

PONDICHERRY UNIVERSITY



Bachelor of Technology

**Computer Science and Engineering
(Internet of Things and Cyber Security
Including Block Chain Technology)**

REGULATIONS, CURRICULUM AND SYLLABUS

(2020- 2021)

PONDICHERRYUNIVERSITY
BACHELOR OF TECHNOLOGY PROGRAMMES
(EIGHT SEMESTERS)

REGULATIONS

1. CONDITIONS FOR ADMISSION:

- (a) Candidates for admission to the first semester of the 8 semester B.Tech. Degree programme should be required to have passed:

The Higher Secondary Examination of the (10+2) curriculum (Academic Stream) prescribed by the Government of Tamil Nadu or any other examination equivalent there to with minimum of 45% marks(a mere pass for OBC and SC/ST candidates) in aggregate of subjects – Mathematics, Physics and any one of the following optional subjects: Chemistry / Biotechnology/ Computer Science / Biology (Botany & Zoology) or an Examination of any University or Authority recognized by the Executive Council of the Pondicherry University as equivalent thereto.

- (b) For Lateral entry in to third semester of the eight semesters B.Tech programme:

The minimum qualification for admission is a pass in three year diploma or four year sandwich diploma course in engineering / technology with a minimum of 60 % marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in the subjects covered from 3rd to final semester or a pass in any B.Sc. course with mathematics as one of the subjects of study with a minimum of 60 % marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in main and ancillary subjects excluding language subjects. The list of diploma programs approved for admission for each of the degree programs is given in **Annexure A**.

2. AGE LIMIT:

The candidate should not have completed 21 years of age as on 1st July of the academic year under consideration. For Lateral Entry admission to second year of degree programme, candidates should not have completed 24 years as on 1st July of the academic year under consideration. In the case of SC/ST candidates, the age limit is relaxable by 3 years for both the cases.

3. DURATION OF PROGRAMME:

The Bachelor of Technology degree programme shall extend over a period of 8 consecutive semesters spread over 4 academic years – two semesters constituting one academic year. The duration of each semester shall normally be 15 weeks excluding examinations.

4. ELIGIBILITY FOR THE AWARD OF DEGREE:

No candidate shall be eligible for the award of the degree of Bachelor of Technology, unless he/she has undergone the course for a period of 8 semesters (4 academic years) / 6 semesters (3 academic years for Lateral Entry candidates) in the faculty of Engineering and has passed the prescribed examinations in all the semesters.

5. BRANCHES OF STUDY:

Branch I	-	Civil Engineering
Branch II	-	Mechanical Engineering
Branch III	-	Electronics & Communication Engineering
Branch IV	-	Computer Science & Engineering
Branch V	-	Electrical & Electronics Engineering
Branch VI	-	Chemical Engineering
Branch VII	-	Electronics & Instrumentation Engineering
Branch VIII	-	Information Technology
Branch IX	-	Instrumentation & Control Engineering
Branch X	-	Biomedical Engineering
Branch XI	-	Food Technology
Branch XII	-	Robotics and Automation Engineering

Or any other branches of study as and when offered. The branch allocation shall be ordinarily done at the time of admission of the candidate to the first semester.

6. SUBJECTS OF STUDY:

The subjects of study shall include theory and practical courses as given in the curriculum and shall be in accordance with the prescribed syllabus. The subjects of study for the first two semesters shall be common for all branches of study.

7. EXAMINATIONS:

The theory and practical examinations shall comprise continuous assessment throughout the semester in all subjects as well as university examinations conducted by Pondicherry University at the end of the semester (November / December or April / May).

(a) Theory courses for which there is a written paper of 75 marks in the university examination.

The Internal Assessment marks of 25 has to be distributed as 10 marks each for two class tests and 5 marks for class attendance in the particular subject. The distribution of marks for attendance is as follows:

5 marks for 95% and above

- 4 marks for 90% and above but below 95%
- 3 marks for 85% and above but below 90%
- 2 marks for 80% and above but below 85%
- 1 mark for 75% and above but below 80%

A minimum of three tests are to be conducted for every theory subject and, of them two best are to be considered for computation of internal assessment marks.

(b) Practical courses for which there is a university practical examination of 50marks: Every practical subject carries an internal assessment mark of 50 distributed as follows:

- (i) Regular laboratory exercises and records – 20 marks (ii) Internal practical test-15 marks (iii) Internal viva-voce – 5 marks and (iv) Attendance – 10 marks.

The marks earmarked for attendance are to be awarded as follows: 10 marks for 95% and above

8 marks for 90% and above but below 95%

6 marks for 85% and above but below 90%

4 marks for 80% and above but below 85%

2 marks for 75% and above but below 80%

8. REQUIREMENT FOR APPEARING FOR UNIVERSITY EXAMINATION:

A candidate shall be permitted to appear for university examinations at the end of any semester only if:

- (i) He / She secures not less than 75% overall attendance arrived at by taking into account the total number of periods in all subjects put together offered by the institution for the semester under consideration.

(Candidates who secure overall attendance greater than 60% and less than 75% have to pay a condonation fee as prescribed by the University along with a medical certificate obtained from a medical officer not below the rank of Assistant Director)

- (ii) He / She earns a progress certificate from the Head of the institution for having satisfactorily completed the course of study in all the subjects pertaining to that semester.

- (iii) His / Her conduct is found to be satisfactory as certified by the Head of the institution.

A candidate who has satisfied the requirement (i) to (iii) shall be deemed to have satisfied the course requirements for the semester.

9. PROCEDURE FOR COMPLETING THE COURSE:

A candidate can join the course of study of any semester only at the time of its normal commencement and only if he/she has satisfied the course requirements for the previous semester

and further has registered for the university examinations of the previous semester in all the subjects as well as all arrear subjects if any.

