlete branding

SUGGESTED READINGS:

1. Covey, S. , `` 7 Habits of Highly Effective People, '' Covey Publications, USA
2. Magill, R.A., `` Motor Learning and Control: Concepts and Applications,'' McGraw Hill Publication.
3. Masteralexis, L.P., C. Barr and M. Humms, ``Principles and Practices of Sport Management,'' Jones and Bartlett Publisher
4. Bishop, J.G., ``Fitness through Aerobics,'' Benjamin Cummings USA.
5. Brown K.M., `` Physical Activity and Health: An Interactive Approach,'' Jones and Bartlett Publisher
6. Cornwell. T.B, `` Sponsorship in marketing: Effective communications through sports, arts and events, '' Routledge Publishers
7. DeGarris, L., ``Sports Marketing: A Practical Approach,'' Routledge Publishers, USA

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE003	National Service Scheme (NSS)	0L-0T-4P	None

COURSE OUTCOMES (CO):

1. Develop among them a sense of social and civic responsibility;

2. Utilize their knowledge in finding practical solution to individual and community problems;

3. Identify the needs and problems of the community and involve them in problem solving process;

4. Utilize their knowledge in finding practical solution to individual and community problems;

5. Develop capacity to meet emergencies and natural disasters

COURSE CONTENT:

Passed in the meeting of Standing Committee on Academic matters, University of Delhi, held on June 03, 2016

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

Unit-I Introduction to NSS: Orientation and structure of NSS, History of Social Reforms in Modern India: Brahmo Samaj, Arya Samaj, Satya Shodhak Samaj: Principles and Functions

Unit-II Regular activities: Distribution of working hours- association between issues and programs- community project- urban rural activities, association- modes of activity evaluation

Unit-III concept of society- development of Indian society: Features- Division of labors and cast system in India; Features of Indian constitution; Provisions related to social integrity and development

Unit – IV N.S.S. Regular Activities

A) College campus activities

B) N.S.S.activities in Urban and Rural areas

C) Role of Non-Government Organisation (NGO) in social Reforms

i) Red Cross

ii) Rotary

SUGGESTED READINGS:

1. National Service Scheme Manual, Govt. of India

2. Training Programme on National Programme scheme, TISS.

3. Orientation Courses for N.S.S. programme officers, TISS.

4. Ram Ahuja, ``Social Problems in India," Rawat Publication.

5. History of Social Reforms in Maharashtra, Ed. J. Y. Bhosale, S. U. Kolhapur.

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE004	National Cadet Corps (NCC)	0L-0T-4P	None

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

COURSE OUTCOMES (CO):

1. Develop among them a sense of social and civic responsibility;

2. Utilize their knowledge in finding practical solution to individual and community problems;

3. Identify the needs and problems of the community and involve them in problem solving process;

4. Utilize their knowledge in finding practical solution to individual and community problems;

5. Develop capacity to meet emergencies and natural disasters;

COURSE CONTENT:

UNIT I: Introduction to NCC, National Integration & Awareness: Religions, Culture, Traditions and Customs of India, National Integration: Importance and Necessity, Freedom Struggle.

UNIT II: Adventure Training: – Obstacle course, Slithering, Trekking, Cycling, Rock Climbing, Para Sailing, gliding, Scuba Diving- methods and use.

UNIT III: Environment Awareness and Conservation: Natural Resources – Conservation and Management. Water Conservation and Rainwater Harvesting

UNIT IV: Personality Development and Leadership: Introduction to Personality Development, Factors Influencing /Shaping Personality: Physical, Social, Physiological, Philosophical and Psychological, Self Awareness Know yourself/ Insight, Change Your Mind Set, Communication Skills: Group Discussion / Lecturettes (Public Speaking), Leadership Traits, Types of Leadership

SUGGESTED READINGS:

1. Bhogle Anita & Bhogle Harsha, ``The Winning way, Learning from sports for managers,'' Westland Publications
2. Sharma Robin, `` The leader had no title, '' Simon and Schuster Ltd.

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE005	Corporate social	2L-0T-0P	None

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

responsibilities		

COURSE OUTCOMES (CO):

1. The course will help students to understand corporate and emerging social responsibility for the corporate in reference to India and global situation
2. The course will support students to prepare themselves to work with corporate understanding collective aspiration of the society, individual and corporate social responsibility.

COURSE CONTENT:

UNIT I: Corporate social responsibility in Indian context and International: CSR – Definition, concepts, Approaches of CSR, overview of corporate social responsibility and corporate social accountability, SR Tools, National and International CSR activities, corporate philanthropy, drivers of CSR, difference between corporate governance, corporate philanthropy and CSR

UNIT II: Business ethics and corporate social responsibility: Concept of business ethics – meaning, Importance and factors influencing business ethics. Corporate Governance – meaning, significance, principles and dimensions. Ethical decision – making in different culture, consumer protection, environment protection, gender issues in multiculturalism, ethics and corruption, ethics and safety. Business benefits of CSR

UNIT III: Legislative measures of CSR: Corporate, labor, stake holders, Environmental and pollution. Social Accounting, Social Auditing, SA: 8000 and Corporate Social Reporting.

SUGGESTED READINGS:

1. Harsh Srivastava,`` The business of social responsibility,'' books for change
2. CV. Baxi and Ajit Prasad,`` Corporate social responsibility – concepts and cases," Excel Books
3. Dr. M. Mahmoudi,`` Global strategic management," Deep & Deep Publications Pvt. Ltd.
4. S K. Bhatia,`` International Human resource management – Global perspective," Deep & Deep Publications Pvt. Ltd.
5. J.P. Sharma, ``Governace, Ethics and Social responsibility of business, '' Ane books Ltd.
6. Kotler Philip and Lee Nancy, `` Corporate social responsibility; doing the most good for your company,'' John Wiley
7. Simpson, Justine and Taylor, John R, `` Corporate Governace Ethics and and CSR,'' Kogan Page Publishers

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE006	**Environmental Sciences**	2L-0T-0P	None

COURSE OUTCOMES (CO):

1. Recognize major concepts in environmental sciences and demonstrate in-depth understanding of the environment.
2. Develop analytical skills, critical thinking, and demonstrate problem-solving skills using scientific techniques.
3. Demonstrate the knowledge and training for entering graduate or professional schools, or the job market.

COURSE CONTENT:

UNIT I: Environmental Studies: Ecosystems, Bio-diversity and its Conservation

(i) The Multidisciplinary Nature of Environmental Studies Definition, scope and importance of Environmental Studies. Biotic and a biotic component of environment, need for environmental awareness.

(ii) Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structures and function of different ecosystem

(iii) Bio-diversity and its Conservation: Introduction to biodiversity —definition: genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, national and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity : Habitat loss, Poaching of wildlife, man wildlife conflicts, rare endangered and threatened species(RET) endemic species of India, method of biodiversity conservation: In-situ and ex-situ conservation.

UNIT II: Natural Resources: problems and prospects

(i) Renewable and Non-renewable Natural Resources

Concept and definition of Natural Resources and need for their management

• Forest resources: Use and over-exploitation, deforestation, case studies, timber extraction, mining, dams and their effects on forests and tribal people.

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

• Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems, Water conservation, rain water harvesting, watershed management.

• Mineral resources: Uses are exploitation, environmental effects of extracting and using mineral resources, case studies.

• Food resources: World food problems, changes causes by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

• Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Urban problems related to energy, case studies.

• Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

UNIT III: Environmental Pollution Control: Environmental Pollution, Definition, types, causes, effects and control measures of (a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution, (e) Noise pollution, (f) Thermal pollution. Nuclear hazards. Solid waste and its management: causes, effects and control measures of urban and industrial waste.

UNIT IV: Disaster Management, Social Issues, Human Population and the Environment. Social Issues, Human Population and the Environment, Sustainable development, Climate change, global warming, acid rain, ozone layer depletion, Environmental ethics: Issues and possible solutions, Consumerism and waste products, , Wasteland reclamation. Population growth, problems of urbanisation.

SUGGESTED READINGS:

1. E. Barucha,`` Textbook of Environmental Studies for Undergraduate Courses," Universities Press (India)

   Pvt. Ltd.

2 . S. Chawla,`` A Textbook of Environmental Studies," McGraw Hill Education Private Limited.

SCHEME OF COURSES - B.E. INFORMATION TECHNOLOGY

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE007	Environmental Development and Society	2L-0T-0P	None

COURSE OUTCOMES (CO):

1. To sensitize the students regarding the relationship between human society and ecosystem.
2. To help students understand the various approaches to the study of environment and ecosystem.
3. To create awareness among the students regarding environmental degradation and the importance of development and sustainable Development.

COURSE CONTENT:

UNIT I. Basic Issues and Approaches

a. Importance of the study of ecology and society

b. The relation between Environment and Development

c. Conceptual clarifications: social ecology; sustainable development; sustainability.

d. Approaches: Realism, Appropriate Technology, Ecofeminism

UNIT II. People and Natural Resources: Unequal Access and Shrinking Commons

a. Water: depleting water resources & pollution; unequal distribution of water –(utilization of water for commercial crops, industrial use, power generation), the big dams debate.

b.   Forest: Colonial policy, diverting resources for mining and other commercial and industrial use, monoculture and loss of biodiversity, rights of forest dwelling communities.

c.   Land: modern technology, green revolution, biotechnology and impact on land, shrinking commons and its effects on rural poor.

UNIT III. Environmental issues and Problems.

a. Environmental Pollution: Air, Water, Noise, Land and Radioactive Pollution

b.   Problems of urban environment (pollution, health, industrial accidents (e.g. Bhopal), occupational

hazards)

c. Climate change/Global warming.

UNIT IV. Role of Environmental Movements and the State.

a. Environmental Movements in India – Chipko, Narmada Bachao Andolan, Chilka Lake Orissa, are some examples.

SUGGESTED READINGS:

1. Chandna R.C,`` Environmental Awareness," Kalyani Publishers.
2. Agarwal S.K,`` Environmental Issues and Themes," APH Publishing corporation.
3. Barry John,`` Environment and social theory," Routledge.
4. Gadigil, Madhav and Ramachandra Guha,`` Ecology and Equity: The use and Abuse of Nature in contemporary India," OUP.
5. Gole Prakash,`` Nature conservation and sustainable development in India," Rawat publications .

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE008	Spoken Skills in English	2L-0T-0P	None

COURSE OUTCOMES (CO):

1. This course will focus on oral & presentation skills of students with practice sessions in the language lab.
2. This course will develop confidence building in oral skills of learners.
3. It will seek to encourage the day to day conversations/dialogues and communicative needs of learners with ample practice in the lab.
4. The theory class will boost practice in ample language exercises to encourage oral skills.
5. This will also involve practice sessions in interview skills, group discussions & pair work.
6. Basics of communication

COURSE CONTENT:

- Practice on listening and reading comprehension
- Language lab practice for group discussion and interviews
- Definition and discussion on communication & the barriers in communication with practical training to use language as a tool for sharing, discussing, handling and convincing others.

SUGGESTED READINGS:

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Everyday English I & II Cambridge University Press/Foundation books

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE009	Financial Literacy	2L-0T-0P	None

COURSE OUTCOMES (CO):

1. To provide in-depth knowledge of the banking and Principles of Investment, financial planning.
2. Help students in understanding stocks, sell strategy, mutual fund options, investing in education, planning for the future, purchasing your first home, taxes and tax planning, life insurance options, health insurance, property insurance, estate planning, and keeping money in perspective.

COURSE CONTENT:

UNIT I: Banking- Definition, Role of Bank in growth of saving and Investment, Types of banks , Services offered by banks, Deposits and Loans, Types of A/c, Opening a bank A/c, How to Transact with banks, KYC norms, (A/c opening form, Address Proof), How to read bank statement, Banking products and services, Calculating Interests – Saving, FD, Simple and Compound Interest, Power of compounding Loans, Types of loans, taking a home loan, Definition of EMI, Calculation of EMI, Post office-Account and transactions, Basic of foreign Exchange, Importance and Use of Foreign Exchange, Regulator Role of RBI, mutual funds.

UNIT II: Investment: Principles of Investment – Safety, Liquidity and Return, Investment plans, Hybrid plans-Ulip, SIP and VIP of mutual funds, index funds

UNIT III: Financial Planning- Meaning, Household financial health checkup, Important life stages, Medical and other Emergencies, ; Insurance, Meaning, Need and Wants, Loss protection, Life, non-life and health, Benefits of Insurance, Term plans, Social obligations Budgeting, Buying a house, Plan a vacation, Retirement planning, Price of procrastination, Market and financial instruments, Primary market, Secondary market, Financial Statement analysis,

UNIT IV: Scams, Fraud Schemes-Insider trading, Money laundering; Consumer protection and redressal mechanism, Rights of Consumers, Applicable to financial services, Filing a complaint, Complain to entity concerned, Regulators, Arbitration, Consumer courts, Govt. Websites-(PG Portals), Investor Associations, Taxes, Meaning, Need of Taxes, Types of taxes, How taxes impact income, Income, wealth and gift tax, Service tax, STT, Stamp Duty, Tax planning v/s tax evasion, Tax rates, Tax free bonds, Tax saving

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investment

SUGGESTED READINGS:

1. Braunstein, Sandra, and Carolyn Welch,`` Financial literacy: An overview of practice, research, and

 policy," Fed. Res. Bull.

2. Cole, Shawn A., and Gauri Kartini Shastry,`` Smart money: The effect of education, cognitive ability, and financial literacy on financial market participation," Harvard Business School, 2009.

3. Study material of NSE.

4. Gitman, joehnk and Billingsley, ``Personal financial planning,'' Cengage Learning

5. Madura Jeff,`` Personal finance student edition,'' Prentice Hall PTR.

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE010	Introduction to Indian Society	2L-0T-0P	None

COURSE OUTCOMES (CO):

To acquaint the students with the emergence and understanding of Indian Society, theoretical underpinnings of the complexity of society and also with the whole discourse contextualizing Sociology in India.

COURSE CONTENT:

1. **Unit –I Conceptualizing Indian Society:**
 Hindu society and Diverse society (Regional, Linguistic, Religious diversities); Peoples of India-

Groups and Communities ; Unity in diversity; Ethnicity and ethnic identities.

2. **Unit –II Theoretical perspectives I:**
Indological/ Textual (G.S. Ghurye, L. Dumont Structural – Functional M.N. Srinivas, S.C. Dube).

Marxian (D.P. Mukherjee, A.R. Desai)

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3. **Unit –III Theoretical perspectives II:** Civilizational view (N.K. Bose, Surajit Sinha). Subaltern perspective (B.R. Ambedkar, David Hardiman).

SUGGESTED READINGS:

1. Robert W. Stern, `` Introduction: Change, the societies of India and Indian society'' Cambridge University Press
2. Dhanagare. D.N,`` Themes and perspectives in Indian sociology," Rawat Publication.
3. Dube. S.C.`` The Indian Villages," R and K Publication
4. Dumont. Louis Homo Hyerrchicus,`` The Caste System and its implications," Vikas publications.
5. Hardiman, David,`` The coming of the Devi :Adivasi Assertion in western India," Oxford University Press.
6. Marrott. Mckim,`` India through Hindu categories ," Sage publication.
7. Momin. A. R,`` The legacy of G.S. Ghurye. A cemennial festschrift," Popular prakashan.
8. Mukherjee. D.P,`` Diversities," Peoples publication house.
9. Singh. Y,`` Indian Sociology social conditioning and emerging concerns," Vistaar publication.
10. Singh. Y,`` Modernisation of Indian tradition," Thomson press.
11. Singh. K.S.`` The Peoples of India. An introduction," Seagull books.
12. Srinivas. M.N,`` India's Villages," Asia publishing house.
13. Singh Y,`` Identity & Theory in Indian Sociology," Rawat Publication.

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE011	**Soft Skills and Personality Development**	1L-0T-2P	**None**

COURSE OUTCOMES (CO):

Enable students to develop a basic English workplace vocabulary, comprehend sentences spoken or written in English and enables them to confidently converse in simple English.

COURSE CONTENT:

Unit 1: Conceptual Understanding of Communication; Cognition and Re-Cognition; Types of communication: Oral, Verbal, Non-verbal, Kinesics, Interpersonal, Group and Mass Communication, Communion, Barriers to communication; Values and Belief system.

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Unit 2 : Spoken Communication; Art of debating, Elocution, Stage Anchoring, Group Discussion; Interviews; Quiz; Use of Jargon, Slangs and Vocabulary for effective Communication; Voice Modulation and Intonation; Clarity; Brevity; Articulation of thought and speech; Assertiveness; Affirmation.

Unit 3 : Written Communication, KISS rule; Resume writing; Letter writing; Taking notes; Recording minutes and preparing proceedings of meetings; Role of empathy and compassion.

Unit 4 : Self-assessment; Self awareness; Self-esteem, Self-confidence; Perception and observation skills; Benefits of Meditation and Self-Hypnosis, Goal setting and career planning.

Practical: Debate, Declamation; Presentation exercises and written communication exercises.

SUGGESTED READINGS:

1. Barker. A,`` Improve Your Communication Skills," Kogan Page India Pvt Ltd.

2. Adrian Doff and Christopher Jones,`` Language in Use (Upper-Intermediate)," Cambridge University.

3. John Seely,`` The Oxford Guide to Writing and Speaking," Oxford University Press.

4. Shiv Khera,`` You Can Win," Macmillan Books.

5. Stephen Covey,`` 7 Habits of Highly Effective People," Simon and Schuster

6. John Collin,`` Perfect Presentation ," Video Arts Marshal.

7. Jenny Rogers,`` Effective Interviews," Video arts Marshal.

8. Robert Heller,`` Effective Leadership: Essential Manager Series," DK Publishing.

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE012	**Business Communication and Presentation Skills**	1L-0T-2P	**None**
COURSE OUTCOMES (CO):			
To develop management communication skills in the students that will help the students to face future			

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endeavors and will also help in their interviews.

COURSE CONTENT:

Unit-I:

Identity Management Communication:– Face to Face Impression Management & Mediated Communication (Self Introduction & Self-Promoting– Over Stating And Under Stating – Strategies to Overcome Communicative Inhibitions – Creating Positive Self-image through words - Appearance-Verbal and Non Verbal Manners) – Giving Polite Yet Assertive Responses – Responsive strategies to handle criticism - Accepting Failure and Declaring Success.

Unit-II

Business Presentations:– Oral and Power Point Presentations; Preparing Successful Presentations; Assessing Audience, Making Effective Use of Visual Aids, Delivering Presentation, Using Prompts, Handling With Questions and Interruptions, Mock Presentations.

Unit-III

Oratory Skills: – Group Discussion, Extempore, Mock Parliament and Mock Press.

Unit-IV

Interview Management: – Resume Preparation, Types of Interviews, Preparing For Interviews, Facing Interviews, Handling Tough & Tricky Questions, Reviewing Performance, Participating In Mock Interviews

SUGGESTED READINGS:

1. Lori Harvill Moore,`` Business Communication," Bookboon

2. John Thill, Courtland L. Bovee ,`` Excellence in Business Communication," Pearson Prentice Hall

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Course No.	Title of the Course	Course Structure	Pre-Requisite
FE013	Theatre	0L-0T-4P	None

COURSE OUTCOMES (CO):

Our goal is to nurture artist-scholars who are well read in dramatic literature, who understand the social and historical contexts of that literature, who appreciate contemporary performance and dance, who think critically, who master discipline-specific skills, and who make compelling artistic choices on stage.

COURSE CONTENT:

Unit 1 : Concept of Acting in Indian Classical theatre. Western styles of theatre acting.

Unit 2 : Basics of the following: Acting in Grotowski's Poor Theatre, Modern concept of Actor training with reference to Meyerhold, Bertold Brecht and ConstantinStanislavesky; Artaudian acting, Theatre of Cruelty; Theatre of Absurd.

Unit 3 : Acting for Camera –Knowledge of camera frames and movement within the confines of a frame, blocking, difference between theatre and Camera acting, Concentration.

Unit 4 : Acting consistently for different takes, acting scenes out of order, Auditions, acting exercises. Art of Dubbing.