However, the entire course should be completed within 14 consecutive semesters (12 consecutive semesters for students admitted under lateral entry).

10. PASSING MINIMUM:

(i) A candidate shall be declared to have passed the examination in a subject of study only if he/she secures not less than 50% of the total marks (Internal Assessment plus University examination marks) and not less than 40% of the marks in University examination.

(ii) A candidate who has been declared -Failed|| in a particular subject may reappear for that subject during the subsequent semesters and secure a pass. However, there is a provision for revaluation of failed or passed subjects provided he/she fulfills the following norms for revaluation.

(a) Applications for revaluation should be filed within 4 weeks from the date of declaration of results or 15 days from the date of receipt of marks card whichever is earlier.

(b) The candidate should have attended all the college examinations as well as university examinations.

(c) If a candidate has failed in more than two papers in the current university examination, his/her representation for revaluation will not be considered.

(d) The request for revaluation must be made in the format prescribed duly recommended by the Head of the Institution along with the revaluation fee prescribed by the University.

The internal assessment marks obtained by the candidate shall be considered only in the first attempt for theory subjects alone. For the subsequent attempts, University examination marks will be made up to the total marks. Further the University examination marks obtained in the latest attempt shall alone remain valid in total suppression of the University examination marks obtained by the candidate in earlier attempts.

11. AWARD OF LETTER GRADES:

The assessment of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain points, will be awarded

as per the range of total marks (out of 100) obtained by the candidate, as detailed below:

Range of Total Marks	Letter Grade	Grade Points
90 to 100	S	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
55 to 59	D	6
50 to 54	E	5
0 to 49	F	0
Incomplete	FA	

Note: F denotes failure in the course. FA denotes absent / detained as per clause 8.

After results are declared, grade sheets will be issued to the students. The grade sheets will contain the following details:

- (a) The college in which the candidate has studied.
- (b) The list of courses enrolled during the semester and the grades scored.
- (c) The Grade Point Average (GPA) for the semester and The Cumulative Grade Point Average (CGPA) of all enrolled subjects from first semester onwards.
- (d) GPA is the ratio of sum of the products of the number of credits (C) of courses registered and the corresponding grades points (GP) scored in those courses, taken for all the courses and sum of the number of credits of all the courses

$$\text{GPA} = (\text{Sum of } (C \times \text{GP}) / \text{Sum of } C)$$

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. FA grades are to be excluded for calculating GPA and CGPA.

- (e) The conversion of CGPA into percentage marks is as given below

$$\% \text{ Mark} = (\text{CGPA} - 0.5) \times 10$$

12. AWARD OF CLASS AND RANK:

- (i) A candidate who satisfies the course requirements for all semesters and who passes all

the examinations prescribed for all the eight semesters (six semesters for lateral entry candidates) within a maximum period of 7 years (6 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of degree.

(ii) A candidate who qualifies for the award of the degree passing in all subjects pertaining to semesters 3 to 8 in his/her first appearance within 6 consecutive semesters (3 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 8 shall be declared to have passed the examination in **FIRST CLASS** with **DISTINCTION**.

(iii) A candidate who qualifies for the award of the degree by passing in all subjects relating to semesters 3 to 8 within a maximum period of eight semesters after his/her commencement of study in the third semester and in addition secures CGPA not less than 6.5 shall be declared to have passed the examination in **FIRST CLASS**.

(iv) All other candidates who qualify for the award of degree shall be declared to have passed the examination in **SECOND CLASS**.

(v) For the Award of University ranks and Gold Medal for each branch of study, the CGPA secured from 1st to 8th semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from 1st to 8th semester in the first attempt. Rank certificates would be issued to the first ten candidates in each branch of study.

13. PROVISION FOR WITHDRAWAL:

A candidate may, for valid reasons, and on the recommendation of the Head of the Institution be granted permission by the University to withdraw from writing the entire semester examination as one Unit. The withdrawal application shall be valid only if it is made earlier than the commencement of the last theory examination pertaining to that semester. Withdrawal shall be permitted only once during the entire course. Other conditions being satisfactory, candidates who withdraw are also eligible to be awarded **DISTINCTION** whereas they are not eligible to be awarded a rank.

14. DISCONTINUATION OF COURSE:

If a candidate wishes to temporarily discontinue the course for valid reasons, he/she shall apply through the Head of the Institution in advance and obtain a written order from the University permitting discontinuance. A candidate after temporary discontinuance may rejoin the course only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees to the University. The total period of completion of the course reckoned from the commencement of the first semester to which the candidate was admitted shall not in any case exceed 7 years, including of the period of discontinuance.

15. REVISION OF REGULATIONS AND CURRICULUM:

The University may from time to time revise, amend or change the regulations of curriculum and syllabus as and when found necessary.

ANNEXURE – A

(Diploma programs for admission for B.Tech. Lateral Entry)

B.Tech courses in which admission is sought	Diploma courses eligible for admission
Civil Engineering	Civil Engineering Civil and Rural Engineering Architectural Assistantship Architecture Agricultural Engineering
Mechanical Engineering	Mechanical Engineering Automobile Engineering Agricultural Engineering Mechanical and Rural Engineering Refrigeration and Air-conditioning Agricultural Engineering & Farm Equipment Technology Metallurgy Production Engineering Machine Design & Drafting Machine tool maintenance and Repairs Printing Technology / Engineering Textile Engineering / Technology Tool Engineering
Electrical and Electronics Engineering Electronics & Communication Engineering Electronic and Instrumentation Engineering Instrumentation and Control Engineering Bio Medical Engineering	Electrical Engineering Electrical and Electronics Engineering Electronics and Instrumentation Engineering Instrumentation Engineering / Technology Electronics and Communication Engg. Electronics Engineering Medical Electronics Instrumentation and Control Engineering Applied Electronics
Chemical Engineering	Chemical Engineering Chemical Technology Petrochemical Technology Petroleum Engineering Ceramic Technology Plastic Engineering Paper & Pulp Technology Polymer Technology
Information Technology Computer Science & Engineering Computer Science & Engineering (Internet of Things and Cyber Security Including Block Chain Technology)	Computer Science and Engineering Computer Technology Electrical and Electronics Engineering Electronics & Communication Engineering Electronics & Instrumentation Engineering Instrumentation Engineering / Technology

Food Technology	Biotechnology Food Technology B.Sc. Bio Science B.Sc. Bio Chemistry Chemical Technology Agriculture Engineering and Farming
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Curriculum

for

B.Tech.

**Computer Science and Engineering
(Internet of Things and Cyber
Security Including Block Chain
Technology)**

2020-2021

PONDICHERRY UNIVERSITY

B.Tech. Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

CURRICULUM

I Semester

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	UE	TM
	Theory							
T101	Mathematics – I	3	1	-	4	25	75	100
T102	Physics	4	-	-	4	25	75	100
T103	Chemistry	4	-	-	4	25	75	100
T110	Basic Civil and Mechanical Engineering	4	-	-	4	25	75	100
T111	Engineering Mechanics	3	1	-	4	25	75	100
T112	Communicative English	4	-	-	4	25	75	100
	Practical							
P104	Physics Laboratory	-	-	3	2	50	50	100
P105	Chemistry Laboratory	-	-	3	2	50	50	100
P106	Workshop Practice	-	-	3	2	50	50	100
	Total	22	2	9	30	300	600	900

II Semester

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	UE	TM
	Theory							
T107	Mathematics – II	3	1	-	4	25	75	100
T108	Material Science	4	-	-	4	25	75	100
T109	Environmental Science	4	-	-	4	25	75	100
T104	Basic Electrical Electronics and Instrumentation Engineering	3	1	-	4	25	75	100
T105	Engineering Thermodynamics	3	1	-	4	25	75	100
T106	Computer Programming	3	1	-	4	25	75	100
	Practical							
P101	Computer Programming Laboratory	-	-	3	2	50	50	100
P102	Engineering Graphics	2	-	3	2	50	50	100
P103	Basic Electrical Electronics and Instrumentation Laboratory	-	-	3	2	50	50	100

P107	NSS / NCC *	-	-	-	-	-	-	-
	Total	22	4	9	30	300	600	900

III Semester

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	UE	TM
	Theory							
CS T31	Discrete Mathematics	3	1	-	4	25	75	100
CS T32	Digital Circuit and Microprocessor	3	1	-	4	25	75	100
CS T33	Data Structures	3	1	-	4	25	75	100
CS T34	Oops and Java Programming	3	1	-	4	25	75	100
CS T35	Python Programming	3	1	-	4	25	75	100
CS T36	Software Engineering	3	1	-	4	25	75	100
	Practical							
CS P31	Digital Circuit and Microprocessor Lab	-	-	3	2	50	50	100
CS P32	Data Structures Lab using Python	-	-	3	2	50	50	100
CS P33	Java Programming Lab	-	-	3	2	50	50	100
	Total	18	6	9	30	300	600	900

IV Semester

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	UE	TM
	Theory							
CS T41	Operating Systems	3	1	-	4	25	75	100
CS T42	Computer Networks	3	1	-	4	25	75	100
CS T43	Database Management	3	1	-	4	25	75	100
CS T44	Design and Analysis of Algorithms	3	1	-	4	25	75	100
CS T45	Distributed Computing Systems	3	1	-	4	25	75	100
CS T46	Cryptography	3	1	-	4	25	75	100
	Practical							
CS P41	Operating Systems Lab	-	-	3	2	50	50	100
CS P42	Computer Networks Lab	-	-	3	2	50	50	100
CS P43	Database Management Lab	-	-	3	2	50	50	100
SP P44	Physical Education *	-	-	-	-	-	-	-
	Total	18	6	9	30	300	600	900

* Student is required to secure a pass and no grade will be awarded

V Semester

Code	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	UE	TM
	Theory							
CS T51	IoT Architecture and Protocols	3	1	-	4	25	75	100
CS T52	Web Technologies	3	1	-	4	25	75	100
CS T53	Big Data Analytics	4	-	-	4	25	75	100
CS T54	Blockchain Technologies	3	1	-	4	25	75	100
CS T55	Ethical Hacking & Information Security	3	1	-	4	25	75	100
	Elective-I	4	0	-	4	25	75	100
	Practical							
CS P51	IoT Lab	-	-	3	2	50	50	100
CS P52	Web Technologies Lab	-	-	3	2	50	50	100
CS P53	Big Data Analytics lab	-	-	3	2	50	50	100
HS P54	General Proficiency – I	-	-	3	1	100	-	100
	Total	20	4	12	31	400	600	1000

VI Semester

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	UE	TM
	Theory							
CS T61	Smart Contracts and Application Development	3	1	-	4	25	75	100
CS T62	Cloud Computing and Virtualization	3	1	-	4	25	75	100
CS T63	Cyber and Digital Forensics	3	1	-	4	25	75	100
CS T64	Fog and Edge Computing	3	1	-	4	25	75	100
	Elective-II	4	0	-	4	25	75	100
	Practical							
CS P61	Smart Contracts and Application Development Lab	-	-	3	2	50	50	100
CS P62	Cloud Computing Lab	-	-	3	2	50	50	100
CS P63	Cyber Security Lab	-	-	3	2	50	50	100
HS P64	General Proficiency – II	-	-	3	1	100	-	100
	Total	16	4	12	27	375	525	900