SUGGESTED READINGS:

1. Boleslavsky, Richard,`` Acting: the First Six Lessons," New York Theatre Arts.

2. Hagen, Uta,`` Respect for Acting," Macmillan Press.

3. Hodge, Alison,`` Twentieth Century Actor Training," London and New York.

4. Routledge ,Stanislavski, Konstantin,`` An Actor's Work: A Student's Diary," Trans. and ed. Jean

5. Jeremiah Comey ,`` The Art of Film Acting," Focal Press .

6. Philips B Zarrilli,`` Acting (Re) Considered," Routeledge .

7. Cathy Hassey,`` Acting for Film," Allworth Press

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Course No.	Title of the Course	Course Structure	Pre-Requisite
FE014	Dance	0L-0T-4P	None

COURSE OUTCOMES (CO):

This course will provide the student with the fundamentals necessary for advanced dance skills. Further, this course will develop student appreciation of dance as an art form and lifetime activity. Designed to familiarize students with technique, the student will also study vocabulary, different forms of dance, issues in dance and the history pertaining to the world of dance. The student will develop kinesthetic awareness, movement memory, creative abilities and aesthetic appreciation of various dance forms. The enhancement and the development and maintenance of physical fitness, self-confidence, self-discipline and independence with the body by providing informal showings during class are the goals expected to be achieved. Each student should leave this class having been encouraged, esteemed, and take with them a new appreciation of dance.

COURSE CONTENT:

- Basic workout

- Introduction to Hip Hop and B-Boying with a simple choreography

- Exercise like: Rolling, jumping, moving shoulders. Footwork, Floor steps, Beat knowledge.

- Freestyle combination along with House dance style.

- Expressions class: Body expressions, Face expressions.

- Introduction of Contemporary Dance. Basic exercise of Contemporary Dance. Exercise for flexibility, Floor steps, Spinning and Balancing.

- Introduction to Jazz. Basic exercise and proper routine practice.

SUGGESTED READINGS:

1. Jonathan Burrows, ``A Choreographer's Handbook,'' Routledge
2. Jacqueline M. Smith-Autard, ``Dance Composition: A Practical Guide to Creative Success in Dance Making,'' Routledge

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Course No.	Title of the Course	Course Structure	Pre-Requisite
FE015	Yoga	0L-0T-4P	None

COURSE OUTCOMES (CO):

Students will learn about the importance of yoga in their lives. They will be exposed various types of yoga, their health benefits.

COURSE CONTENT:

UNIT-I

Origin of Yoga & its brief development, Meaning of Yoga & its importance, Yoga as a Science of Art (Yoga Philosophy),Meaning of meditation and its types and principles.

UNIT- II

Classification of Yoga/Types of Yoga, Hatha Yoga , Raja Yoga, Laya Yoga, Bhakti Yoga, Gyan Yoga, Karma Yoga, Asthang Yoga.

UNIT –III

Principles of Yogic Practices, Meaning of Asana, its types and principles, Meaning of Pranayama, its types and principles, Meaning of Kriya its types and principles.

UNIT -IV

Yogic therapies and modern concept of Yoga, Naturopathy, Hydrotherapy, Electrotherapy, Messotherapy,Acupressure, acupuncture, Meaning and importance of prayer, Psychology of mantras, Different mudras during prayers.

SUGGESTED READINGS:

1. William Broad,`` The Science of Yoga: The Risks and the Rewards," Simon and Schuster

2. Swami Vishnu Devananda,`` The Complete Illustrated Book of Yoga," Harmony

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Course No.	Title of the Course	Course Structure	Pre-Requisite
FE016	Digital Film Making	0L-0T-4P	None

COURSE OUTCOMES (CO):

Students will learn about various technicalities involved in digital film making. They will also expose to history of cinema, preproduction etc.

COURSE CONTENT:

Unit 1 – History of Cinema, Research & Script

Early Cinema, Development of Classical Indian & Hollywood Cinema, History of Global Film including European Film (1930-present), Origin of Classical narrative cinema-Soundless film, Exploration of film and analysis of the three-part beginning, middle and end of story, **Research**(Finding and Collecting materials and facts related to your story. Where and How to find the materials related to your story. Things to consider before sketching down your story), **Script (Scriptwriting Process and its various phases), Film Grammar for Scriptwriting.**

Unit 2 – Pre-Production

Digital Video Cinematography: Introduction to Digital Video Cinematography

Cinematography, Interactivity and emotions through Cinematography,

Building blocks, Compositions, Lenses and Cameras, Types of lenses: Zoom Lens, Prime Lens, Types of Cameras: HD Cameras, Basics of Film Camera, Difference between, Film Camera and Digital Camera, DSLR and HDSLR Cameras, Lighting, Psychology of light, Visual Environment, Directional Effect of Light, Lighting design process, Three-point lighting, High-Key lighting, Low Key lighting, Construction of a Shot, Color, Contrast, Deep Focus, Shallow Focus, Depth of Filed, Exposure, Racking focus, Frame Rate, Telephoto shot, Zoom shot.

Unit 3- Digital Video Editing

Effective Editing, Principles of Video Editing, Non-Linear Editing (NLE) Concept, The Three-Point Edit, Non-Linear Editing (NLE) Techniques, Working in the Timeline, Transitions, Key framing, Applying Filters, Ingesting.

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Unit-4Advanced Editing Techniques
NLE Compositing, Color Correction & Color Grading, Working on Audio, Titling
SUGGESTED READINGS:
1. Mark Brindle and Chris Jones, `` **The** Digital Filmmaking Handbook," Quercus

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE017	Workshop (Electrical and Mechanical)	0L-0T-4P	None

COURSE OUTCOMES (CO):

1. Student will be able to make various joints in the given object with the available work material.
2. The students will be able to understand various wiring connections

COURSE CONTENT:

Mechanical Workshop Experiments

1. BLACKSMITH

2. CARPENTRY

3. FITTING

4. FOUNDRY

5. WELDING

Electrical workshop Experiments

1. STUDY & PERFORMANCE OF DIFFERENT TYPES OF WIRE JOINTS

2. STUDY AND PERFORMANCE OF STAIRCASE WIRING

3. STUDY AND PERFORMANCE OF SERIES AND PARALLEL CONNECTION OF

   FLOURESCENT TUBE LIGHT

4. STUDY AND PERFORMANCE OF GODOWN WIRING

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5. SERIES AND PARALLEL CONNECTION OF BULBS AND POWER SOCKETS BY SINGLE SWITCH AND MULTI SWITCHES.

SUGGESTED READINGS:

1. Hajra Choudhury, Hazra Choudhary and Nirjhar Roy, ``Elements of Workshop Technology, vol. I, '' Media promoters and Publishers Pvt. Ltd.
2. W A J Chapman, Workshop Technology,`` Part -1, 1st South Asian Edition,'' Viva Book Pvt Ltd.
3. P.N. Rao, ``Manufacturing Technology, Vol.1,'' Tata McGraw Hill
4. Kaushish J.P., `` Manufacturing Processes, '' Prentice Hall

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE018	Music	0L-0T-4P	None

COURSE OUTCOMES (CO):

The student will be familiarized with the basic terms used in Indian classical music. Also it familiarizes with the life history of some dignitaries in the field of music. This course also throws some light on the ancient music and its origins in India.

COURSE CONTENT:

Unit 1 : Study of the following terms:- Mela (Thãt), ÃshrayRãga, Rãga, Lakshana, Shruti, Alankar, Gamak, Vadi-SamvãdiAnuvãdi-Vivãdi, VakraSwara, Varjit-Swara.

Unit 2 : Biographies & contributions of the following:- Jaidev, MansinghTomar, Abdul Karim Khan, Tyagaraja, Pt. Bhatkhande, Pt. Ravi Shankar

Unit 3 : Study of following Rãgas&TãlaRãga- Yaman, Jaunpuri, Khamaj. Tãla- Ektãl, Jhaptãl

Unit 4 :Genaral discussion and definition of the following:-

a. Khyãl, MaseetKhani – Razakhani gat, Dhrupad, Tarana, Meend, Soot, Murki, Kan, Khatka, Krintan, Harmony, Melody.

b. Writing of Bhatkhande Swarlipi Paddhati.

Passed in the meeting of Standing Committee on Academic matters, University of Delhi, held on June 03, 2016

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c. Writing of Tãlasand Compositions in Notation.

d. Detailed study of Rãgas (Rãga- Bihag, Malkauns, Vrindavani Sarang) and comparative study of Rãgas.

e. Essay, Shastriya Sangeet (Classical Music) & SugamSangeet(Light Music)

Unit 5 : Vedic Music – Samvedic Sangeet, Swara, Vadya, Bhakti, Vikãr .

General study of Natyashastra, SangeetRatnakar.

SUGGESTED READINGS:

1. Vasant and Laxmi Narayan Garg,`` Sangeet Visharad," Sangeet Karyalay

2. Sarat Chandra Pranjpayee and Chowbhamda ,`` BhartiyaSangeetkaItihas," Surbharti Prakashan

3. Bharat Muni,`` NatyaShastra,"

4. Sharangdeva ,`` SangeetRatnakar,"

5. Sharad Chandra Pranjpayee ,`` Sangeet Bodh,"

6. Thakur Jaidev Singh ,`` Indian Music," Sangeet research academy

7. V. N. Bhatkhande,`` Mallika Part II & III," KramikPustak.

8. V. N. Patwardhan,`` RaagVigyan,"

9. RaginiTrivedi,`` Ragvibodha Mishrabani, Vol. I & II,''

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE019	Sociology of Development	2L-0T-0P	None

COURSE OUTCOMES (CO):

The course introduces the students to the issues pertaining to development in the contemporary context. It familiarizes and discusses the theories and models of development and their alternatives and critiques. It also introduces the concept of social exclusion that has emerged in the development

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discourse in the era of globalization.

COURSE CONTENT:

1. Concepts Progress, Growth, Modernization and Development
2. Development Theory Adam Smith, Karl Marx, Talcott Parsons.
3. Development of Underdevelopment, Dependency and World Capitalist System-A.G.Frank, Paul Baran, Samir Amin, Immanuel Wallerstein

4. Critique and Alternative to Development
5. Gender and Development, Culture and Development, Environment and Development, Human Development Index, Gender Development Index

   Gandhi and Schumacher on Alternative development model Appropriate Technology, Sustainable Development

6. Understanding India's Development Debate on the Development Model in India: Nehru, Gandhi, Ambedkar,
7. New Economic Policy
8. Disparities in Development: Class, Caste, Gender, Tribe, Region and Religion
9. Social Exclusion in the era of Globalization
10. Social Exclusion: Minorities and the other Marginalized Development of the Marginalized: Perspectives and Challenges

SUGGESTED READINGS:

1. Debal K. Singha Roy,`` Social Development and the Empowerment of Marginalized Groups," Sage Publications
2. Desai, A.R.,`` Essays on Modernisation of Underdeveloped Societies Vol I and II," Thacker and Company Ltd.
3. Dereze Jean and SenAmartya,`` India Development and Participation," Oxford University Press.
4. Preston, P. W.,`` Development Theory An Introduction," Blackwell Publishers, Oxford.

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE020	**Universal Human Values 1: Self and Family**	**2L-0T-0P**	**None**
COURSE OUTCOMES (CO):			

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1. Sensitization of student towards issues in all dimensions of life

There are a whole range of issues which one faces in life towards which the young students are generally unfamiliar and therefore insensitive. Almost all the concerns - environmental, societal, familial or personal, are result of human action. Sensitization towards them therefore is an important step.

2. Inculcation of Self Reflection.

Human action is governed by various internal factors primarily the beliefs one holds, and therefore 'looking-in' becomes essential, to see what beliefs one is holding, whether they are really true or not, if they are not true, then what could be the process to get the "right" belief and then further validate it.

Most of the young people are somehow trained to look only —outside‖. The motivation and the skill to look inside are missing. Inculcation of self reflection in students will result in them becoming more responsible, honest and trustworthy. Lack of such dualities in individuals is major concern of organizations, institutions and society in general.

3. Understanding (Clarity) of Human Relationships and Family.

It will try to show that relationships and material prosperity are the basic desire for a human being. Two global problems which we face today are war (including terrorism) and imbalance in nature (global warming). If we look at reasons for war, the fundamental cause is: Human Being is in opposition to other Human Being. Therefore one is willing (or gets compelled) to exploit others. This is due to lack of understanding of relationships.

4.Exposure to Issues in Society and nature (larger manmade systems and Nature).

- To show that the fundamental reasons for imbalance in nature are: pollution and resource depletion. Both these aspects are result of consumerist model of development.
- To show how harmony can be ensured at following levels of our living: Individual, human –human relationships, larger society, Various social systems like education system, economic system, political system and others, and rest of the nature.

5. Development of Commitment and Courage to Act.

If the understanding is right, then the actions become right. Commitment and courage to act are considered consequences of right understanding in an individual. In the course, an attempt will be made to build right understanding in the individual, and then further plan of actions will also be discussed in order to implement the understanding in various life situations in the right manner.

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At the end of the course, students are expected to become more aware of their self and their relationships and would have better reflective and discerning ability. They would also become more sensitive to their surroundings including both people and nature, with commitment towards what they believe in (human values).

It is hoped that they would be able to apply what they have learnt to their own self in different ordinary day-to-day settings in real life with higher commitment and courage.

COURSE CONTENT:

1. Motivation and Objectives of Human Values Course.
Introduction to the objectives of the course. Content and process of the course including mode of conduct. Daily life as lab for the course. Activities in the course.
2. Purpose of Education How human being has a need for Knowledge, what should be the content of knowledge, how the content should be discussed in education. Complimentarily of skills and values, how the current education system falls short.

3. Peers Pressure, Social Pressure In various dimensions of life, how do these things work. What is the way out? In the context of education, peer pressure etc. movie —TaareZameen Par‖ can be used.

4. Concept of Competition and Excellence How competition leads to degradation of self and relationships. How excellence is the basic need of a human being. What is excellence? Movie —Fearless‖ can be used to discuss the concept.

5. Time Management:
How does one deal with myriads of activities in college? Focus of the mind.
6. Concept of Preconditioning. How preconditioning affects our thinking, behavior, work, relationships, society and nature. How do we develop pre-conditioning?
What are the various sources of preconditioning? How do we evaluate our Preconditioning? How do we come out of it?

7. Concept of Natural Acceptance in Human Being. What is natural acceptance? How can the concept of natural acceptance be used to evaluate our preconditioning. Universal nature of natural acceptance. Are anger, jealousy, hatred natural? How do we feel when we experience them? Which feelings are natural for a human being and which are not?

8. Understanding Relationships.
a) Are relationships important? What is the role of relationships in our life? If relationships are

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important then why they are important? If they are important then why it is the case that we are not discussing them?

What are the notions/conditions and factors which stop us to explore more into relationships. Relationships in family and extended family. Dealing with anger. Show film —Right Here, Right Now‖.

b) Basic expectations in relationships. Seven types of relations.

c) Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

d) Nine universal values in human relationships. Trust as the founding value.

e) Concept of acceptance. Unconditional acceptance in relationships.

f) Our preconditioning affecting our relationships. Our relationships with subordinate staff, with people of opposite gender, caste, class, race. Movie —Dharm‖(set in Varanasi) can be used to show the conflict between reconditioning and relationships. How relationships have the power to force a person to change his preconditioning.

9. Concept of prosperity

Material goods and knowledge of one's physical needs is essential for feeling of prosperity. What role others have played in making material goods available to me: Identifying from one's own life.

10. Idea of Society. What is a society? What constitutes a society? What systems are needed for a society to work? What is the purpose of society and various systems which are working in it? How understanding of Human Nature is important in order to understand the purpose of Society and various social systems? And what happens when this understanding is lacking?

11. Idea of decentralization of politics, economics, education, justice etc. Its comparison with centralized systems. The idea of Swaraj. Various social initiatives by NGOs, social organizations and other people. (If time permits)

12. Balance in nature

a) Balance which already exists in nature.

b) How human beings are disturbing the balance. Resource depletion and pollution.
Our own role in wastage of electricity, water and in use of plastics. Waste management. (Show episode on city waste from SatyamevaJayate 2.)

c) Issues like global warming, animal extinction. Show —Story of Stuff‖ documentary film. —Home‖ film can also be used.

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SUGGESTED READINGS:

1. Annie Leonard, `` The Story of Stuff,'' Free Press
2. Mohandas Karamchand Gandhi,`` The Story of My Experiments with Truth," Beacon Press
3. J Krishnamurthy,`` On Education," Official repository
4. Hermann Hesse ,`` Siddhartha," Bantam Books
5. ThichNhatHanh,`` Old Path White Clouds," Parallex Press
6. On Education - The Mother Aurobindo Ashram Publication
7. Anne Frank,`` Diaries of Anne Frank ,"
8. G S Banhatti`` Life and Philosophy of Swami Vivekananda," Atlantic
9. Swami Vivekanand`` Swami Vivekananda on Himself," Advaita Ashram
10. E. F Schumacher,`` Small is Beautiful: Economics as if people mattered,"Harper Pereinnial.

11. Cecile Andrews ,`` Slow is Beautiful," New society publishers
12. A.Nagaraj,`` JeevanVidya: EkParichaya," Jeevan Vidya Prakashan.
13. A.N. Tripathi,`` Human Values," New Age Intl. Publishers.
14. Dharampal,`` Rediscovering India," Other India Press
15. Mohandas K. Gandhi,`` Hind Swaraj or Indian Home Rule," Navjeevan publication house
16. Maulana Abdul Kalam Azad,`` India Wins Freedom," Stosius Inc
17. Ramakrishna kijeevani ,`` Romain Rolland
18 Romain Rolland , "Vivekananda" Advait ashram.
19. Romain Rolland , "Gandhi" Srishti Publishers & Distributors.
20. ParamhansaYogananda,`` Autobiography of a Yogi," ," Rider publication.
21. Sahasrabudhe, "Gandhi and Question of Science,"Other India Press.

Course No.	Title of the Course	Course Structure	Pre-Requisite
FE021	**Universal Human Values 2: Self, Society and Nature**	2L-0T-0P	FE020

COURSE OUTCOMES (CO):

1. Sensitization of student towards issues in society and nature.
2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.

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3. Strengthening of self reflection.
4. Development of commitment and courage to act.

At the end of the course, students are expected to become more aware of their surroundings, society, social problems and their sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they believe in (humane values. humane r learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction relationships and humane society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

COURSE CONTENT:

In Universal Human Values 2 course, the focus is more on understanding society and nature on the basis of self and human relationships. and motivation for the course.-conditioning, and natural acceptance.
-existence of self and body. Identifying needs and satisfying needs of self and body. Self observations.
Handling peer pressure family. Hostel and institute as extended family. Real life examples.
-student relationship. Shraddha. Guidance. Goal of education.
– material order, plant order, animal order and human order.
Salient features of each. Human being as cause of imbalance in nature. (Film "Home" can be used.)
– water, food, mineral resources.
Pollution. Role of technology. Mutual enrichment not just recycling.
on of needs of the self and
needs of the body. Right utilization of resources. Understanding the purpose they try to fulfil.
Recapitulation on society. Five major dimensions of human society. Fulfilment of the individual as major goal. Justice in society. Equality in human relationships as naturally acceptable. Establishment of society with abhaya (absence of fear). being through holistic education in just order.

SUGGESTED READINGS:

Text Book
1. R R Gaur, R Sangal, G P Bagaria, "Human Values and Professional Ethics "Excel Books, New Delhi, 2010
 Reference Books
2 . A Nagaraj , "Jeevan Vidya: EkParichaya, " Jeevan VidyaPrakashan, Amarkantak.
3 . A.N. Tripathi , "Human Values," New Age Intl. Publishers, New Delhi, .

Passed in the meeting of Standing Committee on Academic matters, University of Delhi, held on
June 03, 2016

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4. Annie Leonard, "The Story of Stuff" Simon and Schuster.