VII Semester

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	UE	TM
	Theory							
CS T71	Professional Ethics & Human Values	3	-	-	3	25	75	100
CS T72	Wireless Communication Networks	4	-	-	4	25	75	100
CS T73	Network Security	4	-	-	4	25	75	100
	Elective-III	4	-	-	4	25	75	100
	Elective-IV	4	-	-	4	25	75	100
	Practical							
CS P71	Wireless Communication Lab	-	-	3	2	50	50	100
CS P72	Network Security Lab	-	-	3	2	50	50	100
CS P73	Technical Seminar and report writing	-	-	3	1	100	-	100
CS P74	Industrial Visit/Training	-	-	-	1	100	-	100
CS PW7	Project Work-I	-	-	6	4	100	-	100
	Total	19	-	15	29	525	475	1000

VIII Semester

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	UE	TM
	Theory							
CS T81	Cyber Laws and Security Policies	3	-	-	3	100	-	100
CS T82	Energy Harvesting And Power Management for IoT	3	-	-	3	25	75	100
	Elective-V	4	-	-	4	25	75	100
	Elective-VI	4	-	-	4	25	75	100
	Practical							
CS P81	Comprehensive Viva	-	-	3	1	50	50	100
CS PW8	Project Work-II	-	-	9	8	50	50	100
	Total	14	-	12	23	275	325	600

LIST OF ELECTIVES

Group – A (5th and 6th Semesters)

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	UE	TM
CS E 01	Mathematical Foundations of Computer Science	4	-	-	4	25	75	100
CS E 02	Mathematics for Network Engineering	4	-	-	4	25	75	100
CS E 03	Information Coding Techniques	4	-	-	4	25	75	100
CS E 04	Graph Theory and Optimization Techniques	4	-	-	4	25	75	100
CS E 05	Operating Systems: Administration and Security	4	-	-	4	25	75	100
CS E 06	Embedded Systems	4	-	-	4	25	75	100
CS E 07	Graphics and Multimedia systems	4	-	-	4	25	75	100
CS E 08	Software Testing	4	-	-	4	25	75	100
CS E 09	Object Oriented Analysis and Design	4	-	-	4	25	75	100
CS E 10	Free and Open source software	4	-	-	4	25	75	100
CS E 11	Software Defined Networks	4	-	-	4	25	75	100
CS E 12	DataWarehouse and Data Mining	4	-	-	4	25	75	100
CS E 13	Pattern Recognition techniques in Cyber crime	4	-	-	4	25	75	100

Group – B (7th and 8th Semesters)

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	UE	TM
CS E 14	Visual Programming	4	-	-	4	25	75	100
CS E 15	XML Web services	4	-	-	4	25	75	100
CS E 16	Software Project Management	4	-	-	4	25	75	100
CS E 17	Entrepreneurship Development	4	-	-	4	25	75	100
CS E 18	Applied Cryptography	4	-	-	4	25	75	100
CS E 19	Intrusion Detection and Prevention System	4	-	-	4	25	75	100
CS E 20	Wireless Sensor Protocols and Programming	4	-	-	4	25	75	100
CS E 21	Information Security and Risk Management	4	-	-	4	25	75	100

CS E 22	Design and Testing of Digital Systems	4	-	-	4	25	75	100
CS E 23	Multimedia Security & forensics	4	-	-	4	25	75	100
CS E 24	Principles of Modern Cryptography	4	-	-	4	25	75	100
CS E 25	Foundations of modern Networking	4	-	-	4	25	75	100
CS E 26	Network Protocols	4	-	-	4	25	75	100
CS E 27	Smart Convergent Technologies	4	-	-	4	25	75	100
CS E 28	Software Architecture and Interoperability	4	-	-	4	25	75	100

I SEMESTER

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T101	MATHEMATICS – I	3	1	-
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To introduce the idea of applying calculus concepts to problems in order to find curvature, etc. and to give basic introduction on Beta and Gamma functions. • To familiarize the student with functions of several variables. This is needed in many branches of engineering. • To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage. • To introduce effective mathematical tools for the solutions of differential equations that model physical processes 				
<p>Course Outcomes:</p> <ul style="list-style-type: none"> • Learn the evaluation policy of Curvature, evolutes and some special functions like Gamma & Beta function. • Apply partial derivatives to find maxima and minima. • Able to evaluate double integrals and triple integrals, which are used to evaluate area and volume of defined and undefined shapes. • Gain the knowledge to solve first order differential equation arising in Engineering Field. • Gain the knowledge to solve higher order differential equation and able to form mathematical & physical interpretation of its solution. • Acquire knowledge of Differential and Integral Calculus concepts, which are very much essential to solve the problems occurring in the areas of Engineering and Technology. 				
<p>UNIT I – CALCULUS Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties.</p>				
<p>UNIT II– FUNCTIONS OF SEVERAL VARIABLES Partial derivatives, Total derivatives, Differentiation of implicit functions, Change of variables, Jacobians and their properties, Taylor’s series for functions of two variables, Maxima and minima, Lagrange’s method of undetermined multipliers.</p>				
<p>UNIT III – MULTIPLE INTEGRALS AND APPLICATIONS Multiple Integrals, change of order of integration and change of variables in double integrals (Cartesian to polar). Applications: Areas by double integration and volumes by triple integration (Cartesian and polar).</p>				
<p>UNIT IV – DIFFERENTIAL EQUATIONS Exact equations, First order linear equations, Bernoulli’s equation, orthogonal trajectories, growth, decay and geometrical applications. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut’s type.</p>				
<p>UNIT V – DIFFERENTIAL EQUATIONS (Higher order) Linear differential equations of higher order - with constant coefficients, the operator D, Euler’s linear equation of higher order with variable coefficients, simultaneous linear differential equations, solution by variation of parameters method.</p>				
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Venkataraman M.K, Engineering Mathematics-First year, National Publishing Company, Chennai. 2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 41stEdition, 2011. (For Unit II only) 				

Reference Books:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. Kandasamy P. et al, Engineering Mathematics, Vol.1 & 2, S. Chand & Co., New Delhi.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi, 8th Edition.
5. Bali N. and Goyal M., Advanced Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 7th Edition, 2010.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T102	PHYSICS	3	1	-
<p>Course Objectives:</p> <ul style="list-style-type: none"> To understand the concepts of physics and its significant contributions in the advancement of technology and invention of new products that dramatically transformed modern-day society. To expose the students to different areas of physics which have direct relevance and applications to different Engineering disciplines To understand the concepts and applications of Ultrasonics, optics and some optical devices, Lasers and Fiber optics, Nuclear energy sources and wave mechanics 				
<p>Course Outcomes:</p> <ul style="list-style-type: none"> Understand the concepts of ultrasonic production ,detection applications and acoustical properties of buildings. Learn the light properties like interference ,diffraction and polarization and study their parameters like resolving power ,dispersive power of optical devices. Understand the basic operating principles of laser, its applications, optical fiber, and its types, transmission characteristics, applications of optical fibers. Study the wave mechanics concepts through wave equations and applying the knowledge of barrier penetration problem in designing electronic devices like tunnel diode. Understand nuclear properties ,power production through reactors and gain knowledge of fusion reactors which is under research. Expose the students to different areas of physics which have direct relevance and applications to different Engineering disciplines <p>To understand the concepts of physics and its significant contributions in the transformed modern-day society.</p>				
<p>UNIT I – Acoustics & NDT Ultrasonics- Ultrasonic Waves Productions (Piezoelectric & Magnetostriction method) – Detections (Acoustic Grating) NDT applications – Ultrasonic Pulse Echo Method - Liquid Penetrant Method. Acoustics - Factors affecting Acoustic of Buildings (Reverberation, Loudness, Focusing, Echo, Echelon Effect and Resonance) and their Remedies - Sabine’s formula for Reverberation Time.</p>				
<p>UNIT II – Optics Interference- Air Wedge – Michelson’s Interferometer - Wavelength Determination – Interference Filter – Antireflection Coatings. Diffraction - Diffraction Grating – Dispersive power of grating - Resolving Power of Grating & Prism. Polarisation Basic concepts of Double Refraction - Huygens Theory of Double Refraction- Quarter and Half Wave Plates – Specific Rotary Power – Laurent Half Shade Polarimeter.</p>				
<p>UNIT III – Lasers & Fiber Optics Lasers - Principles of Laser – Spontaneous and Stimulated Emissions - Einstein’s Coefficients – Population Inversion and Laser Action – types of Optical resonators (qualitative ideas) – Types of Lasers - NdYAG, CO2 laser, GaAs Laser-applications of lasers. Fiber Optics - Principle and Propagation of light in optical fiber – Numerical aperture and acceptance angle – Types of optical fibers (material, refractive index, mode)- applications to sensors and Fibre Optic Communication.</p>				
<p>UNIT IV – Wave mechanics Matter Waves – de Broglie Wavelength – Uncertainty Principle – Schrödinger Wave Equation – Time Dependent – Time Independent – Application to Particle in a One Dimensional potential Box – Quantum Mechanical Tunneling – Tunnel Diode.</p>				
<p>UNIT V – Nuclear energy source General Properties of Nucleus (Size, Mass, Density, Charge) – Mass Defect – Binding Energy - Disintegration in fission –Nuclear Reactor: Materials Used in Nuclear Reactors. – PWR – BWR – FBTR. Nuclear fusion reactions for fusion reactors-D-D and D-T reactions, Basic principles of Nuclear Fusion reactors.</p>				
<p>Text Books:</p> <ol style="list-style-type: none"> V Rajendran, Engineering Physics, 2 nd Edition, TMH, New Delhi 2011 Avadhanulu M N , Engineering Physics, S. Chand & Co, 2009. Arthur Beiser, Concepts of Modern 				

Physics, 6th Edition, TMH, New Delhi 2008.

Reference Books:

1. Ajoy Ghatak, Optics, 5th Edition TMH, New Delhi, 2012.
2. K. Thyagarajan and Ajoy Ghatak, Lasers Fundamentals and Applications, 2nd Edition, Springer 2010.
3. Richtmyer, Kennard and cooper, Introduction to Modern Physics, TMH, New Delhi 2005.
4. R. Murugesan, Modern Physics, S. Chand & Co, New Delhi 2006.
5. K.R.Nambiar, Lasers, New Age International, New Delhi, 2008.
6. C.M. Srivastava and C. Srinivasan, Science of Engineering Materials, 2nd Edition, New Age Int. (P) Ltd, New Delhi, 1997