5. Mohandas Karamchand Gandhi, " The Story of My Experiments with Truth " Becon Press.

6. J Krishnamurthy, " On Education " Official repository.

7. Hermann Hesse, "Siddhartha " Bantan press.

8. ThichNhatHanh, " Old Path White Clouds " parallax press.

9. On Education - The Mother Aurobindo Ashram Publication.

10 . Diaries of Anne Frank – Anne Frank

11. G.S Banhatti, "Life and Philosophy of Swami Vivekananda," Atlantic publisher.

12. Swami Vivekananda , "Swami Vivekananda on Himself," Advait publication.

13. E. F Schumacher , "Small is Beautiful: Economics as if people mattered,"Harper Pereinnial.

14. Cecile Andrews , "Slow is Beautiful" New society publishers.

15. J C Kumarappa, "Economy of Permanence" Serve seva sangh prakashan.

16. Pandit Sunderlal , "Bharat Mein Angreji Raj"

17. Mahatma and the Rose plant

18 . M.Gandhi, "The Poet and the Charkha" Mani Bhavan

19. Dharampal, "Rediscovering India" other India press.

20 .Mohandas K. Gandhi , "Hind Swaraj or Indian Home Rule," Navjeevan publication house.

21. Arvind Kejriwal , "Swaraj" Harper publication.

22 . Maulana Abdul Kalam Azad, "India Wins Freedom."Stosius Inc.

23. Romain Rolland , "Ramakrishna kijeevani,"Advait Ashram.

24. Romain Rolland , "Vivekananda" Advait ashram.

25. Romain Rolland , "Gandhi" Srishti Publishers & Distributors.

26 . ParamhansaYogananda, " Autobiography of a Yogi," Rider publication.

27. Sahasrabudhe, "Gandhi and Question of Science,"Other India Press.

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SYLLABUS OF DISCIPLINE CENTRIC ELECTIVES

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD01	Distributed System and Computing	ED	3L-0T-2P	4	ITC11

Course Outcomes: At the end of the course, the student should be knowledgeable, skilled and proficient in

CO1: The issues, design and architecture of distributed systems.
CO2: The techniques for efficient message passing through IPC, RPC, etc.
CO3: Capable of handling deadlocks, problems related to synchronization and efficiently using the memory in a distributed system through distributed shared memory.
CO4: Adapt to management of resources, load balancing and understanding/designing file systems through file-accessing models, file-sharing approaches, file-replication.

Syllabus   **No of Hours: 40**

Introduction to DCS, Distributed OS, Issues in designing Distributed OS. Overview of Networks, LAN, WAN, protocols, Inter-process communication, Pipes, FIFO, Message Queues, Shared Memory, Semaphores, Issues in IPC by message passing, Synchronization, Buffering, Multi-datagram Messages, Encoding & Decoding of Message Data, Process Addressing, , Failure Handling, Group Communication.

Remote Procedure Calls (RPC), RPC Model, Transparency of RPC, Implementing RPC mechanism, STUB Generation, RPC Messages, Server Management, Parameter-passing semantics, CALL semantics, Communication protocols for RPCs, Complicated RPCs, Client-server Binding, Exception Handling, Security, Special types of RPCs, RPC in Heterogenous environments, Lightweight RPC, Optimizations for better performance.

Introduction to Distributed Shared Memory (DSM), Architecture of DSM, Design and Implementation issues of DSM, Granularity, Structure of Shared-memory space, Consistency Models, Replacement Strategy, Thrashing.

Synchronization: Clock Synchronization, Event Ordering, Mutual Exclusion, Deadlock, Election Algorithms.

Resource Management, Features of a Global Scheduling Algorithm, Task Assignment Approach, Load Balancing Approach, Load Sharing Approach, Process Management, Process Migration.

Introduction to Distributed File Systems, File Models, File-Accessing Models, File-sharing schemes, File-caching schemes, File Replication, Fault Tolerance, Case Studies

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Suggested Readings:

1) Pradeep K. Sinha "Distributed Operating Systems: Concepts & Design", Wiley.
2) Doreen L. Galli, "Distributed Operating Systems: Concepts & Practice", Prentice Hall.
3) William Buchanan "Distributed Systems and Networks", McGraw-Hill.
4) Avi Silberschatz, Peter Baer Galvin & Greg Gagne "Operating System Concepts", John Wiley & sons.

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD02	Microprocessor and Applications	ED	3L-0T-2P	4	ITC12

Course Outcomes: Knowledge of architecture of basic microprocessors

Ability to build a microprocessor based system for practical applications

Syllabus   **No of Hours: 40**

Overview of 8085: Register Organization, Pin Diagram and Pin Descriptions, Addressing Mode, 8085 Instruction Set**8086:** Introduction, 8086 Architecture, Register Organization, Pin Diagram and Pin Descriptions. 8086 System Connections, Timing Diagram, Min Mode, Max Mode: Basic 8086 Microcomputer System using a logic analyzer to observe microprocessor bus signals, Troubleshoot a simple 8086 based microcomputer.

8086 Instruction Set: Addressing Modes, Instruction set, Assembler Directives and Operators.

8086 Assembly language Programming: Program development or constructing machine codes for 8086 instructions, Using the Assembly Program Development tools (Linker, Loader, Assembler, Editor, Loader).

8086 Interrupts and Interrupt Applications: Hardware Interrupt Applications.DMA Controller, Math Coprocessor 8087, CRT Controller 8275

80386 and 80486 - The 32 bit processors: Register Organization, Addressing Modes, Data types, Real Address Mode, Protected Mode, Segmentation, Paging, Virtual 8086 Mode.

Bus Systems: ISA Bus, EISA Bus, PCI Bus.

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Suggested Readings:
- Douglas V. Hall "Microprocessor and Interfacing"
- Barry B. Brey "The Intel Microprocessor: Architecture, Programming and Interfacing"
- John Uffenbeck "The 8086 Family: Design, Programming and Interfacing"
- James L. Antonakos "An Introduction to the Intel family of microprocessors"
- Abel "IBM PC Assembly Language and Programming"

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD03	Information Security	ED	3L-0T-2P	4	ITC13

Course Outcomes: After taking this course the students should be able to

CO1: Identify the major types of threats to information security and the associated attacks.

CO2: Identify the major techniques, approaches and tools used to discover network and system vulnerabilities.

CO3: Understand firewalls and packet filtering.

CO4: Understand the role of cryptography in information security.

CO5: The major types of cryptographic algorithms and typical applications.

CO6: Understand how digital signatures are performed and the role of digital certificates.

<div align="center">Syllabus   No of Hours: 40</div>

Overview of Modern Cryptography, Number Theory, Probability and Information Theory

Classical Cryptosystems and its analysis

Symmetric Key Ciphers, Modern Block Ciphers (DES), Modern Block Cipher (AES)

Cryptanalysis of Symmetric Key Ciphers: Linear Cryptanalysis, Differential Cryptanalysis, Other Cryptanalytic Techniques, Overview on S-Box Design Principles, Modes of operation of Block Ciphers

Stream Ciphers, Pseudorandom functions

Hash Functions and MACs: The Merkle Damgard Construction, Message Authentication Codes (MACs)

Asymmetric Key Ciphers: Number Theoretic Results, RSA, Knapsack, Rabin, ElGamal, Elliptic Curve, Diffie Hellman Key Exchange algorithm

Network Security: Kerberos, Pretty Good Privacy (PGP), Secure Socket Layer (SSL), Intruders and Viruses, Firewalls

Suggested Readings:
1. B. A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill.

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2.	Douglas Stinson, "Cryptography Theory and Practice", 2nd Edition, Chapman & Hall/CRC. W. Stallings, "Cryptography and Network Security", Pearson Education

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD04	Mobile Communication	ED	3L-0T-2P	4	ITC13

Course Outcomes:

CO1: To provide the students with Brief history of mobile communication and developments towards modern systems

CO2:To familiarize the students with Propagation characteristics of wireless channels- attenuation, fading, Multiple access technologies for resource sharing with TDMA, FDMA, CDMA , OFDMA .CO3:To provide the students the knowledge of Mobile Broadband technologies.

 Syllabus   **No of Hours: 40**

Introduction to Wireless Networks: Evolution of mobile wireless networks. Global system for communication (GSM), GPRS, WLANs, UMTS.

Transmission Fundamentals: Time domain concepts, frequency domain concepts, signal propagatio loss of radio signals, multipath propagation, multiplexing (SDM, FDM, TDM, CDM), modulation tech spread spectrum.

Wireless N/W configuration, Reference Model, Handover, Location Management, Addressing, Quality of service, Mobile N/W layer, Mobile Transport Layer, Mobile Application Protocol.

Wireless LAN: Introduction, advantages, transmission technologies, IEEE 802.11 standard, IEEE architecture, terminology, physical layer, MAC Management, Roaming.

Bluetooth Technology.

Wireless Application Protocol (WAP): WAP forum, WAP service model, WAP Protocol architecture programming model.

Suggested Readings:
1. SCHILLER, "Mobile Communications"
2. C. K. TOH, "Ad Hoc Mobile Networks"
3. D. P. AGRAWAL & QING_AN ZENG, "Introduction to Wireless and Mobile Systems"

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD05	Artificial Intelligence	ED	3L-0T-2P	4	ITC04, ITC17

Course Outcomes: After taking the course, the student should have a clear understanding of

CO1: Distinguish between a conventional system and an intelligent system.

CO2: Explain Artificial Intelligence concept and its applications.

CO3: Represent knowledge using various different techniques.

CO4: Use the appropriate searching techniques in achieving desired goals.

CO5: Apply Artificial Intelligent techniques in solving problems of a particular domain.

| Syllabus | No of Hours: 40 |

Foundational issues in intelligent systems: What is Artificial Intelligence? The AI problems, Underlying assumption, AI technique, Criteria for success, Problems, Problem Spaces and Search Defining problem as a state space search, production systems, problem characteristics, production system characteristics.

AI search techniques: Generate and test, hill climbing, Best first search, best first- A * algorithm, AO* algorithm problem reduction, constraint satisfaction, means and ends analysis.

Knowledge Representations: Knowledge representation issues Representations and mappings, approaches to knowledge representation, issues in knowledge representation Using Predicate Logic Representing simple facts in logic, representing instance and Isa relationships, computable functions and predicates, resolution, Representing knowledge using rules Procedural vs. declarative knowledge, logic programming, forward vs. backward reasoning.

Reasoning under un-certainity: Non-monotonic reasoning, Bayesian networks, Fuzzy logic, DempsterShafer theory.

Advance Topics: Game Playing Overview, Mini-max search procedure, Alpha-beta cutoffs Planning Overview, blocks world problem, components of planning system, goal stack planning.

Suggested Readings:

- Elain Rich and Kevin Knight, " Artificial Intelligence", TMH,

- Ivan Bratko, "Prolog Programming for Artificial Intelligence".

- Staurt Russel and Peter Norvig, "Artificial Intelligence- A Modern Approach", PHI,.

- Patrick Henry Winston, "Artificial Intelligence", 3rd Edition, Wesley,

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD06	Software Testing	ED	3L-0T-2P	4	ITC14

Course Outcomes:

1. Students who complete this course will be able to test software in structured, organized ways.
2. Programmers will learn effective, practical ways to design and automate high quality tests during unit and integration testing.
3. System testers will learn how to efficiently design effective tests. Students will learn how to apply theory in practical ways to design tests based on test criteria.

<center>**Syllabus**   **No of Hours: 40**</center>

Introduction; SOME SOFTWARE FAILURES; The Explosion of the Ariane 5 Rocket; The Y2K Problem; The USA Star-Wars Program; Failure of London Ambulance System; USS Yorktown Incident; Accounting Software Failures; Experience of Windows XP.

TESTING PROCESS; What is Software Testing; Modifications in the program 'Minimum'; Why Should We Test?; Who Should We Do the Testing?; What Should We Test?

SOME TERMINOLOGIES. Program and Software. Verification and Validation; Fault, Error, Bug and Failure; Test, Test Case and Test Suite; Deliverables and Milestones; Alpha, Beta and Acceptance Testing; Quality and Reliability; Testing, Quality Assurance and Quality Control; Static and Dynamic Testing; Testing and Debugging.

LIMITATIONS OF TESTING; Errors in the Software Requirement and Specification Document; Logical Bugs; Difficult to Measure the Progress of Testing.

THE V SHAPED SOFTWARE LIFE CYCLE MODEL. Graphical Representation. Relationship of Development and Testing Parts; 2 Functional Testing.

BOUNDARY VALUE ANALYSIS; Robustness Testing; Worst-Case Testing; Robust Worst-Case Testing; Applicability;

EQUIVALENCE CLASS TESTING; Creation of Equivalence Classes; Applicability;

DECISION TABLE BASED TESTING; Parts of the Decision Table; Limited Entry and Extended Entry Decision Tables; 'Do Not Care' Conditions and Rule Count; Impossible Conditions. Applicability

CAUSE-EFFECT GRAPHING TECHNIQUE; Identification of Causes and Effects; Design of Cause-Effect Graph; Use of Constraints in Cause-Effect Graph; Design of Limited Entry Decision Table; Writing of Test Cases; Applicability; Essentials of Graph Theory.

WHAT IS A GRAPH? Degree of a Node; Regular Graph.

MATRIX REPRESENTATION OF GRAPHS; Incidence Matrix; Adjacency Matrix.

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PATHS AND INDEPENDENT PATHS; Cycles; Connectedness of a Graph.
GENERATION OF A GRAPH FROM PROGRAM: Program Graphs; DD Path Graphs.
IDENTIFICATION OF INDEPENDENT PATHS; Cyclomatic Complexity; Graph Matrices.
Structural Testing; CONTROL FLOW TESTING; Statement Coverage; Branch Coverage; Condition Coverage; Path Coverage.
DATA FLOW TESTING; Define/Reference Anomalies; Definitions; Identification of du and dc Paths; Testing Strategies Using du-Paths; Generation of Test Cases.
SLICE BASED TESTING

Suggested Readings:

- Software Testing. Yogesh Singh, Cambridge : Cambridge University Press,
- William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York,
- Cem Kaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York,
- Boris Beizer, "Software Testing Techniques", Second Volume, Second Edition, Van Nostrand Reinhold, New York
- Louise Tamres, "Software Testing", Pearson Education Asia
- K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi
- Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Fifth Edition, McGraw-Hill International Edition, New Delhi
- Boris Beizer, "Black-Box Testing – Techniques for Functional Testing of Software and Systems", John Wiley & Sons Inc., New York,
- Marc Roper, "Software Testing", McGraw-Hill Book Co., London,
- Gordon Schulmeyer, "Zero Defect Software", McGraw-Hill, New York,
- Watts Humphrey, "Managing the Software Process", Addison Wesley Pub. Co. Inc., Massachusetts,

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD07	Pattern Recognition	ED	3L-0T-2P	4	ITC04, ITC17

Course Outcomes:
CO1: The design and construction of a pattern recognition system.
CO2: The major approaches in statistical and syntactic pattern recognition.
CO3: Can compare a variety of pattern classification, structural pattern recognition, pattern classifier and clustering techniques. Understand Data Transformation and Dimensionality Reduction.
CO4: The student understand the theoretical issues involved in pattern recognition system design such as density estimation, pattern grammars, classification for Normal Distribution and the curse of dimensionality.

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Syllabus   **No of Hours: 40**

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Introduction to statistical, synthetic and descriptive approaches, features and feature extraction, learning.

Bayes Decision Theory: Introduction to Bayesian decision theory-The continuous case. Two category classification, Estimation of Posteriori Probabilities, Generalized Bayes theory , Conditional risk or expected loss, Minimum risk classifier, Minimum error rate classification, classifiers, Discriminant Functions and Decision Surfaces. Error probability and integrals, Bayesian Classification for Normal Distribution, Estimation of Unknown Probability Density Functions

Parameter Estimation and supervised learning: Maximum Likelihood estimation, the Bayes classifier, learning the mean of normal density, general Bayesian learning. Nonparametric Techniques: Introduction, density estimation, Parzen windows, k-nearest neighbor estimation, Estimation of posteriori probability, the nearest neighbor rule, the k-nearest neighbor rule.

Linear Discriminant functions: Introduction, linear discriminant functions and decision surfaces, Generalized linear discriminant functions, the two category Linearly separable case, Non-separable behavior, linear programming procedures. Linear and Nonlinear Classifiers, Linear Discriminant Functions , Feature Generation : Data Transformation and Dimensionality Reduction, The Karhunen-Loeve Transform, Linear Discriminant Analysis (LDA)

Unsupervised learning and clustering: introduction, mixture density and identifiability, maximum likelihood estimates, Application to normal mixtures, Unsupervised Bayesian learning, Data description and clustering, similarity measures, criterion functions for clustering.   Synthetic approach: Introduction to pattern grammars and languages, Higher dimensional grammars-tree, graph web, plex and shape grammars, stochastic grammars, attributes grammars, Parsing techniques, Grammatical inference.
     Suggested Readings:

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- Richard O. Duda, Peter E. Hart, David G. Stork ," Pattern Classification", Second Edition, A Wiley-Interscience Publication
- Sergios Theodoridis, Konstantinos Koutroumbas , " Pattern Recognition", Second Edition, Elsevier Academic Press
- Bishop, C. M.," Pattern Recognition and Machine Learning", Springer.
- Marsland, S. "Machine Learning: An Algorithmic Perspective", CRC Press.
- Russell, S. and Norvig, N., " Artificial Intelligence: A Modern Approach" Prentice Hall Series in Artificial Intelligence.

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD08	Data ware house and data mining	ED	3L-0T-2P	4	ITC08

Course Outcomes:

CO1:To understand the basic principles, concepts and applications of data warehousing and data mining

CO2:To introduce the task of data mining as an important phase of knowledge recovery proces

CO3:Ability to do Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment

CO4:Have a good knowledge of the fundamental concepts that provide the foundation of data mining

CO5:Design a data warehouse or data mart to present information needed by management in a form that is usable for management client

| **Syllabus** | **No of Hours: 44** |

UNIT – I

Introduction to Data Warehousing: Overview, Difference between Database System and Data Warehouse, The Compelling Need for data warehousing, Data warehouse – The building Blocks: Defining Features, data warehouses and data marts, overview of the components, Three tier architecture, Metadata in the data warehouse.

Data pre-processing: Data cleaning, Data transformation ETL Process, ETL tools.

Defining the business requirements: Dimensional analysis, information packages – a new concept, requirements gathering methods, requirements definition: scope and content.

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UNIT – II

Principles of Dimensional Modeling: Objectives, From Requirements to data design, Multi Dimensional Data Model, Schemas: the STAR schema, the Snowflake schema, fact constellation schema.

OLAP in the Data Warehouse: Demand for Online Analytical Processing, limitations of other analysis methods- OLAP is the answer, OLAP definitions and rules, OLAP characteristics, major features and functions, hyper cubes.

OLAP Operations: Drill-down and roll-up, slice-and-dice , pivot or rotation, OLAP models, overview of variations, the MOLAP model, the ROLAP model, the DOLAP model, ROLAP versus MOLAP, OLAP implementation considerations. Query and Reporting, Executive Information Systems (EIS), Data Warehouse and Business Strategy.

UNIT – III

Data Mining Basics: What is Data Mining, Data Mining Defined, The knowledge discovery process (KDD Process), Data Mining Applications- The Business Context of Data Mining, Data Mining for Process Improvement, Data Mining as a Research Tool, Data Mining for Marketing, Benefits of data mining,

Major Data Mining Techniques: Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, KNN Algorithm.

UNIT – IV

Cluster detection, K- means Algorithm, Outlier Analysis, memory-based reasoning, link analysis, Mining Association Rules in Large Databases: Association Rule Mining, genetic algorithms, neural networks, Data mining tools.

Suggested Readings:

1.Paul Raj Poonia, "Fundamentals of Data Warehousing", John Wiley & Sons,
2.Kamber and Han, "Data Mining Concepts and Techniques", Hart Court India P. Ltd. Elsevier Publications Second Edition
3.W. H. Inmon, "Building the operational data store", 2nd Ed., John Wiley,
4."Data Warehousing", BPB Publications,
5.Pang- Ning Tan, Michael Steinbach, Viach, Vipin Kumar, Introduction to Data Mining, Pearson
6.Shmueli, "Data Mining for Business Intelligence : Concepts, Techniques and Applications in Microsoft Excel with XLMiner",Wiley Publications

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD09	Advanced Database Management	ED	3L-0T-2P	4	ITC08

Course Outcomes:

    CO1: The student understand how to Articulate how data is stored in both primary and secondary storage and understand database management system architecture

    CO2: The student understand how to Design and implement advanced queries using Structured Query Language. Design, construct and maintain a database and various database objects using procedural language constructs, forms and reports to solve problems

    CO3: The student understand how to Design and implement a complete problem solution using current database technology. (Oracle 11g) and implementing procedures including database tuning, backup and recovery

    CO4: The student understand how to Propose, implement and maintain database security mechanisms and Explore non-relational database systems and structures

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Syllabus   **No of Hours: 42**

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UNIT I

Architecture of distributed systems: Distributed database systems. (a) Federated database systems, (b) multi database systems, and (c) Client/Server systems, Distributed DBMS architecture.