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T103	CHEMISTRY	3	1	-
Course Objectives: <ul style="list-style-type: none"> To know about the importance of Chemistry in Engineering domain To understand the chemistry background of industrial process To apply chemistry knowledge for engineering disciplines 				
Course Outcomes: <ul style="list-style-type: none"> To impart the students in-depth in the discipline of water technology and develop innovative methods to produce soft water for industrial use and potable water at cheaper cost. Fundamentals and formation of polymers with its properties and engineering applications of polymers such as conducting polymers can be understood. Students are able to illustrate the practical importance of electrochemistry for solving challenges and design of batteries. This unit implicit the concept of corrosion and insist the students to apply their knowledge for protection of different metals from corrosion. Guide the students to gain the knowledge about the cooling curves, phase diagrams, alloys and their practical importance. Strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications. 				
<p>UNIT I - Water Hardness of water - units and calcium carbonate equivalent. Determination of hardness of water-EDTA method. Disadvantages of hardwater – boiler scale and sludge, caustic embrittlement, priming & foaming and boiler corrosion. Water softening methods – internal & external conditioning – Lime-Soda process, Zeolite process and Ion-exchange process. Desalination – reverse osmosis & electrodialysis.</p> <p>UNIT II – Polymers Classification, types of polymerization reactions – mechanism of radical, ionic and Ziegler-Natta polymerizations. Polymer properties – chemical resistance, crystallinity and effect of temperature, Mn and Mw. Thermoplastics and thermosets. Preparation, properties and uses of PVC, TEFLON, Nylons, Bakelite, Polyurithane, Rubbers – vulcanization, synthetic rubber, BuNa-S, BuNa-N, silicone and butyl rubber. Conducting polymers – classification and applications. Polymer composites – FRP – laminar composites. Moulding constituents of plastic, moulding techniques – compression, injection, transfer and extrusion moulding.</p> <p>UNIT III - Electrochemical Cells Galvanic cells, single electrode potential, standard electrode potential, electromotive series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes – hydrogen, calomel, Ag/AgCl & glass electrodes. Batteries – primary and secondary cells, Leclanche cell, Lead acid storage cell, Ni-Cd battery & alkaline battery. Fuel cells – H₂-O₂ fuel cell.</p> <p>UNIT IV - Corrosion and its Control Chemical & electrochemical corrosion – Galvanic, pitting, stress and concentration cell corrosion. Factors influencing corrosion – corrosion control methods – cathodic protection and corrosion inhibitors. Protective coating – types of protective coatings – metallic coating – tinning and galvanizing, cladding, electroplating and anodizing.</p> <p>UNIT V -Phase Rule Definition and derivation of phase rule. Application to one component system – water and sulfur systems. Thermal analysis, condensed phase rule. Two component systems – Pb-Ag, Cu-Ni, and Mg-Zn systems.</p>				
Text Books: <ol style="list-style-type: none"> P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai and Sons, New Delhi 2004. P. Kannan and A. Ravi Krishnan “Engineering Chemistry” Hi-Tech Sri Krishna Publications, Chennai, 9th Ed, 2009 				

3. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, 2 ndEd. PHI Learning PVT., LTD, New Delhi, 2008.

Reference Books:

1. S. S. Dara, A Textbook of Engineering Chemistry, 11th Ed, S.Chand & Co., Ltd. New Delhi, 2008.
2. B. K. Sharma, Engineering Chemistry, 3rdedition Krishna Prakashan Media (P) Ltd., Meerut, 2001.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T104	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	3	1	-
<p>Course Objectives:</p> <ul style="list-style-type: none"> To understand and gain basic knowledge about magnetic and electrical circuits, single phase and three phase power measurement and the operating principles of stationary and rotating machines. To understand the basic operation, functions and applications of PN junction diode, transistor, logic gates and flip flops. To gain knowledge on various communication systems and network models and the use of ISDN. 				
<p>Course Outcomes:</p> <ul style="list-style-type: none"> Gain basic knowledge of DC circuits Acquire knowledge about the single phase and three base electrical circuits Gain knowledge on operating principles of rotating machines and awareness of general structure of power systems. Understand the basic operation, functions and applications of PN junction diode, transistor and oscillators. Acquire knowledge on logic gates, flip flops, shift registers and counters. Gain knowledge on various communication systems and network models and the use of ISDN 				
PART A – ELECTRICAL				
<p>UNIT – I - DC CIRCUITS Definition of Voltage, Current, Power & Energy, circuit parameters, Ohm’s law, Kirchoff’s law & its applications – Simple Problems - Division of current in Series & parallel circuits - star/delta conversion - Node and mesh methods of analysis of DC circuits.</p>				
<p>UNIT – II - AC CIRCUITS Concepts of AC circuits – rms value, average value, form and peak factors – Simple RLC series circuits – Concept of real and reactive power – Power factor - Introduction to three phase system - Power measurement by two wattmeter method.</p>				
<p>UNIT – III – ELECTRICAL MACHINES AND POWER PLANTS Law of Electromagnetic induction, Fleming’s Right & Left hand rule - Principle of DC rotating machine, Single phase transformer and single phase induction motor (Qualitative approach only) - Simple layout of thermal and hydro generation (block diagram approach only).</p>				
PART B – ELECTRONICS				
<p>UNIT – IV V-I Characteristics of diode - Half-wave rectifier and Full-wave rectifier – with and without capacitor filter - Transistor - Construction & working - Input and output characteristics of CB and CE configuration - Transistor as an Amplifier - Principle and working of Hartley oscillator and RC phase shift oscillator - Construction and working of JFET & MOSFET.</p>				
<p>UNIT – V Boolean algebra – Reduction of Boolean expressions - De-Morgan’s theorem - Logic gates - Implementation of Boolean expressions - Flip flops - RS, JK, T and D. Combinational logic - Half adder, Full adder and Subtractors. Sequential logic - Ripple counters and shift registers.</p>				
<p>UNIT – VI Model of communication system - Analog and digital - Wired and wireless channel. Block diagram of various communication systems - Microwave, satellite, optical fiber and cellular mobile system. Network model - PAN, LAN, MAN and WAN - Circuit and packet switching - Overview of ISDN.</p>				
<p>Text Books:</p> <ol style="list-style-type: none"> Kothari D P and Nagrath I J, Basic Electrical Engineering, Tata McGraw Hill, 2009. S.K. Sahdev, Fundamentals of Electrical Engineering and Electronics, Dhanpat Rai & Co, 2013. Jacob Millman and Christos C. Halkias, “Electronic Devices and Circuits” Tata McGraw Hill R.L. Boylestad and L. Nashelsky, “Electronic Devices and Circuit Theory”, PHI Learning Private Limited, Ninth Edition, 2008 				

5. Morris Mano, "Digital design", PHI Learning, Fourth Edition, 2008.
6. Rajendra Prasad , " Fundamentals of Electronic Engineering", Cengage learning, New Delhi, First Edition, 2011
7. Wayne Tomasi, "Electronic Communication Systems- Fundamentals Theory Advanced", Fourth Edition, Pearson Education, 2001.

Reference Books:

1. R.Muthusubramaniam, S.Salivahanan and K.A. Mureleedharan, "Basic Electrical Electronics and Computer Engineering", Tata McGraw Hill, 2004..
2. J.B.Gupta, "A Course in Electrical Power", Katson Publishing House, New Delhi, 1993.
3. David. A. Bell, "Electronic Devices and Circuits", PHI Learning Private Ltd, India, Fourth Edition, 2004
4. Donald P Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications," 6th edition, Tata McGraw Hill Publishing Company Ltd.,New Delhi,2008.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T105	ENGINEERING THERMODYNAMICS	3	1	-
<p>Course Objectives:</p> <ul style="list-style-type: none"> To convey the basics of the thermodynamic principles To establish the relationship of these principles to thermal system behaviors To develop methodologies for predicting the system behavior To establish the importance of laws of thermodynamics applied to energy systems To explain the role of refrigeration and heat pump as energy systems To develop an intuitive understanding of underlying physical mechanism and a mastery of solving practical problems in real world 				
<p>Course outcomes:</p> <ul style="list-style-type: none"> Ability to understand the basic concepts of thermodynamic such as temperature, pressure, system, properties, process, state, cycles and equilibrium. Ability to apply the first Law of Thermodynamics on closed and control volume systems. Ability to apply Second Law of Thermodynamics and entropy concepts in analyzing the thermal efficiencies of heat engines and the coefficients of performance for refrigerators. Students would understand air standard cycle analysis such as the Otto cycle, diesel, bray ton and dual cycles. To explain the role of refrigeration cycles & systems. 				
<p>UNIT I - Basic Concepts and Definitions Energy conversion and efficiencies - System, property and state - Thermal equilibrium - Temperature - Zeroth law of Thermodynamics – Pure substance - P, V and T diagrams – Thermodynamic diagrams.</p> <p>UNIT II - First Law of Thermodynamics The concept of work and adiabatic process - First law of thermodynamics - Conservation of Energy principle for closed and open systems - Calculation of work for different processes of expansion of gases</p> <p>UNIT III - Second Law of Thermodynamics Equilibrium and the second law - Heat engines - Kelvin-Planck statement of second law of thermodynamics - Reversible and irreversible processes - Carnot principle - Clausius inequality- Entropy</p> <p>UNIT IV - Gas Power Cycles Air standard cycles: The air standard Carnot cycle - Air standard Otto cycle, diesel cycle, dual cycle and Bryton cycles and their efficiencies</p> <p>UNIT V - Refrigeration Cycles and Systems Reverse Carnot cycle - COP - Vapor compression refrigeration cycle and systems (only theory) - Gas refrigeration cycle - Absorption refrigeration system – Liquefaction – Solidification (only theory).</p>				
<p>Text Books:</p> <ol style="list-style-type: none"> Nag, P. K., “Engineering Thermodynamics”, 4th edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 1995 Wark, K., “Thermodynamics”, 4th edition, Mc Graw Hill, N.Y., 1985 				
<p>Reference Books:</p> <ol style="list-style-type: none"> Arora, C.P., “Thermodynamics”, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 1998. Burghardt, M.D., “Engineering Thermodynamics with Applications”, 4th edition, Harper & Row, N.Y., 1986. Huang, F.F., “Engineering Thermodynamics” 2nd edition, Macmillan Publishing Co. Ltd., N.Y., 1989. Cengel, Y.A. and Boles, M.A., "Thermodynamics - An Engineering Approach", 5th edition, Mc-Graw Hill, 2006 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T106	COMPUTER PROGRAMMING	3	1	-
Course Objectives: <ul style="list-style-type: none"> To introduce the basics of computers and information technology. To educate problem solving techniques. To impart programming skills in C language To practice structured programming to solve real life problems. 				
Course outcomes: <ul style="list-style-type: none"> Have a deeper knowledge on the evolution of computers, components and its applications, have an awareness of internet, network structures, word processing and worksheets. Know about various problem solving techniques, program development cycle, basics tokens of C program and its structure. Learn about various control statements, declaration and initialization of arrays, functions, storage classes and string functions. Became familiar on structure, pointers and its manipulation. Know about Preprocessors, command line arguments and various file operations. How programming can be applied to real math problems. 				
<p>UNIT – I History of Computers – Block diagram of a Computer – Components of a Computer system – Classification of computers- Hardware – Software – Categories of Software – Operating System – Applications of Computers – Network structure – Internet and its services – Intranet – Study of word processor – Preparation of worksheets.</p> <p>UNIT – II Problem solving techniques – Program – Program development cycle – Algorithm design – Flowchart - Pseudo code. Introduction to C – History of C – Importance of C - C tokens – data types – Operators and expressions – I/O functions.</p> <p>UNIT – III Decision making statements – branching and looping – arrays – multidimensional arrays – Functions – Recursion – Passing array to functions. Storage classes – Strings – String library functions.</p> <p>UNIT – IV Structures – Arrays and Structures – nested structures – passing structures to functions – user defined data types – Union. Pointers – pointers and arrays – pointers and functions - pointers and strings - pointers and Structures.</p> <p>UNIT – V Files – operations on a file – Random access to files – command line arguments. Introduction to preprocessor – Macro substitution directives – File inclusion directives – conditional compilation directives – Miscellaneous directives.</p>				
Text Books: <ol style="list-style-type: none"> Balagurusamy. E, “Programming in ANSI C”, Tata McGraw Hill, Sixth edition, 2012 				
Reference Books: <ol style="list-style-type: none"> Vikas Verma, “A Workbook on C “, Cengage Learning, Second Edition, 2012 Ashok N Kamthane, “Computer Programming”, Pearson education, Second Impression, 2008. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
P101	COMPUTER PROGRAMMING LABORATORY	-	-	3