Distributed database design: Top down design- Designing issues, Fragmentation, Allocation, Data dictionary, Bottom up design- Schema Matching, Schema Integration, Schema Mapping, Data Cleaning

Data and Access Control: views in centralised and distributed DBMS, Data security, Semantic Integrity Control.

UNIT II

Query Processing: Characterization of query processors, Layers of query processing, Query Decomposition: Normalization, Analysis, Elimination of redundancy,

Data Localization: Reduction of primary horizontal fragmentation, Reduction of vertical fragmentation, reduction of derived fragmentation, hybrid fragmentation.

Optimization of Distributed Query: Join ordering, Semi join based algorithms, optimisation.[No. of Hours: 11]

UNIT III

Transaction Management: Properties of transactions, Types of transactions- flat transactions, nested transactions, and workflow.

Distributed Concurrency Control: Serializability theory, Locking based concurrency control Algorithm, Time-stamp based algorithms,

Deadlock Management: Prevention, Avoidance, Detection and Resolution

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UNIT IV
Distributed DBMS Reliability: Local Reliability protocol, Distributed Reliability protocol- two phase commit protocol, three phase commit protocol.
Parallel Database System: System architecture, Parallel query processing, Load Balancing, Database Clusters.
Web Data Management: Web Search-crawling, indexing ranking, Web Querying, Distributed XML Processing.
Suggested Readings:
1. Ozsu and Valduriez, "Principles of Distributed Database Systems". Prentice Hall.
2. Ceri and Pelagatti, "Distributed Database Principles and Systems". McGraw Hill.
3. Coulouris, Dollimore, and Kindberg, "Distributed Systems: Concept and Design". AW.
4. Kumar and Hsu, "Recovery Mechanisms in Database Systems", Prentice Hall.
5. Bernstein, Hadzilacos and Goodman "Concurrency Control and Recovery in Database Systems", AW

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD10	Advanced Computer Networks	ED	3L-0T-2P	4	ITC13

Course Outcomes:
CO1: The student Apply knowledge of the TCP/IP layering model to intelligently debug networking problems.
CO2: The student Use Linux commands to understand how a PC is configured.
CO3: The student will Differentiate between different LAN-based forwarding devices so that they can make thoughtful suggestions on how to build a network.
CO4: The student Write networking code that uses TCP and UDP in client-server applications.

 Syllabus   **No of Hours: 40**

UNIT I
Review of Basic Network Architectures: OSI reference model, TCP/IP reference model, Applications(WWW, Audio/Video Streaming, Video conference, Networked Games, Client/Server); Traffic Characterization (CBR, VBR)
UNIT II
Asynchronous Transfer Mode: ATM layered model, switching and switching fabrics, network layer in ATM,

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QOS, LAN emulation.

UNIT III

Switching Paradigms; Multiplexing; Error Control; Flow Control, FTH, DTH, PON, ISDN, DSL, CATV, SONET, Optical Networks.

UNIT IV

Local Area Network Technologies: Fast Ethernet, Gigabit Ethernet, IEEE 802.11 WLAN, Bluetooth, Connecting LANs, VLANS.

UNIT V

Internetworking: Interdomain Routing, BGP, IPv6, Multicast Routing Protocols, Multi Protocol Label Switching, Virtual Private Networks, High speed transport protocols, Quality of Service Mechanisms, Improving QoS in Internet

UNIT VI

Multimedia Networking: Streaming audio and video, RTSP, jitter removal and recovery from lost packets; Protocols for real-time interactive applications: RTP, RTCP, SIP, H.323; Content distribution networks; Integrated and differentiated services, RSVP.

UNIT VII

Applications and Other Networking Technologies: RTP, RTSP, SIP, VoIP, Security Systems, SSH, PGP, TLS, IPSEC, DDoS Attack, Mitigation in Internet, Security in MPLS; Introduction to Cellular, Satellite and Ad hoc Networks.

Suggested Readings:

1. Behrouz A. Forouzan, Data Communications and Networking, Fourth Ed., Tata McGraw Hill
2. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, Fourth Ed, Morgan Kaufmann
3. Jean Walrand and Pravin Varaiya, High Performance Communication Networks, 2nd Ed., Morgan Kauffman
4. Kurose, J. F. and Ross, R.W., "Computer Networking", 3rd Ed., Pearson Education

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD11	Recent Trends in Information Technology	ED	3L-0T-2P	4	None

Course Outcomes:
CO1: Identify sources for gathering information on new issues in information technology
CO2: Read, comprehend, and apply these issues to society in general and to their career in the information technology field
CO3: Identify the importance of keeping up to date with new trends and issues
CO3: Develop a network of other information technology students through the CIS student organization

Syllabus   **No of Hours:40**
Current Trends in Software, Operating Systems, Application Software's, Programming Languages, Network technologies and other areas of Information technology.

Suggested Readings:

1. John M. Jordan, Information, Technology, and Innovation: **Resources for Growth in a Connected World** John Wiley & Sons,

2. *

- Books Based on the current trends of Information Technology

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD12	Image Processing	ED	3L-0T-2P	4	ITC09, ITC15

Course Outcomes:
    CO1: Understand how images are formed, sampled, quantized and represented digitally.
    CO2: Understand how image are processed by discrete, linear, time-invariant systems
    CO3: Understand how images are perceived by humans
    CO4: Understand how color is represented
    CO5: Understand how image information can be modeled analytically
    CO6: Understand transform-domain representation of images (Fourier, DCT, Haar, WHT)
    CO7: Understand how images are enhanced to improve subjective perception
    CO8: Understand how images are restored based on the knowledge of acquisition system

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CO9: Understand how image are analyzed to extract features of interest
CO10: Understand the principles of image compression

Syllabus	No of Hours: 39

Introduction, Mathematical Preliminaries, Image Digitization, Visual perception, Representation of Data in Transform Domain, Data Compression, Image Enhancement with Histrogram Techniques and Frequency Domain techniques, Image restoration, Image segmentation and Feature detection, Morphological Processing and Image Analysis.

Suggested Readings:

Rafael C. Gonzalez; Richard E. Woods, "Digital Image Processing". Prentice Hall.
WILLIAM K. PRATT, "Digital image processing:". Piks scientific inside, 4th ed

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD13	Adhoc Network	ED	3L-0T-2P	4	ITC13

Course Outcomes:
CO1: Describe the unique issues in ad-hoc/sensor networks.
CO2: Describe current technology trends for the implementation and deployment of wireless ad-hoc/sensor networks.
CO3: Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc/sensor networks.
CO4: Discuss the challenges in designing routing and transport protocols for wireless Ad-hoc/sensor networks.
CO5: Comprehend the various sensor network Platforms, tools and applications.

Syllabus	No of Hours: 40

Introduction To Wireless Networks: Evolution of Mobile Cellular Networks, Global System for Mobile Communications, GPRS, WLAN, UMTS, IMT2000, cdma2000 evolution.
Origins of Ad Hoc: Packet Radio Networks: Introduction, Technical Challenges, Architecture, Component of Packet Radios, Routing in PRNETs, Route Calculation, Pacing Techniques, Media Access, Flow Acknowledgements.

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Ad Hoc Wireless Networks: Introduction, Mobile Devices, Traffic Profiles, Types of Ad Hoc Mobile Communications, Types of Mobile Host Movements, Challenges.

Ad Hoc Wireless Media Access Protocols: Introduction, Challenges in Channel access, Receiver Initiated MAC Protocols, Sender Initiated MAC Protocols, Protocols-MACA, MACA-BI, PAMAS, DBTMA, MARCH.

Overview of Ad Hoc Routing Protocols: Table Driven approaches, DSDV, WRP, CSGR, Source Initiated on-demand approaches, AODV, DSR, TORA.

Ad Hoc Wireless Multicast Routing: Multicasting in Wired Networks, Multicast routing in Mobile Ad hoc Networks, Protocols- AODV multicast, CAMP, ODMRP, LBM, DVMRP, Comparisons of protocols.

Communication Performance of Ad hoc Networks: Introduction, Performance Parameters, Route Discovery Time, End to End Delay, Communication throughput, Packet loss, Route Repair time, Power Management. **Security Threats in Ad hoc Networks, Recent advances in Ad Hoc Networks**

Recommended Books

1. CHARLES E. PERKINS "Ad Hoc Networking"
2. S. BASAGNI, M. CONTI, S. GIORDANO and I. STOJMENOVIC "Mobile Ad Hoc Networking"
3. C. K. TOH "Ad Hoc Mobile Networks"

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD14	Software Quality and Assurance	ED	3L-0T-2P	4	ITC14

Course Outcomes:

CO1: Critically evaluate alternative standards, models and techniques aimed at achieving quality assurance in a variety of software development environments,

CO2: Research, consolidate and present large amounts of information related to appropriate quality assurance techniques and be able to make recommendations for management strategies,

CO3: Propose and defend innovative solutions to software quality assurance and measurement problems in the context of various software development environments,

CO4: Critically evaluate different software development environments and contexts with

respect to the application of appropriate standards and models,
CO5: Critically evaluate leading edge approaches in software development and attendant quality assurance methodologies, presenting the research using Harvard referencing.
CO6: Understand and apply key quality assurance techniques tailored for specific software development environments.

<center>**Syllabus**   **No of Hours: 40**</center>

Unit-1

Introduction: Concepts of Software Quality, Quality Attributes, Software Quality Control and Software What is Quality Assurance, Evolution of SQA, Major SQA activities, Major SQA issues, Zero defect Software.The Meaning of Quality, The Relationship of Assurance to the Software Life-Cycle, SQA Techniques.

Unit-2
Tailoring the Software Quality Assurance Program: Reviews, Walkthrough, Inspection, and Configuration Audits.
Evaluation: Software Requirements, Preliminary design, Detailed design, Coding and Unit Test, Integration and Testing, System Testing, types of Evaluations.
Configuration Management: Maintaining Product Integrity, Change Management, Version Control, Metrics, Configuration Management Planning.
Unit-3
Error Reporting: Identification of Defect, Analysis of Defect, Correction of Defect, Implementation of Correction, Regression Testing, Categorization of Defect, Relationship of Development Phases.
Trend Analysis: Error Quality, Error Frequency, Program Unit Complexity, Compilation Frequency.
Unit-4
Corrective Action to Cause: Identifying the Requirement for Corrective Action, Determining the Action to be Taken, Implementing the Correcting the corrective Action, Periodic Review of Actions Taken.
Traceability, Records, Software Quality Program Planning, Accuracy, Authority, Benefit, Communication, Consistency, and Retaliation.
Suggested Readings:
1. Robert Dunn, "Software Quality Concepts and Plans", Prentice-Hall
2. Alan Gillies, "Software Quality, Theory and Management", Chapman and Hall

3. Michael Dyer, "The Cleanroom approach to Quality Software Engineering", Wiley & Sons
4. Daniel Freedman, Gerald Weinberg, "Handbook of Walkthroughts, Inspections and Technical Reviews", Dorset House Publishing
5. Tom Gilb, "Principles of Software Engineering Management", Addison-Wesley
6. Tom Gilb, Dorothy Graham, "Software Inspection" Addison-Wesley

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7. Watts Humphrey, "Managing the Software Process", Addison-Wesley
8. Watts Humphrey, "A Discipline for Software Engineering", Addison-Wesley,
9. Arthur Lowell, "Improving Software Quality An Insiders guide to TQM", Wiley & Sons.

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD15	Software Project Management	ED	3L-0T-2P	4	ITC14

Course Outcomes:
CO1:Understand and apply project management best practices from the Project Management Institute
(PMI) in the Project Management Body of Knowledge (PMBOK Guide).
CO2:Provide a foundation covering the framework, terminology, and concepts for project
management.
CO3:Introduce and apply the fundaments of Microsoft Project 2010 (or current software).
CO4:Understand and apply project management tools and techniques to plan, manage, and close a
project.
CO5:Display proactive behavior in project development and completion.
CO6:Be able to question, search for answers and meaning, and develop ideas that lead to action.

Syllabus   **No of Hours: 40**

Unit-1

Introduction:Software development as a project; Stakeholders in software project; Software product, process, resources, quality, and cost; Objectives, issues, and problems relating to software projects.
Project Planning:Steps in project planning; Defining scope and objectives; work breakdown structure; Deliverables and other products; time, cost, and resource estimation; Alternatives in planning
Project Evaluation:Strategic assessment; Technical assessment; Cost-benefit analysis; Cash flow forecasting; Cost-benefit evaluation techniques; Break-even analysis; Risk evaluation
Selection of Project Approach:Choosing development technology and methodology; choice of process model; Rapid application development; Waterfall model; V-process model; Spiral model; Prototyping,; Incremental delivery.
Unit-2
Software Effort Estimation
Problem in software estimation; Effort estimation techniques; Expert judgement; Estimation by analogy; Delphi technique; Algorithmic methods; Top-down and bottom-up estimation; Function point analysis; Object points;

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COCOMO model.

Activity Planning

Network planning model; Activity-on-arrow network; Precedence network; Forward pass; Backward pass; Critical path; Slack and float.

Risk Management

Nature and categories of risk in software development; risk Identification; Risk assessment; Risk mitigation, monitoring, and management; Evaluating schedule risk using PERT.

Unit-3

Recourse Allocation

Nature of project resources; Identifying resource requirement of activities; Allocating and scheduling resources; cost of resources; Standard, planned, and actual cost; Cost variance; time-cost trade-off.

Project Control

Measurement of physical and financial progress; Earned value analysis; Status reports; Milestone reports; Change control.

Contact Management

Outsourcing of products and services; Types of contracts; Stages in contract placement; Terms of contract; Contract monitoring; Acceptance testing

Unit-4

Managing People and Organizing Teams

Organizational behaviour; Recruitment and placement; Motivation; Group behaviour; Individual and group decision making; Leadership and leadership styles; forms of organizational structures.

Quality Assurance

Planning for quality; Product versus process quality management; Procedural and quantitative approaches; Defect analysis and prevention; Statistical process control; Pareto analysis; Causal analysis; Quality standards; ISO 9000; Capability Maturity Model; Quality audit.

Configuration Management

Configuration management process; Software configuration items; Version control; change control; Configuration audit; Status reporting.

Text Book:
1. Bob Hughes and Mike Cotterell, "Software Project Management", Third Edition 2002, McGraw-Hill
2. Pankaj Jalote, "Software Project Management in Practice", 2002, Pearson Education Asia.
Reference:
1. Roger S. Pressman, "Software Engineering: A practitioner's Approach", Fifth Edition 2001 McGraw-Hill
2. Robert T. Futrell, Donald F. Shafer, and Linda I.. Shafer, "Quality Software Project Management" 2002, Pearson Education Asia.
3. Ramesh Gopalaswamy, "Managing Global Software Projects", 2003, Tata McGraw-Hill

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD16	Computer Vision	ED	3L-1T-0P	4	ITC09, ITC15

Course Outcomes:

CO1: The student understand the Design convolving filters for smoothing, differentiation, edge detection and sharpening.
CO2: Describe the approaches for object recognition.
CO3: The student Understand the roles of image transformations and their invariances in pattern recognition and classification

Syllabus	**No of Hours: 40**

Engineering Approach to pattern recognition. Relationship of PR to other areas. Pattern
Recognition application.
Pattern Recognition, Classification & Description
Abstract representation of pattern mappings. Structure of typical PR system.
Pattern & Feature Extraction
Patterns & Features, Pattern distortions, feature-extraction using generalized cylinders for
3-D object description and classification. Classifiers. Decision regions and boundaries and
Discriminant
function, Training & learning in PR System:
Using a prior knowledge or 'experience' learning curves, Training Approaches.
Pattern Recognition Approach: The syntactic, Neural & statistical pattern recognition approach,
comparison of syntactic, neural & statistical pattern recognition approach. Black – box approach &
reasoning driven pattern recognition.

Suggested Readings:
David A. Forsyth "Computer Vision: A Modern Approach", 2nd Edition
Richard Szeliski "Computer Vision: Algorithms and Applications"

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD17	Information Theory and Coding Techniques	ED	3L-1T-0P	4	ITC04,ITC05

Course Outcomes: After taking the course, the student should have a clear understanding of

CO1: The basic notions of information and channel capacity.
CO2: The convolutional and block codes, coding and decoding techniques.
CO3: The basic concepts of Efficient Code generation, leading to the channel capacity information.
CO4: The error control coding techniques that are applied in communication systems.

Syllabus　　　　　　　　　　　　　　　　　**No of Hours: 40**

Introduction to information Theory, Uncertainty and information, Entropy, Information rate, Zero memory Source, Redundancy, Kraft McMillan inequality, Mutual information, Joint and conditional entropies. Markov source, Markov Source of mth order, classification of codes, Block code and Instantaneous code, Shanon-fano-elias coding, Huffman Coding, Non -binary Huffman Coding, Adaptive Huffman Coding, Arithmetic Coding.

Information Entropy, Extended sources, Shanon's noiseless coding theorem. Source Coding.Mutual Information, Channel Capacity. BSC and other channels, Shanon's Channel capacity theorem, Continuous channels. Basis of detection theory, Comparison of Communication System based on Information Theory, Channel Coding: Block and convolutional block codes. Majority Logic decoding, Viterbi decoding algorithm, coding gains and performance, Principles of Turbo coding.

Suggested Readings:

1.Norman Abramson "Information Theory and Coding", McGraw-Hill
2. Ranjan Bose Information Theory- Coding and Cryptography 2nd Edition
3. Robert McEliece, "The theory of Information and Coding"

Reference Books:

1. K Sayood, "Introduction To Data Compression" 3/E, Elsevier

2. S Gravano, "Introduction To Error Control Codes", Oxford University Press

3. Amitabha Bhattacharya, "Digital Communication", Tmh

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD18	Soft Computing	ED	3L-1T-0P	4	ITC17

Course Outcomes: After taking the course, the student should have a clear understanding of
CO1: Implement numerical methods in soft computing ,
CO2: Apply derivative based and derivative free optimization,
CO3: Comprehend neuro fuzzy modelling,
CO4: Demonstrate some applications of computational intelligence.

<div align="center">

Syllabus   **No of Hours: 40**

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Introduction to Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning.

ANN Training Algorithms: Perceptrons, Training rules, Delta, Back Propagation Algorithm,

Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Introduction to Fuzzy Logic: Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

Fuzzy Arithmetic: Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Information & Uncertainty, Non specificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets

Advance Topics: Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks.

Application of Fuzzy Logic: Medicine, Economics etc. Genetic Algorithm: An Overview, GA in problem solving, Implementation of GA.

Suggested Readings:

- SN Sivanandam & SN Deepa- Principles of Soft Computing, Wiley
- G.J. Klir & B. Yuan- Fuzzy Sets & Fuzzy Logic, PHI
- Melanie Mitchell- An Introduction to Genetic Algorithm, PHI
- Anderson J.A- An Introduction to Neural Networks, PHI

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD19	Wireless Communication	ED	3L-1T-0P	4	ITC13

Course Outcomes: A student who successfully completes Wireless Communications will

CO1: Understand the basics of propagation of radio signals

CO2: Understand how radio signals can be used to carry digital information in a spectrally efficient manner.

CO3: Understand how radio signals can be used to carry digital information in a power efficient manner.

CO4: Gain insights into how diversity afforded by radio propagation can be exploited to improve performance

CO5: Have an understanding of design considerations for how to effectively share spectrum through multiple access

CO6: Have an understanding of the basic principles behind radio resource management techniques such as power control, channel allocation and handoffs.

CO7: Gain knowledge and awareness of the technologies used in Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA) and WiFi Networks.

CO8: Gain the experience of working in a group towards a final project that will involve experiments, analysis and the design of exemplary wireless communication techniques and/or systems.

Syllabus   **No of Hours: 40**

Unit 1
Introduction: Basic of Digital Communication, Cellular system, Cellular system from 1G to 4G and wireless 5G systems.
Unit 2
Radio propagation and propagation path-loss model: Free-space attenuation, Multipath channel characteristics, Signal fading and shadowing statistics, Path-loss models etc.
Unit 3
Fundamentals of cellular communications: Hexagonal cell geometry, Frequency reuse factor, Co-channel interference, Adjacent channel interference, Cellular system design, sectoring using directional antennas, Trunking and Grade of Service.
Unit 4

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Multiple access techniques: Frequency division multiple access (FDMA), Time division multiple access (TDMA), Code division multiple access (CDMA), Space division multiple access (SDMA), Orthogonal frequency division multiplexing (OFDM), Multicarrier CDMA (MC-CDMA), Random access methods.

Unit 5

Other Wireless systems: Wide-area wireless networks (WANs), Long Term Evolution Technologies (LTE), IEEE 802.11 WLAN (Wi-Fi), IEEE 802.22 WRAN, WiMAX.

Suggested Readings:

1. Mischa Schwartz. , *Mobile Wireless Communications*, Cambridge University Press (2013) ISBN: 9781107412712.
2. Theodore, S. Rappaport ,*Wireless Communications, Principles, Practice* , PHI, 2nd Ed., 2002.
3. Ian F. Akyildiz, David M. GutierrezEstevez, Elias Chavarria Reyes. *The evolution to 4G cellular systems:* LTE-Advanced Broadband Wireless Networking Laboratory, School of Electrical and Computer Engineering, Georgia Institute of Technology.
4. Vijay K. Garg, *Wireless Communications and Networking*, Morgan Kaufmann Publishers, 2007, ISBN 978-0-12-373580-5.
5. Andrea Goldsmith ,*Wireless Communications*, Cambridge University Press 2005.
6. GottapuSasibhushana Rao, *Mobile Cellular Communication*, Pearson Education, 2012.
7. William Stallings ,*Wireless Communication and Networking* , PHI, 2003.
8. KavehPahLaven and P. Krishna Murthy , *Principles of Wireless Networks* , PE, 2002.

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD20	Game Theory	ED	3L-1T-0P	4	ITC05

Course Outcomes:

On completion of the course, students should be able to:

CO1: Reconstruct fundamental game theory models and clearly state their assumptions and predictions and work out the analysis.

CO2: Be able to convert a standard multi-person decision situation into an analytic model and correctly analyze it.

CO3: Apply and explain appropriate models or modifications to some real world issues and work out its policy implications.

Syllabus   **No of Hours: 40**

Unit 1
Elements of a game: players, objectives, information structure, actions and policies. Overview of games, uses of game theory, some applications and examples, and formal definitions of: the normal form, payoffs, strategies, Notion of equilibria, equilibrium pairs, maximin and minimax pairs, pure and mixed strategies.

Unit 2
Classes of games: cooperative and non-cooperative, static and dynamic, zero and non-zero sum, open and closed loop, perfect and imperfect information, complete and incomplete information Zero-sum games.

Unit 3
2-Person Zero-sum Game; Saddle Point, Mini-Max and Maxi-Min Theorems and problems, Games without Saddle Point, Graphical Method, Principle of Dominance. Pure-strategy Nash equilibrium, dominated strategies. Mixed-strategy Nash equilibria: Definitions, examples, application to computer networks.

Unit 4
Nash Theorem, proof of the Nash Theorem. Swastika Method to find the equilibrium pairs, solution of Non-zero sum games. Solution of the Prisoners dilemma, Battle of sexes, Symmetric games etc.

Unit 5
Bargaining or Negotiation set, Pareto optimal, Nash bargaining axioms, Proof of Nash theorem using bargaining axioms. Maximin bargaining solutions,Threat Bargaining solutions.

Suggested Readings:

1. M. J. Osborne and A. Rubinstein. *A Course in Game Theory*. MIT Press, Cambridge, MA
2. D. Fudenberg and J. Tirole. *Game Theory*. MIT Press, Cambridge, MA
3. L.C.Thomas, *Game theory and applications*, Dover Publications
4. J. Watson, Strategy: *An introduction to Game Theory*, Norton
5. A. Dixit and B. Nalebuff. *Thinking Strategically*, Norton,

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD21	Operational Research	ED	3L-1T-0P	4	FC006,ITC05

Course Outcomes:

CO1: Identify and develop operational research models from the verbal description of the real system. Understand the mathematical tools that are needed to solve optimisation problems.
CO2: Use mathematical software to solve the proposed models.
CO3: Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

Syllabus   **No of Hours: 40**

UNIT-I Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modelling, phases of OR study. Linear Programming: Two variable Linear Programaming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, senstivity analysis.

UNIT-II Transportation Problems: Types of transportation problems, mathemataical models, transportation algorithms, Assignment: Allocation and assignment problems and models, processing of job through machines.

UNIT-III Network Teachniques: Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem. Project Management: Phases of project management, guidelines for network construction, CPM and PERT.

UNIT-IV Theory of Games: Rectangular games, Minimax theorem, Game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized poisson queing model, single server models.

UNIT-V Inventory Control: Models of inventory, operation of inventory system, quantity discount. Replacement: Replacement models: Equipments that deteriorate with time, equipments that fail with time.

Suggested Readings:
1. Wayne L. Winston,"Operations Research" Thomson Learning
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education
3. R. Panneer Seevam, "Operations Research" PHI Learning
4. V.K.Khanna, "Total Quality Management" New Age International

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Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD22	E-commerce and E-governance	ED	3L-1T-0P	4	None

Course Outcomes:

CO1:Understand the nature of e-Commerce and E-governance

CO2:Understand and recognize the business impact and potential of e-Commerce; discuss the

CO3:Understand the current drivers and inhibitors facing the business world in adopting and using eCommerce and E-governance

CO4:Understand the E-governance the economic consequences of e-Commerce

CO5:Describe the network infrastructure and security needed for E-commerce.

CO6:Use the conventional approaches that are widely used in E-Commerce applications and the current ideas that are applicable to the Electronic Commerce world.

Syllabus   **No of Hours: 40**

Unit I

ntroduction to e-commerce: History of e-commerce, Comparison between Traditional commerce and E-commerce; Advantages & disadvantages of e-commerce, Buying & Selling on Internet, Issues in implementing Electronic Commerce. Information Technology applied to various functional areas of management such as Production/Operations, Human Resource, Marketing, Finance and Materials Management.

Unit II

e-business models: B2B, B2C, C2C, C2B, e-procurement, supply chain coordination; on-line research; organizing for online marketing, Internet retailing.

Unit III

Electronic Payment Systems: Credit cards, debit cards, smart cards, e-credit accounts, e-money, Marketing on the web, marketing strategies, advertising on the web, customer service and support, introduction to m-commerce, case study: e-commerce in passenger air transport.

Unit IV

E-Government, theoretical background of e-governance, issues in e-governance applications, evolution of e-governance, its scope and content, benefits and reasons for the introduction of e-governance, e-governance models- broadcasting, critical flow, comparative analysis, mobilization and lobbying, interactive services / G2C2G.

Unit V

E-readiness, e-government readiness, E- Framework, step & issues, application of data warehousing and data mining in e-government, Case studies: NICNET-role of nationwide networking in e- governance, e-seva.

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Unit VI

E-Government systems security: Challenges and approach to e-government security, security concern in e-commerce, security for server computers, communication channel security, security for client computers.

Suggested Readings::

1. Gary P. Schneider, "E-commerce", Cengage Learning India.
2. C.S.R. Prabhu, "E-governence: Concept and Case Study", PHI Learning Private Limited.
3. V. Rajaraman, "Essentials of E-Commerce Technology", PHI Learning Private Limited.

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD23	Neural Networks	ED	3-1-0	4	ITC04, ITC17

Course Outcomes:

CO1: Understand and explain strengths and weaknesses of the neural-network algorithms

CO2: Determine under which circumstances neural networks are useful in real applications

CO3: Distinguish between supervised and unsupervised learning and explain the key principles of the corresponding algorithms

CO4: Efficiently and reliably implement the algorithms introduced in class on a computer, interpret the results of computer simulations

CO5: Describe principles of more general optimisation algorithms

CO6: Write well-structured technical reports in English presenting and explaining analytical calculations and numerical results

CO7: Communicate results and conclusions in a clear and logical fashion

<center>**Syllabus**   **No of Hours: 40**</center>

Basic concepts: Artificial Neural Networks (ANN) and their biological roots and motivations, ANNs as numerical data/signal/image processing devices, Encoding (training phase) and decoding (active phase).

Taxonomy of Neural Networks: Feed-forward and recurrent networks with supervised and unsupervised learning laws., Static and dynamic processing systems. Basic data structures: mapping of vector spaces, clusters, principal components.

The Perceptron: The Perceptron and its learning law. Classification of linearly separable patterns, Linear

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Networks, Multi-Layer Feed-forward Neural Networks: Multi-Layer Perceptrons, Supervised Learning, Fast training algorithms. Applications of multilayer perceptrons.

Self-Organizing systems: Unsupervised Learning, Competitive Learning: MinNet and MaxNet networks, Clustering, Self-Organising Feature Maps: Kohonen networks.

Recurrent Networks: Hopfield networks.

Books/References

1. Simon Haykin, Neural Networks -- a Comprehensive Foundation, Prentice Hall, 2nd Edition,
2. Martin T. Hagan,. H. Demuth,M. Beale, Neural Network Design, PWS Publishing
3. Introduction to Artificial Neural Systems by Jacek M Zurada,West Publisher
4. Neural Computing: Theory and Practice by Philip D. Wasserman, Van Nostrand Reinhold
5. Neural Networks: A Classroom Approach, by Satish Kumar, Tata McGraw Hill, 2nd Edition.
6. **Neural Networks –Algorithms, Applications, and Programming Techniques by Freeman, J. A. and D. M.Skapura, Pearson Education,3rd Edition**

Course No	Title of the Course	Category	L-T-P	Credits	Pre-Requisite
ITD24	Genetic Algorithms	ED	3L-1T-0P	4	ITC17

Course Outcomes:

CO1:Understand the relations between the Genetic Algorithms, other most important evolutionary algorithms (ES, GP, etc.), and other search and optimization techniques.

CO2:Understand the implementation issues of Genetic Algorithms.

CO3:Determine the appropriate parameter settings to make Genetic Algorithms work well.

CO4:Design new operators, representations and fitness functions for specific practical and scientific applications.

CO5:Apply evolutionary algorithms to multi-objective optimization problems.

Syllabus   **No of Hours: 40**

Overview of Combinatorial Optimization, Introduction to Genetic Algorithms, Theoretical Foundations of Genetic Algorithms.

Simple Genetic Algorithm and its major operators: Reproduction, Crossover, Mutation etc., Fitness proportional selection and fitness scaling – Ranking methods, Mathematical Construction of Genetic Operators.

Genetic Algorithms in Natural Evolution, The Basic (Binary) Genetic Algorithm, Advanced Genetic

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Algorithms, Optimization using Genetic Algorithms, Advanced Applications of GA, Simulated Annealing and Tabu Search, Particle Swarm & Ant Colony Algorithms.

Suggested Readings:

1. Goldberg and David E, "Genetic Algorithms in Search. Optimization and Machine Learning", Pearson Education, New Delhi
2. David A Coley, "An introduction to Genetic Algorithms for Scientists and Engineers", World scientific publishing company
3. Mitchell, An Introduction to Genetic Algorithms, MIT Press,
4. Koza, John, Wolfgang Banzhaf, Kumar Chellapilla, Kalyanmoy Deb, Marco Dorigo, David Fogel, Max Garzon, David Goldberg, Hitoshi Iba, and Rick Riolo(Eds.), "Genetic Programming", Academic Press. Morgan Kaufmann, USA,

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SYLLABUS OF OPEN ELECTIVES

Course No	Title of the Course	Course Structure	Pre-Requisite
EO001	**Technical Communication (TC)**	3L-1T-0P	None

Course Outcomes: Course Objectives

a) The course will improve writing and documentation skills of students with emphasis on the importance of effective communication with focus on choice of words, formation of proper sentence structures and writing styles.
b) This will enhance the students capability to prepare technical documents and correspondence.
c) The course will equip the student with good communications skills for placements, preparing SOPs and CVs.
d) The course will sensitize the students towards research ethics, copyright and plagiarism.

Course Content:

- Definition of communication, meaning, importance & process of communication, objectives, types, C's of communication, barriers to communication
- human & non -human communication, distinctive features of human languages
- Business correspondence-definition, meaning and importance of business communication, business letters- purchase, enquiry, quotation, order, followup, acceptance-refusal
- Emphasis on (i) paragraph writing, its kinds, coherence & cohesion
        (ii)writing a paragraph/thesis: selection of topic and its development
        (iii) writing reports, manuals, notices, memos, agendas, minutes
        (iv)Interviews, speeches, presentations,

- research ethics, methodologies, copyright, plagiarism

Suggested Readings:

Martin Hewing , "Advanced English Grammar"
Meenakshi Raman & Sangeeta Sharma, "Technical Communication"

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Course No	Title of the Course	Course Structure	Pre-Requisite
EO002	**Disaster Management**	3L-1T-0P	None

Course objectives:

- Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Course Content:

Unit -I: Introduction

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem.

Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit -II: Disaster Prone Areas In India

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

Unit -III: Disaster Preparedness And Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk:

Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit -IV: Risk Assessment

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Unit -V: Disaster Mitigation

Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

Suggested Readings:

1. R. Nishith, Singh AK "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company
2. Sahni, Pardeep et. al., "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India
3. Goel S. L. "Disaster AdminastrationAnd Management Text And Case Studies", Deep &Deep Publication Pvt. Ltd.

Course No	Title of the Course	Course Structure	Pre-Requisite
EO003	**Basics of Financial Management**	3L-1T-0P	None

Course Outcomes:

Course Objective:-

The course's objective is to provide a theoretical framework for considering corporate finance problems and issues and to apply these concepts in practice. In this course, you will enhance your knowledge and understanding of financial management. You will learn how managers should organize their financial transactions effectively and with integrity and how to give everybody the ability and confidence to tackle common financial problems in practice. It will also provide adequate preparation for future finance classes.

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Course Content:

Unit I

Nature, scope and objectives of financial management, Time value of money, Risk and return (including Capital Asset Pricing Model).

Unit II

Long term investment decisions: The Capital Budgeting Process, Cash Flow Estimation, Payback Period Method, Accounting Rate of Return, Net Present Value (NPV), Net Terminal Value, Internal Rate of Return (IRR), Profitability Index.

Unit III

Financing Decisions: Sources of long-term financing, Estimation of components of cost of capital, Methods for calculating Cost of Equity, Cost of Retained Earnings, Cost of Debt and Cost of Preference Capital, Weighted Average Cost of Capital (WACC). Capital Structure- Theories of Capital Structure (Net Income, Net Operating Income, MM Hypothesis, Traditional Approach). Operating and Financial leverage. Determinants of capital structure

Unit IV

Dividend Decisions: Theories for Relevance and irrelevance of dividend decision for corporate valuation-Walter's Model, Gordon's Model, MM Approach, Cash and stock dividends. Dividend policies in practice.

Unit V

Working Capital Decisions: Concepts of Working Capital, Operating & Cash Cycles, sources of short term finance, working capital estimation, cash management, receivables management, inventory management.

Suggested Readings:

1. Khan, M.Y. and P.K. Jain, "Financial Management: Text and Problems", Tata McGraw Hill.
2. Srivastava, Rajiv, and Anil Mishra, "Financial Management", Oxford University Press, UK.
3. Chandra, P. "Financial Management-Theory and Practice", Tata McGraw Hill.
4. Horne, Van; James C., John Wachowicz, "Fundamentals of Financial Management", Pearson Education.

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Course No	Title of the Course	Course Structure	Pre-Requisite
EO004	**Basics of Human Resource Management**	3L-1T-0P	None

Course Objective:

This course is designed to provide students with an understanding of human resource management (HRM) functions within organizations, including an appreciation of the roles of both HRM specialists and line managers in designing and implementing effective HRM policies and practices.

Course Content:

Unit - I

Evolution and growth of human resource management (with special reference to scientific management and Human relations approaches).Role of HR in strategic management.Nature.objectives, scope, and functions of HR management.

Unit - II

Challenges of HR (the changing profile of the workforce - knowledge workers, employment opportunities in BPOs, IT and service industries, Flexi options), Workforce diversity (causes, paradox, resolution of diversity by management).

Unit III

HRD; Human resource management as a profession.Concepts of line-staff in the structure of human resource department and the role of human resource manager.

Unit - IV

Manpower planning -objectives, elements, advantages, process. Job design - (simplification, rotation, enlargement, enrichment and approaches}.Job analysis.Job evaluation.

Unit - V

Recruitment (factors affecting, sources, policy, evaluation). Selection(procedure, tests, interviews). Placement and Induction.

Suggested Readings:

1. Aswathappa K., "Human Resource and Personnel Management", Tata McGraw-Hill
2. Chhabra T.N., "Human Resource Management", DhanpatRai and Co.
3. Saiyadain S. Mirza, "Human Resource Management", Tata Mc-GrawHill
4.Chadha, N.K., "Human Resource Management-issues, case studies, experiential exercises", Sri SaiPrintographers

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Course No	Title of the Course	Course Structure	Pre-Requisite
EO005	Project Management	3L-1T-0P	None

Course Outcomes:

Course Objectives:-

In this comprehensive course, student will learn the fundamentals of project management: how to initiate, plan, and execute a project that meets objectives and satisfies stakeholders. This course provides a step-by-step guide to planning and executing a project and to develop a manageable project schedule.

Course Content:

Unit-I

Objectives of Project Planning, monitoring and control of investment projects. Relevance of social cost benefit analysis, identification of investment opportunities. Pre-feasibility studies.

Unit-II

Project Preparation: Technical feasibility, estimation of costs, demand analysis and commercial viability, risk analysis, collaboration arrangements; financial planning; Estimation of fund requirements, sources of funds.Loan syndication for the projects.Tax considerations in project preparation and the legal aspects.

Unit-III

Project appraisal: Business criterion of growth, liquidity and profitability, social cost benefit analysis in public and private sectors, investment criterion and choice of techniques. Estimation of shadow prices and social discount rate.

Unit-IV

Project review/control-Evaluation of project. PERT/CPM.resource handling/leveling.

Unit-V

Cost and Time Management issues in Project planning and management , success criteria and success factors, risk management.

Suggested Readings:

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1. Ravi Ravindran, "Operations Research and Management Science Handbook", CRC Press
2. Harold Kerzner, "Applied Project Management: Best Practices on Implementation", John Wiley & Sons, Inc
3. Goodpasture, J. C., "Quantitative Methods in Project Management", J Ross Publishing
4. Meredith, J. R. and Mantel Jr., S. J., "Project Management: A Managerial Approach", John Wiley
5. Clifford Gray, "Project Management", Richard D. Irwin

Course No	Title of the Course	Course Structure	Pre-Requisite
EO006	Basics of Corporate Law	3L-1T-0P	None

Course objectives:

The objective of this Course is to provide in-depth knowledge of the Corporate laws and process related to integrate these aspects of management studies in decision making within an organization; analyze and interpret management information; make decisions based on the information available; communicate information effectively; understand and apply the theoretical aspects of accounting methods used for collecting, recording and reporting financial information; explain and appraise the taxation laws which govern corporations and individuals.

Course Content:

Unit I: Introduction : Administration of Company Law, characteristics of a company; common seal; lifting of corporate veil; types of companies including private and public company, government company, foreign company, one person company, small company, associate company, dormant company, producer company; association not for profit; illegal association; formation of company, promoters and their legal position, pre incorporation contract and provisional contracts; on-line registration of a company.

Unit II: Documents: Memorandum of association and its alteration, articles of association and its alteration, doctrine of constructive notice and indoor management, prospectus, shelf prospectus and red herring prospectus, misstatement in a prospectus; GDR; book building; issue, allotment and forfeiture of shares, calls on shares; public offer and private placement; issue of sweat capital; employee stock options; issue of bonus shares; transmission of shares, buyback and provisions regarding buyback; share certificate; D-Mat system; membership of a company.

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Unit III: Management and Meetings: Classification of directors, additional, alternate and adhoc director; women directors, independent director, small shareholders' director; director identity number (DIN); appointment, who can appoint a director, disqualifications, removal of directors; legal position, powers and duties; key managerial personnel, managing director, manager; meetings of shareholders and board; types of meeting, convening and conduct of meetings, requisites of a valid meeting; postal ballot, meeting through video conferencing, e-voting; committees of board of directors – audit committee, nomination and remuneration committee, stakeholders relationship committee, corporate social responsibility committee; prohibition of insider trading.

Suggested Readings:

1. Hicks, Andrew & Goo S.H., "Cases and Material on Company Law", Oxford University Press
2. Gowar, LCB, "Principles of Modern Company Law", Stevens & Sons
3. Majumdar, A.K., and G.K. Kapoor, "Company Law and Practice", Taxmann
4. Hanningan, Brenda," Company Law", Oxford University Press
5. Sharma, J.P., "An Easy Approach to Corporate Laws", Ane Books Pvt. Ltd.
9. Ramaiya, "A Guide to Companies Act, LexisNexis" Buttersworthwadhwa.
6. Kannal, S., & V.S. Sowrirajan, "Company Law Procedure", Taxman's Allied Services (P) Ltd.

Course No	Title of the Course	Course Structure	Pre-Requisite
EO007	**BIOLOGICAL COMPUTING**	3L-1T-0P	None

Course Outcomes:
 Course Objectives . To understand computing in context of biological systems
2. To understand computing languages needed to solve biological problems
3. To acquire computational skills for analysis of biological processes through grid computing
4. To gain knowledge of different biological databases and their usage
5. To gain innovative insight into DNA computing

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Course Content:
Introduction, Orientation and UNIX,
Python: Introduction to Variables and Control flow, Python II - Parsing In and Output,
     Python III - Scripting and Functions, Python IV- Number Crunching and Plotting,
Grid computing, Biogrid, R basics and Visualization, Unix for fast text processing, SQL
     Database
Biological databases, R for speed, R for fun, Local BLAST, Unit Testing and Code Correctness
DNA computing

Suggested Readings:
 	
  1. H. Bolouri, R. Paton, "Computations in cells & tissues", 1st Edition by, Springer
  2. Haubold, Bernhard, Wiehe, "Introduction to Computational Biology: An Evolutionary Approach", Springer

Course No	Title of the Course	Course Structure	Pre-Requisite
EO008	**Basics of Social Sciences**	3L-1T-0P	None

Course Outcomes: **Course Objectives** **Social science** is a major category of academic disciplines, concerned with society and the relationships among individuals within a society. It in turn has many branches, each of which is considered a "social science".
Course Content: **Unit I:** Economics, political science, human geography, demography and sociology. **Unit II:** Humanities, anthropology, archaeology, jurisprudence, psychology, history, and linguistic. **Unit III:** Political science, economics, sociology, international politics and scientific methodology.
Suggested Readings: 1. A.C. Kapoor, "Principles of Political Science,'' S. Chand Publications 2. A.K. Sharma, "Issues in Social Demography,'' Mittal Publications 3. Kathy S. Stolley, "The Basics of Sociology,'' Greenwood Press.

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<div style="border:1px solid">

4.   Paul M. Muchinsky ,"Psychology Applied to Work,'' Thomson Learning Inc

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Course No	Title of the Course	Course Structure	Pre-Requisite
EO009	**ENTREPRENEURSHIP**	3L-1T-0P	None

Course Objectives:
This Course Aims at Instituting Entrepreneurial skills in the students by giving an overview of who the entrepreneurs are and what competences are needed to become an entrepreneur.
contents:

Course Content:

Unit I-Introduction:

Concept and Definitions, Entrepreneur v/s Intrapreneur; Role of entrepreneurship in economic development; Entrepreneurship process; Factors impacting emergence of entrepreneurship; Managerial versus entrepreneurial Decision Making; Entrepreneur v/s Investors; Entrepreneurial attributes and characteristics; Entrepreneurs versus inventors; Entrepreneurial Culture; Women Entrepreneurs; Social Entrepreneurship; Classification and Types of Entrepreneurs; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs.

Unit II- Creating Entrepreneurial Venture:

Generating Business idea- Sources of Innovation, methods of generating ideas, Creativity and Entrepreneurship; Challenges in managing innovation; Business planning process; Drawing business plan; Business plan failures; Entrepreneurial leadership- components of entrepreneurial leadership; Entrepreneurial Challenges; Legal issues – forming business entity, considerations and Criteria, requirements for formation of a Private/Public Limited Company, Intellectual Property Protection- Patents Trademarks and Copyrights – importance for startups, Legal Acts Governing Business in India.

Unit III-Functional plans:

Marketing plan– for the new venture, environmental analysis, steps in preparing marketing plan, marketing mix, contingency planning; Organizational plan – designing organization structure and

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Systems; Financial plan – pro forma income statements, pro forma cash budget, funds Flow and Cash flow statements; Pro forma balance sheet; Break Even Analysis; Ratio Analysis.

Unit IV- Entrepreneurial Finance:

Debt or equity financing, Sources of Finance- Commercial banks, private placements, venture capital, financial institutions supporting entrepreneurs; Lease Financing; Funding opportunities for Startups in India.

Unit V- Enterprise Management:

Managing growth and sustenance- growth norms; Factors for growth; Time management, Negotiations, Joint ventures, Mergers & acquisitions.

Suggested Readings:

1. Kumar, Arya, "Entrepreneurship: Creating and Leading an Entrepreneurial Organization" , Pearson
2. Hishrich., Peters, "Entrepreneurship: Starting, Developing and Managing a New Enterprise", Irwin
3. Taneja, "Entrepreneurship", Galgotia Publishers.
4. Barringer, Brace R., and R. Duane Ireland, "Entrepreneurship", Pearson Prentice Hall, New Jersy (USA)
5. Hisrich, Robert D., Michael Peters and Dean Shephered, "Entrepreneurship", Tata McGraw Hill
6. Lall, Madhurima, and Shikha Sahai, "Entrepreneurship", Excel Books
7. Charantimath, Poornima, "Entrepreneurship Development and Small Business Enterprises", Pearson Education

Course No	Title of the Course	Course Structure	Pre-Requisite
EO010	**Social work**	3L-1T-0P	None

Course Outcomes:

Course Objective: In this course students will learn about various methods of social work, about community organization, social welfare administration, Problems pertaining to Marriage, Family and caste

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Course Content:

Unit 1.Social work

Philosophy and Methods. Social work: Meaning, Objectives, Scope, Assumptions & Values; History of Social work in U.K. U.S.A.and India, philosophy of Social Work. Democratic (Equality, Justice Liberty & Fraternity) and Humanitarian (Human Rights) Matrix.Social works as a profession.

Unit 2. Methods of Social work

Meaning, Scope Principles, Processes (Psychosocial study, Assessments, treatment-goal formulation and techniques), Evaluation, Follow-up and Rehabilitation. Social Groups work: Meaning,Objective, Principles, Skills, Processes (Study, Diagnosis, treatment and evaluation), Programme, Planningand Development, Role of Social group worker, Leadership Development.

Unit 3 Community organization

Meaning, Objective, Principles, Approaches, Roles of Community Organization Worker.

Unit 4 Social Welfare Administration

Meaning Scope, Auspices-Private and Public, Principles, Basic Administrative Processes and Practice decision making communication, planning.organisation, budgeting and finacial control, reporting. Social work Research: Meaning objectives, types, scope, scientific method, Selection and formulation of the problem Research Design Sampling, Sources and Methods of Data Collection, Processing of Data, analysing and interpretation, Report writing. Social Action: Meaning,Scope, approaches (Sarvodays, Antyodaya etc.) and Strategies.

Unit 5 Work in India Problem pertaining to Marriage, Family and caste

Dowry- child Marriage, Divorce, Families with working couples, Disorganised Families, Families with Emigrant Heads of the Households, Gender Inequality, Authoritarian Family structure, Major Changes in Caste systems and problem of casteism. Problems Pertaining of Weaker Sections. Problems of Children, Women Aged. Handicapped and Backward Classes (SCs, STs, and other Backward Classes). Problems of Deviance**:** Truancy Vagrancy and Juvenile Delinquency, Crime, White Colla Crime, Organized Crime,Collective Violence, Terrorism, Prostitution and Sex Related Crimes. Social Vices: Alcohilism. Drug Addiction, Beggary, Corruption and communalism. Problems of Social Structure **:** Poverty, Unemployment, Bonded Labour, Child Labour. Fields of Soclal work India **:** Child Development, Development of Youth, Women's Empowerment, Welfare of aged, Welfare of

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Physically. Mentally and Social Handicapped, Welfare of backward Classes (Scs, STs and Other Backward Classes) Rural Development Urban Community Development, Medical And Psychiatric Social work, Industrial Social work, Social Security offender Reforms.

Suggested Readings:
1. Rajni Bedi, "Social Work: An Introductory Text Book"
2. Sanjay Bhattacharya, "Social Work: An Integrated Approach"
3. NiteshDhawan, "Social work perspective Philosophy and Methods"
4. P. R. Gautam, "Social Work: Methods Practices And Perspectives"

Course No	Title of the Course	Course Structure	Pre-Requisite
EO011	**Intellectual property and Patenting**	3L-1T-0P	None

Course Outcomes:

Course objectives

The objective of this Course is to provide in-depth knowledge of the laws and process related to Trademarks, Copyrights and other forms of IPs with focus on Patents, the Indian and International Patent filing procedure, drafting patent application and conducting prior art searches. Students will be exposed to the technical, management and legal aspects of IP and Patents.

Course Content:

UNIT I: Introduction: Historical and philosophical background of patents and other intellectual property, Patent System: the Constitution, Congress, Patent Office (PTO), and courts; Analyzing and understanding judicial opinions

UNITII: Comparative overview of patents, copyrights, trade secrets, and trademarks: Legal fundamentals of patent protection for useful inventions**,** Design and plant patents, Legal fundamentals of copyright protection, Similarity and access, Expression vs. ideas and information, merger, Fair use of copyrighted works (e.g., for classroom use), Contributory copyright infringement, Critical differences between patent and copyright protection, Copyright infringement distinguished from plagiarism, Legal fundamentals of trade-secret protection, Legal fundamentals of trademark protection

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UNIT III: Requirements and limitations of patentability: New and useful: (A) The legal requirement of novelty (B) First to invent vs. first inventor to file, The legal requirement of non-obviousness.

UNIT IV: The process of applying for a patent ("patent prosecution"): Anatomy of a patent application, Adequate disclosure, The art of drafting patent claims, Patent searching: (A) Purposes and techniques, Actions for patent infringement, Interpretation of claims, Doctrine of equivalents, Product testing as a possibly infringing use, Doctrine of exhaustion

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Suggested Readings:

1. Rines, Robert H., "Create or Perish: The Case for Inventions and Patents", Acropolis.

Course No	Title of the Course	Course Structure	Pre-Requisite
EO012	**Supply Chain Management and Logistics**	3L-1T-0P	None

Course Outcomes:

Course objectives:-

Supply chain management consist of all parties (including manufacturer, marketer, suppliers, transporters, warehouses, retailers and even customers) directly or indirectly involved in fulfillment of a customer. The main objective is to acquaint the students with the concepts and tools of supply chain management and logistics as relevant for a business firm.

Course Content:

Unit I

Introduction: Concept of supply chain management (SCM) and trade logistics; Scope of logistics; Logistic activities – an Overview; Contribution of logistics at macro and micro levels; SCM and trade logistics; Business view of SCM; Concept, span and process of integrated SCM; Demand management – methods of forecasting; Supply chain metrics (KPIs), performance measurement and continuous improvement; Product development Process and SCM; Strategic role of purchasing in the supply chain and total customer satisfaction; Types of purchases; Purchasing cycle.

Unit II

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Managing Relationship: Role of Relationship marketing in SCM; Managing relationships with suppliers and customers; Captive buyers and suppliers; Strategic partnerships; Supplier-retailer collaboration and alliances.

Unit III

Focus Areas of Logistics and Supply Chain management: Transportation-Importance of effective transportation system; Service choices and their characteristics; inter-modal services; Transport cost characteristics and rate fixation; In-company management vs. out-sourcing; World sea borne trade; International shipping- characteristics and structure; Liner and tramp operations; Liner freighting; Chartering-Types, principles and practices; Development in sea transportation-Unitization, containerisation, inter and multimodal transport; CFC and ICD. Air transport: Set up for air transport and freight rates; Carriage of Goods by sea -Role and types of cargo intermediaries. Warehousing and inventory management: Reasons for warehousing; Warehousing evaluation and requirements; Warehousing location strategies; Inventory management principles and approaches; Inventory categories -EOQ, LT, ICC; Material management systems and techniques – JIT purchasing, manufacturing and in-bound logistics; Packing and marking; Control and communication.

Unit IV

IT Enabling Logistics and Supply Chain: Technology in logistics – EDI, bar Coding, RFID etc., data warehousing, electronic payment transfers; Business management systems; TRADITIONAL ERP, SPECIAL ERP, MR, DRP, PDM, EIP, CPFR, WMS, TMS; Re-engineering the supply chain- Future directions.

Unit V

Trends and Challenges in logistics and supply chain management: Third party logistic outsourcing – challenges and future directions.

Suggested Readings:

1. Christopher, M., "Logistics and Supply Chain Management", Prentice Hall.
2. Handfield and Nicholas, Jr., "Introduction to Supply Chain Management", Prentice Hall.
3. Jhon J Coyle, C. JhonandLangley, Brian J Gibs, "Logistics approach to Supply Chain Management", Cengage Learning.

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Course No	Title of the Course	Course Structure	Pre-Requisite
EO013	**Organization Development**	3L-1T-0P	None

Course Outcomes:

Course Objectives

Organisation Development is a growing field of Human Resource Management. It has its foundations in a number of behavioral and social sciences.

Course Content:

1. Organizational Systems and Human Behavior - Developing a basic knowledge of how organizattons and groups function as systems; introducing and discussing various theoretical approaches and issues.
2. Interpersonal and Consulting Skills - Increasing effectiveness as a change agent by providing a variety of opportunities in order to increase self-awareness, practice alternative ways of approaching personal and interpersonal problem-solving and develop basic consulting and interviewing skills.
3. Introduction to Organization Development - Introducing some basic theories, models and methods in the field of organization development, especially those relating to the role of consultant and strategies for change.
4. Intervention and Change in Organizations - Consolidating and further developing consulting skills and strategies
5. Action Research Project - Carrying out a change activity in an organization, while also researching the effects and/or the process. This provides participants with an opportunity to consolidate and demonstrate skills and knowledge gained in other units of the course

SUGGESTED READINGS:

1. Wendell L. French, Cecil H. Bell Jr., Veena Bohra, "Organization development," Pearson Prentice Hall.
2. Donald L. Anderson, "Organization Development: The process of leading organizational change,'' Sage Publications, Inc.
 3 W. Warner Burke, Debra A. Noumair, "Organization Development: A process of learning and changing,''

 Pearson Education Ltd.

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Course No	Title of the Course	Course Structure	Pre-Requisite
EO014	**Industrial organisation and managerial economics**	3L-1T-0P	None

Course Objectives: This course help students in understanding the basics of management and Industrial organisation.

Course Content:

Unit I: Principles of management, General idea, various functions, scope of engineering. Organisation structure, Types, merits and demerits.

Unit II: Plant location and layout, Factors effecting location, types of layout. Production planning and control, Sequence of planning and control of production. Scheduling , routing, despatching., Methods Study, Methods analysis, time study methods of rating.

Unit III: General idea of personnel management, Industrial psychology, job evaluation and monitoring. Business decision making and forward planning. Demand and demand forcasting of production analysis-prices and pricing decision-profit and capital, management. Analysis of inter-industry relation, macro-economics and business.

SUGGESTED READINGS:

1. Lawrence L. Bethel ,"Industrial organization and management" McGraw-Hill
2. Ralph Currier Davis,"Industrial organization and management" Harper & Row
3. James L. Riggs, Lawrence L. Bethel,"Industrial organization and management" McGraw-Hill
4. Richard Hines Lansburgh, William Robert Spriegel, "Industrial management" John Wiley
5. Harold T. Amrine, John A Ritchey, Colin L. Moodie, Joseph F. Kmec, "Manufacturing Organization and

   Management" Pearson Education India

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Course No	Title of the Course	Course Structure	Pre-Requisite
EO015	**Global Strategies and Technology**	3L-1T-0P	None

Course Objectives
This subject focuses on the specifics of strategy and organization of the multinational company, and provides a framework for formulating successful and adaptive strategies in an increasingly complex world economy.

Course Content:
Globalization of industries, the continuing role of country factors in competition, organization of multinational enterprises, and building global networks
Analysis of competitive situations from the general management point of view, including fit between key environmental forces and the firm's resources, and changes in these over time. Formulating and implementing strategy based on that analysis. Developing and leveraging a firm's core competencies to gain long-term sustainable advantage

SUGGESTED READINGS:

1. Kazuyuki Motohashi ,"Global Business Strategy" Springer
2. M. Pinedo, I. Walter, "Global Asset Management: Strategies, Risks, Processes, and Technologies" SimCorp, strategylab
3. Frank McDonald and Richard Thorpe, " Organizational Strategy and Technological Adaptation to Global Change" Macmillan Business
4. Prashant Palvia, Shailendra C. Jain Palvia, Albert L. Harris ," Managing Global Information Technology : Strategies and Challenges
5. **McDonald**, Frank, **Thorpe**, Richard, "Organizational Strategy and Technological Adaptation to Global Change" Macmillan Business

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Course No	Title of the Course	Course Structure	Pre-Requisite
EO016	**Engineering System analysis and Design**	3L-1T-0P	None

Course Objective:
The students will learn about system definitions and role of system analyst. They will learn about system modeling and design. They will be exposed to System Implementation and Maintenance issues.

Course Content:
Unit 1

System definition and concepts: Characteristics and types of system, Manual and automated systems Real-life Business sub-systems: Production, Marketing, Personal, Material, finance Systems models types of models: Systems environment and boundaries, Real time and distributed systems, Basic principles of successful systems

Unit 2
Systems analyst: Role and need of systems analyst, Qualifications and responsibilities, Systems Analyst, agent of change.
Various phases of systems development life cycle: Analysis, Design, Development, Implementation, Maintenance

Unit3
Systems Design and modeling:Process modeling, Logical and physical design, Design representation, Systems flowcharts and structured charts, Data flow diagrams, Common diagramming conventions and guidelines using DFD and ERD diagrams. Data Modeling and systems analysis, designing the internals: Program and Process design, Designing Distributed Systems

Unit 4
 User Interfaces – Relational Analysis – Database design – program design– structure chart – HIPO – SSADM – Alternate Life cycles – Prototypes.

Unit 5
System Implementation and Maintenance:Planning considerations, Conversion methods, producers and controls, System acceptance Criteria, System evaluation and performance, Testing and validation, Systems qualify Control and assurance, Maintenance activities and issues.

Suggested Readings:

1)Haryszkiewycz, "Introduction to Systems Analysis and Design", II Ed. PHI
2) James A Senn, "Analysis and Design of Information Systems", McGraw Hill

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Course No	Title of the Course	Course Structure	Pre-Requisite
EO017	BIOLOGY FOR ENGINEERS	3L-1T-0P	None

Course Objectives:

1. General understanding of organization in biological systems
2. Conceptual knowledge of functioning in biological systems
3. Clarity about relevance of Biology to engineering graduates
4. Understanding human body as a study-model for engineering students
5. Understanding electrical, chemical and magnetic forces, and communication networks in human body

Course Content:

Unit I: Principles of Biology: Form and Function, Modularity and Incremental Changes, Genetic Basis, Competition and Selection, Biological Hierarchies, Biological complexity vs simplicity

Unit II: Biological Responses: Need for Water, Oxygen, Food, Nutrients, Heat Sources and Sinks, Adaptation to their Environments, Waste tolerance, Response to Chemical and Mechanical Stresses, Optimization to Save Energy and Nutrient Resources, **Allometric Relationships from Evolutionary Pressure**

Biology for Engineering Solutions: Systems Approach, Relationships between Engineering and Biology, The Completed Design

Biological Systems and Dynamics: Basic principles, Qualitative and quantitative description of Human Body, Modeling of Human Body: Compartments, Fluid streams, Production sources, The Hemodynamic System, Cheyne-Stokes Respiration,

Neural system: Action Potentials and Ion Channels, Ficks Law, Ohms Law and the Einstein Relation, Cellular Equilibrium: Nernst and Goldman, Equivalent Circuits, Dendrites; **Mathematical Neurodynamics:** Hodgkin, Huxley and the Squid Giant Axon FitzHugh-Nagumo Model, Fixed Points and Stability of a One-Dimensional Differential Equation, Nullclines and Phase Plane, Pitchfork and Hopf Bifurcations in Two Dimensions Excitability

Bioelectric and biomagnetic phenomena and their measurements

Suggested Readings:
1. T. Johnson, "Biology for Engineers", CRC Press
2. Michael Small, "Dynamics of Biological system", CRC Press
3. Johnny T. Ottesen, MS Olufsen, JK Larsen, "Applied Mathematical Models and Human Physiology", Society for Industrial and Applied Mathematics

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Course No	Title of the Course	Course Structure	Pre-Requisite
EO018	Energy, Environment and Society	3L-1T-0P	None

Course Objective:

The objective is to aware students about various renewable resources, Basics of energy, environmental Impact of Energy sources. Students will also learn about the role of appropriate Technology in Transformation of Society

Course Content:

Unit 1 Technology and Development
Introduction to Technology, Appropriate Technology, Role of Appropriate Technology in Transformation of Society, Importance of Technology Transfer, Impact of technology on Society.

Unit 2 Energy Basics
Importance of Energy in achieving Maslow's hierarchy of Needs, Human Development Index and Energy Consumption, Current Energy Trends, Demand and Supply of Energy in World and Nepal, Introduction to Global warming, Clean Development Mechanism, and Sustainability Issues, Conventional and Non-Conventional/Renewable Energy Sources,. Conventional Energy Sources: Fossil fuel, Nuclear Energy

Unit 3 Renewable Energy Sources
Solar radiation, Solar thermal energy, Solar Cell (Photovoltaic Technology), Hydropower Water sources and power , Water turbines and hydroelectric plants, Hydro Power Plant Classification (pico, micro, small, medium, large), Wind Energy , Availability of Wind Energy sources, Wind turbines, wind parks and power control, Geothermal Energy, Sources of Geothermal Energy, Uses of Geothermal Energy, .Bio-mass and Bio-energy, Synthetic fuels from the biomass ,Thermo-chemical, physio-chemical and bio-chemical conversion, Bio-fuel cells , Hydrogen Energy and Fuel Cell , Basics of electrochemistry, Polymer membrane electrolyte (PEM) fuel cells, Solid oxide fuel cells (SOFCs) , Hydrogen production and storage.

Unit 4 Environmental Impact of Energy sources
Emission hazard, Battery hazard, Nuclear hazard

Unit 5 Energy Storage

Passed in the meeting of Standing Committee on Academic matters, University of Delhi, held on
June 03, 2016

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Forms of energy storage, Hybrid vehicles, Smart grid systems, Batteries, Super-capacitors
Suggested Readings: 1) Saxena, A.B., "Energy, Environment, Ecology and Society" 2) Juan Martinez-Alier and Klaus Schlupmann, "Ecological Economics: Energy, Environment and Society"

Course No	Title of the Course	Course Structure	Pre-Requisite
EO019	**Public Policy and Governance**	3L-1T-0P	None

Course Objective:
Students will be introduced to Public Policy and Administrative governance. They will also learn about Administrative Governance.

Course Content:

Unit 1 Introduction to Public Policy and Administrative Governance: Introduction to public policy, econometrics for policy research, policy analysis, economics for public decision making.

Unit 2 Public Bureaucracy in Theory and Practice: Benefit cost analysis, public budgeting, revenue and expenditures, managing and leading public service organisations.

Unit 3 Administrative Governance: The Challenge of Policy Implementation, public and non-profit programme evaluation.

Unit 4 Non-state Actors in Policy-making and Administrative Governance: governance in twenty-first century, Social Diversity and the Question of "Difference" in Policy-making and administrative Governance

Suggested Readings:
  1. John Shields and B. Mitchell Evans, "Shrinkingthe State: Globalization and Public administration Reform" Halifax: Fernwood
  2. Beryl Radin, "Beyond Machiavelli: Policy Analysis Reaches Midlife", 2nd edition Washington, DC: Georgetown University Press
  3. Frank R. Baumgartner, Jeffrey M. Berry, Marie Hojnacki, and David C. Kimball, "Lobbying and Policy Change: Who Wins, Who Loses, and Why" Chicago, IL: University of Chicago Press.

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4. Timothy Conlan, Paul Posner, and David Beam, "Pathways of Power: The dynamics of National Policymaking", Washington, DC: Georgetown University press.

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO020	**Numerical Methods**	**3L-0T-2P**	4	None

Course Outcomes:

By the end of this course, the student will be able to

1. Write program and solve algebraic & transcendental equations and system of equations.

2. Analyze data through interpolation and able to write programs for Numerical Integration.

3. Write programs to solve Ordinary Differential Equations and Partial Differential Equations.

Course Content:

Solution of Algebraic and Transcendental Equations: Bisection method, Regula Falsi method, Secant methods, Newton's method, Rate of convergence, Fixed-point iteration method.
System of Linear Algebraic Equations: Gauss elimination method, Gauss-Jordan method, Crout's method, Jacobi's method, Gauss-Seidel method, Relaxation method.
Interpolation: Finite difference operators, Interpolating polynomials using finite difference (Newton forward, Newton backward, Stirling and Bessels). Lagrange polynomials, divided difference
Numerical Differentiation and Integration: Derivatives from differences tables, Higher order derivatives, Newton-Cotes integration formula, Trapezoidal rule, Simpson's rules and error estimation, Romberg's Integration.
Numerical Solution of Ordinary Differential Equations: Taylor series method, Euler and Modified Euler method, Runge-Kutta methods, Milne's method.
Numerical Solution of Partial Differential Equations: Finite difference approximations of partial derivatives, Solution of Laplace equation and Poisson's method (Standard 5-point formula only), One-dimensional heat equation (Schmidt method, Crank-Nicolson method) and Wave equation.
Practical:
Based on the above methods using C / C++

Suggested Readings:
1   Curtis F. Gerald and Patrick G. Wheatley, "Applied Numerical Analysis", Pearson Education

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Ltd
2 E. Balagurusamy, "Numerical Method", T.M.H.
3 M. K. Jain, S.R.K. Iyenger and R.K. Jain, "Numerical Methods for Scientific and Engg. Computations", Wiley Eastern Ltd.
4. S.S. Sastry, "Introductory Methods of Numerical Analysis", P.H.I.

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO021	**Mathematical Statistics**	**3L-1T-0P**	4	None

Course Outcomes:

By the end of this course, the student will be able to:

1. Collect and analyze the data using statistical techniques.
2. Describe sampling distributions of sample means and sample proportions
3. Estimate unknown parameters of the population from a sample.
4. Construct confidence intervals for mean difference of means and proportions; and perform hypothesis tests for means.

Course Content:

Random Variable, Moments, Rectangular distribution, Exponential distribution, Beta distribution of first and second kind, Gamma distribution, Marginal and Conditional probabilities, Tchebycheff's and Markov's inequalities, Important theoretical Distributions: Binomial, Poisson, Normal and Multinomial distributions and their properties, Fitting of Normal Distribution by Method of ordinates and Method of areas, Dirichlet distribution, Moment Generating Functions and Cumulants, Weak Law of Large Numbers, Central Limit Theorem.
Method of least square: Fitting a straight line, Parabola and Exponential Curves.
Bivariate distribution: Correlation and Regression, Probable Error, Rank Correlation.
Simple sampling of Attributes: Large samples, Mean and S.D. in simple sampling of attributes, Test of significance for large samples, Standard error, Null Hypothesis, Confidence Limits, Chi-Square Distribution, Degree of Freedom, m. g. f. of Chi square distribution, Level of Significance, Test of Goodness of Fit, Test of Independence, Coefficient of Contingency, Yate's Correction for Continuity.

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Sampling of Variables: Small samples, t-Distribution, Test of significance of the mean of random sample from Normal population, F-Distribution, ANOVA: Analysis of variance, meaning and definition, Variance within and between classes, One criterion of Classification and problems based on it.

Suggested Readings:

1. Walpole, et al., "Probability and Statistics for Engineers and Scientists", Prentice   Hall
2. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", Academic Press.

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO022	**Abstract and Linear Algebra**	3L-1T-0P	4	None

Course Outcomes: By the end of this course, the student will be able to:

1. Know the concepts of Group theory and its applications
2. Know the concept of Rings
3. Know the concepts of Vector Spaces and Linear Transformations

Course Content:

GROUPS: Binary operation, Group, Finite and Infinite Groups, Order of a   Group, Additive and Multiplicative groups of integers (mod m). Composition table,   Subgroup, Permutation group, Cyclic permutation, even and odd permutations, Cayley's Theorem, Isomorphism, Automorphism, homomorphism, Lagrange's Theorem, Quotient Group, Cyclic Group, Normal Subgroup, Centre of a group, Normalizer, Homomorphism, Isomorphism.

RINGS: Rings, Integral domain, Field, Theorems on Rings, Integral domain and Fields, Subrings, Left and Right Ideals, Quotient Ring, Homomorphism, Isomorphism, Kernel of a homomorphism.

(i)   **VECTOR SPACES:** Vector space and its examples, Subspaces, Linear combinations, Linear spaces, Linear dependence and Linear Independence, Cauchy–Schwarz's inequality, Minkowski inequality, Basis, Dimension and simple examples. Linear Transformation, Isomorphism, Nullity and Rank, Linear functional, Linear operators,

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Dual Space, Dual Basis, Annihilator, Transpose of a Linear map.
Suggested Readings: I. N. Herstein, "Topics in Algebra", Wiley J. B Fraleigh, "A First Course in Algebra", Narosa

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO023	**Optimization Techniques**	**3L-1T-0P**	4	None

Course Outcomes: By the end of this course, the student will be able to: 1. Know the concepts of Linear Programming 2. Know the concept of Non-linear Programming 3. Know the concepts of Dynamite Programming
Course Content: Linear programming, Duality Theory, dual Simplex method, Revised Simplex method, Sensitive analysis. Integer Programming, Cutting plane algorithm. Branch and bound technique, travelling salesman problem. Nonlinear Programming, Kuhn-Tucker conditions, quadratic programming, Wolfe's algorithm. Dynamite programming, Deterministic and stochastic examples. Advanced queuing Models, Finite source queues, Balking and Reneging, Priority queue disciplines.
Suggested Readings: 1. Hamdy Taha, "Operations Research, An Introduction", Pearson Education 2. J R Fletcher, "Practical Methods of Optimization", Wiley

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Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO024	**Introduction to Mathematical Software and Programming Languages**	**2L-0T-4P**	4	None

Course Outcomes: By the end of this course, the student will be able to:

1. Know using different Mathematical Software to solve Engineering Problems.

2. Know preparing Texts/ Reports / Dissertation and presentations using Latex

Course Content: Use of MATHEMATICA, MATLAB, MATHCAD, MAPLE, STASTITICA, LATEX, and other application software packages to study models of simultaneous equations, eigenvalues and eigenvectors, system of linear and non-linear differential equations, stability analysis, numerical integration, regression analysis, etc.

Suggested Readings:

Online Manuals of the related Software.

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO025	**Mathematical Finance**	**3L-0T-1P**	4	None

Course Outcomes:

Course Content:

Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound, discrete

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and continuous), time value of money, inflation, net present value, internal rate of return (calculation by bisection and Newton-Raphson methods), comparison of NPV and IRR. Bonds, bond prices and yields, Macaulay and modified duration, term structure of interest rates: spot and forward rates, explanations of term structure, running present value, floating-rate bonds, immunization, convexity, putable and callable bonds.

Asset return, short selling, portfolio return, (brief introduction to expectation, variance, covariance and correlation), random returns, portfolio mean return and variance, diversification, portfolio diagram, feasible set, Markowitz model (review of Lagrange multipliers for 1 and 2 constraints), Two fund theorem, risk free assets, One fund theorem, capital market line, Sharpe index. Capital Asset Pricing Model (CAPM), betas of stocks and portfolios, security market line, use of CAPM in investment analysis and as a pricing formula, Jensen's index. Forwards and futures, marking to market, value of a forward/futures contract, replicating portfolios, futures on assets with known income or dividend yield, currency futures, hedging (short, long, cross, rolling), optimal hedge ratio, hedging with stock index futures, interest rate futures, swaps. Lognormal distribution, Log-normal model / Geometric Brownian Motion for stock prices, Binomial Tree model for stock prices, parameter estimation, comparison of the models. Options, Types of options: put / call, European / American, pay off of an option, factors affecting option prices, put call parity.

Suggested Readings:

1. David G. Luenberger, "Investment Science", Oxford University Press
2. John C. Hull, "Options, Futures and Other Derivatives (6th Edition)", Prentice Hall India, Indian reprint
3. Sheldon Ross, "An Elementary Introduction to Mathematical Finance", Cambridge University Press, USA

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO026	**Quantum Electronics**	**3L-0T-2P**	4	None

Course Outcomes: This course imparts understanding of various mechanisms in semiconductor, laser, maser and optical fibre communication using quantum mechanics as fundamental tool. It prepares students to take advanced courses in the related fields and finally equips students to take up R&D and higher studies. This course is very useful in designing electronic and optical communication devices for using in optical communications, medicine, environment, industries and

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related fields.
<u>Course Content:</u> 1. Semiconductor Laser Homojunction laser: Population inversion at a junction; Emission spectra; The basic semiconductor laser; Heterojunction: Formation of ideal heterojunctions between (a) a p-type wide band-gap semiconductor and an n-type narrower band-gap semiconductor, (b) an n-type wide band-gap semiconductor and a p-type narrower band-gap semiconductor, (c) wide and lightly doped narrower band gap n-type semiconductors; Anderson's model of ideal heterojunction. Heterojunction laser: Single and double heterojunction laser; Analysis of carrier confinement in a single heterojunction laser. 2. Electrons in quantum structures Energy level and wave functions for quantum well, quantum wire and quantum dot; Density of states for quantum well, quantum wire and quantum dot; Modulation | doped quantum well; Multiple quantum well; Coupling between quantum wells. Super lattice: The concept of a super lattice; Kronig-Penney model of a super lattice | zone folding, Tight binding approximation for a super lattice. 3. Quantum Semiconductor Laser Light amplification in quantum well; Modulation bandwidth; Strained quantum well laser; Quantum wire laser; Blue quantum well laser. 4. Electro-optic effect in quantum structures Franz-Keldysh effect in Semiconductor; Electro-optic effect in quantum wells; Electro-optic effect in super lattice. 5. Parallel and Perpendicular Transport in Quantum Structures High field electron transport|Hot electrons in quantum structures; Double barrier resonant-tunneling structures; Super lattices and ballistic injection devices. 6. Quantum Transistor Resonant-tunneling unipolar and bipolar transistor; Velocity modulation and quantum interference transistor. 7. Guided wave optics (a) Waveguide modes, Modes characteristics for a planar waveguide, Step index planar waveguide, Maxwell equations in inhomogeneous media: TE modes and TM modes, Radiation modes, Guided modes, Leaky modes, Quasi modes. (b) Propagation in optical fibre, Numerical aperture, Pulse dispersion in fibres, Scalar wave

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equation and modes of the fibre, Modal analysis for a step index fibre.

8. Masers

Ammonia beam maser, Energy levels, Methods for population inversion, Maser operation.

9. Coherent interactions of a radiation field and an atomic system

(a) Induced resonant transitions, Inclusions of decay phenomena, Rotating wave approximation, Exact Rabi Solution in the strong field, Rabi flopping, Dressed state picture.

(b) Density matrix, Rate equation for density matrix, Optical Bloch equations, Vector model of density matrix, The Bloch sphere.

10. Semiclassical laser theory

Electromagnetic field equations, Expansion in normal modes of a cavity, Lambs self-consistency equations, Density matrix equations, Polarization of the medium, Single mode operation, Non-linear effect in polarization, Hole burning, Steady state power, Frequency pulling and pushing.

Suggested Readings:

1. Mitin, Kochelap and Stroscio, "Quantum Heterostructures: Microelectronics and Optoelectronics"
2. Martinez-Duart, Martin-Palma, Agullo-Rueda, "Nanotechnology for Microelectronics and Optoelectronics"
3. A. Yariv, "Quantum Electronics"
4. A.K. Ghatak and K. Thyagarajan, "Optical Electronics"
5. O. Svelto, Principles of Lasers"
6. P. Bhattacharyya, "Semiconductor Optoelectronics Devices"
7. R.W. Boyd, "Nonlinear Optics"
8. B.G. Streetman and S. Banerjee, "Solid State Electronic Devices"
9. T. Suhara, "Semiconductor laser fundamentals"
10. S.M. Sze, "Physics of Semiconductor Devices"
11. J. Orton, "The Story of Semiconductors"
12. Rogers, Pennathur, Adams, "Nanotechnology: Understanding Small Systems"

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Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO027	Laser Systems and Applications	3L-0T-2P	4	None

Course Outcomes:

Course Content:

Introduction: Review of elementary quantum physics, Schrodinger equation, concept of coherence, absorption, spontaneous emission and stimulated emission processes, relation between Einstein's A and B coefficients, population inversion, pumping, gain, optical cavities.

Lasers & Laser Systems: Main components of Laser, principle of Laser action, introduction to general lasers and their types. Three & four level Lasers, CW & Pulsed Lasers, atomic, ionic, molecular, excimer, liquid and solid state Lasers and systems, short pulse generation and Measurement.

Applications: Laser applications in medicine and surgery, materials processing, optical communication, metrology and LIDAR and holography(recording and reconstruction).

Course Outcome: The concept and understanding of laser action are helpful in designing and developing new devices used in optical communications, medicine, environment, industries and related physics. It also gives value addition in the students' understanding of the basic principles involved. It prepares students to take advanced courses in the related fields and finally equips students to take up R&D in the related field.

Suggested Readings:

1. K.R. Nambiar, "Laser Principles, Types and Application" New Age International.
2. S. A. Ahmad, "Laser concepts and Applications" New Age International.

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Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO028	Optoelectronics and Photonics	3L-0T-2P	4	None

Course Outcomes: This course imparts understanding of various mechanisms in semiconductor laser, photonics and optical fibre communication. It prepares students to take advanced courses in the related fields and finally equips students to take up R&D and higher studies. This course is very useful in designing opto-electronic and optical communication devices for using in optical communications, medicine, environment, industries and related fields.

Course Content:

Semiconductor lasers for optical fiber communications, Fabry-Perot cavity, heterostructure semiconductor lasers, single frequency semiconductor lasers, semiconductor lasers for coherent systems. Distributed feedback in Ga-As-P lasers. Device structure and fabrication, photodetectors for fiber optics, reverse bias photo-detectors, dark current, quantum efficiency, signal to notice ratio, types of detectors. Receivers for digital fiber optic communication systems: basic components, detectors for digital fiber optic receivers, PIN diode, Avalanche photodiode, Fronts ends for digital fiber optic receivers, equalizer for optical communication, receivers, PIN-FET receivers for longer wavelength communication systems. Coherent optical fiber transmission systems, coherent detection principles, comparison of direct and coherent performance, homodyne and heterodyne systems. Non linear process in optical fibers, phase matching in waveguide, phase matched harmonic generation in waveguides. Second harmonic generation (SHG) in integrated optics, Cerenkov configuration SHG. Optical fiber sensor and devices, intensity modulation through light interruption, distributed sensing with fiber optics. Basic principles of interferometric optical fiber sensor, signal processing in mono mode fiber optic sensor, photonic band gap materials.

Suggested Readings:

1. G.Keiser, "Optical fiber communication", McGraw-Hill.
2. J.Senior, "Optical fiber Communication", Prentice- Hall International

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Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO029	**Electromagnetic Theory and Waveguides**	**3L-0T-2P**	4	None

Course Outcomes: This course imparts understanding of various mechanisms in the propagation of electromagnetic waves through space and wave guides. The understanding of various electromagnetic laws are helpful in designing and developing new devices used in optical communications, industries and related field. It prepares students to take advanced courses in the related fields and finally equips students to take up R&D and higher studies.

Course Content: Electrostatics; Boundary value problems Dielectrics, Steady currents, Magnetostatics; Time varying fields, Maxwell's equations, Lorentz force equation and motion of charges, Plane electromagnetic waves. Waveguides and resonant cavities, fields at the surface of and within a conductor, cylindrical cavities and waveguides, modes in a rectangular waveguide, energy flow and attenuation in waveguides, perturbation of boundary conditions, resonant cavities, power losses in a cavity, Earth and ionosphere as resonant cavity, dielectric waveguide.

Suggested Readings:

1. Griffiths,D.J., "Introduction to Electrodynamics", Printice- Hall Pvt.Ltd.
2. J.D.Kraus, "Electromagnetics", Tata- McGraw Hill.

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO030	**POLYMER SCIENCE & TECHNOLOGY**	**3L-0T-2P**	4	None

Course Outcomes:

CO 1: To know about polymer science and technology.

CO 2: To have an understanding of nanotechnology in polymers.

Course Content: Polymer Chemistry, Polymer Physics, Polymer Technology, Polymer Characterization, Polymer Engineering and Rheology, Polymer Processing, Polymer Testing and

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properties, Polymer Composites, Polymer Blends and Alloys, Rubber Technology, Polymer Processing, Polymers in Packaging, Nanotechnology in Polymers, Engineering Plastics and Specialty Polymers, New innovations in Polymers.

Practical related to above theory.

Suggested Readings:

1) P.J.Flory, "Introduction to polymer Chemistry", Asian Books

2) Miles & Briston, "Polymer Technology", J.G.Chemical Publishing Company,New York

3) R.T. Fenner, "Principle of Polymer Processing", Maxwell McMillan International Edn, London.

4) Stephen L. Rosen, "Fundamental principles of polymer materials practices for engineers, Plastics Materials", Barnes & Noble, New York.

5) Joel Frados, "Plastics Engineering Handbook", Van Nostrand Reinhold, New York

6) Morton & Jones, "Polymer Processing", Chapman & Hall.

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO031	**Semiconductor Physics and Devices**	3L-0T-2P	4	None

Course Outcomes: This course is very helpful in understanding the various phenomena/mechanisms which are very useful in designing electronic devices, energy storage devices and other transistor based devices used in all sphere of life. It prepares students to take advanced courses in the related fields and finally equips them to take up R&D and higher studies.

Course Content: Semiconductor Physics; Semiconductor, Bonds in Semiconductors, Energy band, Effect of temperatures on Semiconductor, Hole currents, Intrinsic & extrinsic semiconductor, Majority and minority carriers, p-n junction, Volt- ampere characteristics of p-n junction. Semiconductor Diode: Semiconductor diode, Crystal diode rectifiers, Half wave rectifiers, Efficiency of half wave rectifier, Full wave rectifier, Centre tap full wave rectifier, Ripple factor, Filter Circuits, Voltage stabilization, Zener diode, Zener diode as Voltage stabilizer. Transistors: Transistors, Transistors connections, Common base connection, Common emitter connection, common collector connection, Comparison of transistor connections, Transistor as an amplifier in CE arrangement, Transistor load line analysis, Operating point, Cut off and saturation points,

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Applications of Common base amplifier, Bipolar junction Transistors, Hybrid Parameters, Field effect Transistor: JFET/MESFET, MOSFET, Unipolar Devices.	

Suggested Readings:

1. Joseph Lindmayer, Charles Y. Wrigly, "Fundamentals of Semiconductor Devices", Litton Educational Publishing Inc.
2. S.M.Sze, "Physics of Semiconductor Devices", John Wily & Sons, New Delhi.
3. A.K. Sharma, "Semiconductor Electronics" , New Age International (P) Limited
Publisher, New Delhi.

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO032	**Elements of Fiber Optics**	**3L-0T-2P**	4	None

Course Outcomes: This course imparts understanding of various mechanisms in optical fibre communication. Concepts of Optical Fiber waveguides are helpful in designing and developing new devices used in optical communications, medicine, environment, industries and related physics. It prepares students to take advanced courses in the related fields and finally equips students to take up R&D and higher studies.

Course Content:

Over view of optical fiber communications, the evolution of fiber optics systems, elements of an optical fiber transmission links. Electromagnetic analysis of optical waveguides, classification of modes for a planner waveguide, TE and TM modes in a symmetric step index planner waveguide, power associated with a mode, excitation of guided modes, Maxwell equations in inhomogeneous media: TE and TM modes in planner waveguide. Leaky modes, leakage of power from the core, bending loss in optical waveguides. Optical fiber waveguides, optical fiber types, numerical aperture, pulse dispersion in step index fibers, scalar wave equations and modes of a fiber, Modal analysis for a step index fiber and graded-index fiber. Linearly polarized modes, power flow, multi mode fibers with optimum profiles, single mode fiber, propagation modes in single mode fibers, fiber materials, fiber fabrication. Vapor-deposition methods, Fiber optic cables, optical fiber connections, joints and couplers, signal degradation in optical fiber, absorption loss, radiation loss, attenuation, signal distortion in optical waveguides, pulse broadening, mode coupling.

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Suggested Readings:

1. Keiser and Seniar "Optical fiber communication"
2. A.K.Ghatak "Introduction to Optical fiber", Cambridge University Press

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO033	**Material Physics**	**3L-0T-2P**	4	None

Course Outcomes:

Course Content: 1. Overview of materials

Crystalline and amorphous materials, glasses, semiconductors, compound semiconductors, solar energy materials, luminescent and optolectronic materials, polymer, liquid crystals, ceramics, classification according to bonding | Pauling and Philips theories.

2. Synthesis and preparation of materials

Single crystal growth, zone refining, doping techniques of elemental and compound semiconductors, fabrication and control of thin films, PVD and CVD processes, principles of polymer processing, preparation of ceramics powders | mechanical and chemical methods.

3. Characterization of materials

Defects and microstructures; Diffraction techniques: X-ray diffraction | structure determination from XRD data; Neutron diffraction; Thermal methods: DTA, TGA, DSC; Microscopy: TEM, SEM; Optical spectroscopy: UV and IR; Nuclear techniques: NMR, ESR, Mossbauer and Positron annihilation. Heat treatments, quenching and annealing; Radiation damage.

4. Phase transition in materials

Thermodynamics and phase diagrams, statistical theories of phase transitions, critical phenomena, calculation of critical exponents for van der Waals gas and ferromagnets; Diffusion in solids, variation of diffusion constant with temperature.

5. Mechanical properties

Deformation and fracture, Deformation at low and high temperature, Intrinsically hard materials.

6. Spinodal decomposition

Spinodal curve, Free energy of composition fluctuations, Kinetics of Spinodal decomposition.

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7. Electrical properties of alloys, ceramics, and conducting polymer

Resistivity variation of metals at low and high temperature, Kondo effect; Effect of pressure on resistivity, resistivity variation in ceramics and conducting polymer; Ferroelectricity, Landau-Ginzburg theory of ferroelectricity; Piezoelectricity.

8. Magnetic properties of different materials

Antiferromagnetism, ferrimagnetism, magnons, thermal properties of magnons, magnetic storage, applications as capacitors, transducers, sensors, memories, displays; Quantum Hall effect.

9. Glasses

Definitions, properties of glass transition, tunnelling states, calculation of specifc heat from tunneling states and from a model two level system having random energy gap, theories for glass transition.

10. Non-crystalline semiconductors

Classifcations, electrical properties, temperature variation of dc conductivity, ac conductivity, magnetoresistance, Colossal magnetoresistance (CMR).

11. Exotic solids

Structure and symmetries of liquids, liquid crystals, amorphous solids; Aperiodic solids and quasicrystals; Fibonacci sequence; Penrose lattices and their extensions in 3 dimensions; Special carbon solids, fullerenes and tubules, formation and characterization of fullerenes and tubules, single wall and multiwall carbon tubules; Electronic properties of tubules; Carbon nanotubule based electronic devices, Defnition and properties of nanostructured materials. methods of synthesis of nano-structured materials; Special experimental techniques for characterization of materials; Quantum size effect and its applications.

Suggested Readings:

1. C. Kittel, "Introduction to Solid State Physics"
2. R. Zallen, "The Physics of Amorphous Solids"
3. N.F. Mott and E.A. Davies, "Electronic Processes in Non-crystalline Materials"
4. C.N.R. Rao and B. Raveau, "Colossal Magnetoresistance, Charge Density and Related Properties of Manganese oxides"
5. J.M. Yeomans, "Statistical Mechanics of Phase Transitions"
6. R.E. Prange and S.M. Girvin (editors), "The Quantum Hall E_ect"

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7. H.P. Klug and L.E. Alexander, "X-ray Diffraction Procedures"

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO034	**Advanced Electromagnetic Theory and Special Relativity**	**3L-0T-2P**	4	None

Course Outcomes: This course imparts understanding of various mechanisms in the propagation of electromagnetic waves through space and wave guides. The understanding of various electromagnetic laws are helpful in designing and developing new devices used in optical communications, industries and related field. It prepares students to take advanced courses in the related fields and finally equips students to take up R&D and higher studies.

Course Content: Maxwell's equations, wave equations in scalar and vector potential, solutions of scalar and vector wave equations by Fourier analysis. Relativistic motion in electromagnetism, postulates of special theory of relativity, Lorenz transformation, relativistic mechanics, contraction of length, dilation of time, magnetism as relativistic effect, four vector, co-variance of Maxwell's equations, Lienard-Wiechert potentials and the field of a uniformly moving electron, radiation from an accelerated charge, cyclotron synchrotron, Brensstrahlung and Cerenkov radiations. Scattering and absorption of electromagnetic waves, antenna, radiated power and angular distribution of radiation, electric dipole radiation.

Suggested Readings:
1. R.Resnik "Introduction to Special Relativity", Wiley Eastern Ltd.
2. J.D. Jackon "Classical Electrodynamics"

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO035	**Fiber and Integrated Optics**	**3L-0T-2P**	4	None

Course Outcomes: This course imparts understanding of various mechanisms in optical fibre communication. Concepts of Optical Fiber waveguides are helpful in designing and developing new

devices used in optical communications, medicine, environment, industries and related physics. It prepares students to take advanced courses in the related fields and finally equips students to take up R&D and higher studies.

Course Content: Modes in an asymmetric planer waveguides. Ray analysis of planer waveguide, W. K. B. analysis of inhomogeneous planer waveguide, strip waveguides, periodic waveguide-coupled mode analysis, and rectangular core waveguides metal clad waveguides. Anisotropic polarizer, leaky modes in a planer structure. Polarization maintaining fibers and their applications different types of polarization maintaining fibers, high birefringent fibers, single polarization single mode fibers. Integrated optic devices: electro-optic effect, phase modulator, polarization modulators and wavelength filters. The Mach Zhender Interferometric modulator, logic operations, optical directional coupler, leaky mode, metal clad polarizer.

Suggested Readings:

1. Snyder, A.W. and Love, J.D., Chapmann, "Optical Wave guide Theory", Hall.
2. A.K.Ghatak "Introduction to optical fiber", Cambridge University Press.

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO036	**Condensed Matter Physics**	**3L-0T-2P**	4	None

Course Outcomes:

Course Content: 1. Symmetry in crystals
Concepts of point group; Point groups and Bravais lattices; Crystal symmetry | space groups; Symmetry and degeneracy | crystal _eld splitting; Kramer's degeneracy; Quasicrystals: general idea, approximate translational and rotational symmetry of two-dimensional Penrose tiling, Frank-Casper phase in metallic glass.
2. Lattice dynamics
Classical theory of lattice vibrations in 3-dimensions under harmonic approximation; Dispersion relation: accoustical and optical, transverse and longitudinal modes; Lattice vibrations in a monatomic simple cubic lattice; Frequency distribution function; Normal coordinates and phonons; Occupation number representation of the lattice Hamiltonian; Thermodynamics of phonons; The

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long wavelength limits of the acoustical and optical branches; Neutron diffraction by lattice vibrations; Debye-Waller factor; Atomic displacement and melting point; Phonon-phonon interaction, interaction Hamiltonian in occupation number representation; Thermal conductivity in insulators.

3. Density Functional Theory

Basics of DFT, Comparison with conventional wave function approach, Hohenberg-Kohn Theorem; Kohn-Sham Equation; Thomas-Fermi approximation and beyond; Practical DFT in a many body calculation and its reliability.

4. Electronic properties: I

The Boltzmann transport equation and relaxation time; Electrical conductivity of metals | impurity scattering, ideal resistance at high and low temperatures, U-processes; Thermo-electric effects; Thermal conductivity; The Wiedemann-Franz law.

5. Electronic properties: II

Electronic properties in a magnetic field; Classical theory of magneto-resistance; Hall effect and magneto-resistance in two-band model; K-space analysis of electron motion in a uniform magnetic field; Idea of closed, open and extended orbits, cyclotron resonance; Azbel-Kaner resonance; Energy levels and density of states in a magnetic field; Landau diamagnetism; de Haas-van Alphen effect; Quantum Hall effect.

6. Optical properties of solids

The dielectric function: the dielectric function for a harmonic oscillator, dielectric losses of electrons, Kramers-Kronig relations; Interaction of phonons and electrons with photons; Interband transition | direct and indirect transition; Absorption in insulators; Polaritons; One-phonon absorption; Optical properties of metals, skin effect and anomalous skin effect.

Suggested Readings:

1. M. Tinkham, "Group Theory and Quantum Mechanics"
2. M. Sachs, "Solid State Theory"
3. A.O.E. Animalu, "Intermediate Quantum Theory of Crystalline Solids"
4. N.W. Ashcroft and N.D. Mermin, "Solid State Physics"
5. J.M. Ziman, "Principles of the Theory of Solids"
6. C. Kittel, "Introduction to Solid State Physics"

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Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO037	**Microwave**	**3L-0T-2P**	4	None

Course Outcomes:

Course Content: 1. Transmission line and waveguide

Interpretation of wave equations; Rectangular wave guide | TE and TM modes, power transmission, excitation of modes; Circular waveguide | TE, TM and TEM modes, power transmission, excitation of modes. Microstrip lines | characteristic impedance, loss and Q of microstrip lines, coplanar strip lines and shielded strip lines.

2. Component

Scattering parameter and scattering matrix, properties of S-parameter; Quality factor and Q-value of a cavity resonator, Q-value of a coupled cavity; Wave guide tees, magic tee, hybrid ring, couplers; Ferrites and Faraday's rotation, gyrator, circulator, isolator and terminator; λ/4 section filter, tuner and sliding short.

3. Measurement

Smith chart, single stub and double stub matching; Microwave bridge, measurement of frequency, attenuation and phase; Measurement of dielectric parameters of amorphous solids | dielectric constant, ac conductivity, resistivity, insertion loss, return loss, shielding coefficient. Measurement of microstrip line parameters.

4. Source

Conventional sources {their limitations.

(a) Vacuum tube sources | Klystron, reex klystron, travelling wave tubes and switching tubes; Magnetrons, FWCFA and Gyrotrons.

(b) Microwave transistors and FETs, Gunn, IMPATT, TRAPATT and parametric devices.

(c) Laser | Laser processes, Pockels-Cell; Laser modulators, infrared radiation and sources.

5. Antenna

Transmitting and receiving antennas, antenna gain, resistance and bandwidth; Antenna dipoles, straight, folded and broadband dipoles; Beam width and polarisation; Antenna coupling.

6. Microwave integrated circuit

Materials and fabrication technique; MOSFET fabrication, memory construction, thin film formation, planar resistor, planar inductor and planar capacitor formation; Hybrid integrated circuit formation.

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Suggested Readings:

1. Samyel Y. Liao, "Microwave Devices and Circuits"
2. Herbert J. Reich, "Microwave Principles"
3. K.C. Gupta, "Microwaves"
4. M.L. Sisodia and G.S. Raghubanshi, "Microwave Circuits and Passive Device"
5. N. Mercuvitz, "Waveguide Handbook"
6. S.M. Sze, "Physics of Semiconductor Devices"
7. R.E. Collins, "Foundations of Microwave Engineering"
8. J.D. Ryder, "Network Lines and Fields"
9. Royal Signals, "Handbook of Line Communication"
10. W. Frazer, "Telecommunications"
11. J.D.Kraus, "Antenna"

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO038	**Fundamentals of Instrumentation and experimental techniques in Physics**	**3L-0T-2P**	4	None

Course Outcomes: The knowledge of various measurement instruments and techniques are very helpful in the scientific laboratories, organizations and industries for faithful measurements, characterizations and interpretation of data with high accuracy. It also gives value addition in the students' understanding of the basic principles involved. It prepares students to take advanced courses in the related fields and finally equips students to take up higher studies and R&D in the related field

Course Content: Physical Measurement: Sources of uncertainty and experimental error, Systematic and random error, Analysis of repeated measurements, Distribution functions, Propagation of error, Analysis of data. Optical measurements and the electromagnetic spectrum, Temperature transducers and linear position sensors.

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Signal to noise considerations: Fluctuations and noise measurement systems, Noise in frequency domain, Signal to Noise and experimental design, Frequency and bandwidth considerations, Signal to noise enhancement, Digital and auto correlation methods.

Vacuum techniques: Characteristics and applications of vacuum, Vacuum systems-pumps and gauges, pumping speed, Thin film techniques, Film thickness monitors and measurements.

Optical Instruments: Spectroscopic Instrumentation, visible and infrared spectroscopy, Spectrometer design- lenses and refractive optics, Dispersive elements. Lasers and fibre optics.

X-ray Measurement: X-ray Fluorescence- line spectra, fine structure, Absorption and emission processes, X-ray production, X-ray diffraction and crystallography- powder diffraction spectra, information available from spectra.

Analytical Instrumentation: Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), Environmental Scanning Electron Microscope (ESEM), Surface Analytical Methods-Auger Electron spectroscopy, X-ray photo electron spectroscopy (XPS) and secondary ion mass spectrometer (SIMS). X-ray fluorescence, Tunneling scanning microscope.

Occupational Health and Safety : Occupational health and safety, Chemical substances- Storage and Disposal, Work hazardous materials information system(WHMIS). Safety from electromagnetic radiation, General Electrical and testing standards- CSA approval, General laboratory and workshop practice.

Suggested Readings:

Michael Sayer and Abhai Mansingh, "Measurement, Instrumentation and Experiment Design in Physics and Engineering", Prentice-Hall , India

Course No	Title of the Course	Course Structure	Credits	Pre-Requisite
EO039	**Lasers and Photonics**	**3L-0T-2P**	4	None

Course Outcomes: The understanding of Laser, Photonics and Optical Fiber are helpful in designing and developing new devices used in optical communications, solar energy devices, medicine, environment, industries and related physics. It also gives value addition in the students' understanding of the basic principles involved. It prepares students to take advanced courses in the

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related fields and finally equips students to take up higher studies and R&D in the related field

Course Content: Properties of Lasers, Absorption**,** Spontaneous emission and stimulated emission processes, relation between Einstein's A and B coefficients, population inversion, pumping, gain, Working principle of laser, Optical cavities. Ruby Laser, Helium Neon Laser, Semiconductor Laser. Three & four level Lasers, CW & Pulsed Lasers, atomic, ionic, molecular, excimer, liquid and solid state Lasers and systems, short pulse generation and Measurement. Laser applications in medicine and surgery, materials processing, optical communication, metrology and LIDAR and holography(recording and reconstruction)

Photonics : Basics of Solid state lighting- LED- Photodetectors, photovoltaic cell, Junction & avalanche photodiodes, photo transistors, thermal detectors, Solar cells- I-V characteristics, Optic fibre- principle of propagation, numerical aperture, optical communication system. Industrial, medical and technological applications of optical fibre. Fibre optic sensors- basics of Intensity modulated and phase modulated sensors.

Suggested Readings:

1. K.R. Nambiar, "Laser Principles, Types and Application" New Age International
2. G.Keiser, "Optical fiber communication", McGraw-Hill.