LIST OF EXPERIMENTS

1. Study of OS Commands
2. Write a simple C program to find the Area of the triangle.
3. Write a simple C program to find the total and average percentage obtained by a student for 6 subjects.
4. Write a simple C program to read a three digit number and produce output like 1 hundreds 7 tens 2 units for an input of 172.
5. Write a simple C program to check whether a given character is vowel or not using Switch – Case statement.
6. Write a simple C program to print the numbers from 1 to 10 along with their squares.
7. Write a simple C program to find the sum of ‘n’ numbers using for, do – while statements.
8. Write a simple C program to find the factorial of a given number using Functions.
9. Write a simple C program to swap two numbers using call by value and call by reference.
10. Write a simple C program to find the smallest and largest element in an array.
11. Write a simple C program to perform matrix multiplication.
12. Write a simple C program to demonstrate the usage of Local and Global variables.
13. Write a simple C program to perform various string handling functions: strlen, strcpy, strcat, strcmp.
14. Write a simple C program to remove all characters in a string except alphabets.
15. Write a simple C program to find the sum of an integer array using pointers.
16. Write a simple C program to find the Maximum element in an integer array using pointers.
17. Write a simple C program to create student details using Structures.
18. Write a simple C program to display the contents of the file on the monitor screen.
19. Create a File by getting the input from the keyboard and retrieve the contents of the file using file operation commands.
20. Write a simple C program to pass the parameter using command line arguments.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
P102	ENGINEERING GRAPHICS	3	1	-
Course Objectives: <ul style="list-style-type: none"> • To convey the basics of engineering drawing • To explain the importance of an engineering drawing • To teach different methods of making the drawing • To establish the importance of projects and developments made in drawing that are used in real systems To explain the role of computer aided design AutoCad • To develop an intuitive understanding of underlying significance of using these drawings 				
UNIT 0 Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning. UNIT I Conic sections, Involutcs, Spirals, Helix. Projection of Points, Lines and Planes. UNIT II Projection of Solids and Sections of Solids. UNIT III Development of surfaces - Intersection of surfaces (cylinder-cylinder, cylinder-cone). UNIT IV Isometric projections and Orthographic projections. UNIT V Computer Aided Drafting: Introduction to Computer Aided Drafting hardware - Overview of application software - 2D drafting commands (Auto CAD) for simple shapes - Dimensioning				
Text Books: <ol style="list-style-type: none"> 1. K.R. Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics, InzincPublishers,2007. 2. K.V. Natarajan, A Text Book of Engineering Drawing, Dhanalakshmi Publishers,2006. 3. BIS, Engineering Drawing practice for Schools &College,1992. 				
Reference Books: <ol style="list-style-type: none"> 1. N.D. Bhatt, Engineering Drawing, 49th edition, Chorotar Publishing House,2006. 2. K. Venugopal, Engineering Drawing and Grahics + Auto CAD, 4th edition, New AgeInternational Publication Ltd., 2004. 3. David I cook and Robert N Mc Dougal, Engineering Graphics and Design with computer applications, Holt – Sounders Int. Edn.1985. 4. James D Bethune and et. al., Modern Drafting, Prentice Hall Int.,1989. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
P103	BASIC ELECTRICAL ELECTRONICS AND INSTRUMENTATION LABORATORY	-	-	3
<p style="text-align: center;">LIST OF EXPERIMENTS</p> <ol style="list-style-type: none"> 1. Load test on separately excited DC generator. 2. Load test on Single phase Transformer. 3. Load test on Induction motor. 4. Verification of Circuit Laws. 5. Verification of Circuit Theorems. 6. Measurement of three phase power. 7. Load test on DC shunt motor. 8. Diode based application circuits. 9. Transistor based application circuits. 10. Study of CRO and measurement of AC signals. 11. Characteristics of LVDT. 12. Calibration of Rotometer. 				

II SEMESTER

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T107	MATHEMATICS – II	3	1	-
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To develop the use of matrix algebra techniques that is needed by engineers for practical applications. • To introduce the concepts of Curl, Divergence and integration of vectors in vector calculus which is needed for many application problems. • To introduce Laplace transform which is a useful technique in solving many application problems and to solve differential and integral equations. • To acquaint the students with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic. 				
<p>Course Outcomes:</p> <ul style="list-style-type: none"> • Find the Eigen values and Eigen vectors of a matrix and use Cayley-Hamilton Theorem for finding the inverse of a matrix. • Understand the statements of Stoke’s Theorem and Gauss Divergence Theorem and be aware of applications of these theorems in Engineering Field • Determine the Fourier Transform, Fourier Cosine and Sine Transform of elementary functions, properties of transforms and its applications in engineering • Acquire knowledge of matrix algebra technique, vector calculus, Laplace and Fourier Transform which are very much essential to solve the problems occurring in the areas of Engineering and Technology. 				
<p>UNIT I – MATRICES Eigenvalues and Eigen vectors of a real matrix, Characteristic equation, Properties of Eigenvalues and Eigenvectors. Cayley-Hamilton Theorem, Diagonalization of matrices. Reduction of a quadratic form to canonical form by orthogonal transformation. Nature of quadraticforms.</p> <p>UNIT II – VECTOR CALCULUS Gradient, divergence and curl, their properties and relations. Gauss divergence theorem and Stoke’s theorem (without proof). Simple application problems.</p> <p>UNIT III – LAPLACE TRANSFORM Definition, Transforms of elementary functions, properties. Transform of derivatives and integrals. Multiplication by t and division by t. Transform of unit step function, transform of periodic functions. Initial and final value theorems.</p> <p>UNIT IV – APPLICATIONS OF LAPLACE TRANSFORM Methods for determining inverse Laplace Transforms, convolution theorem, Application to differential equations and integral equations. Evaluation of integrals by Laplacetransforms.</p> <p>UNIT V – FOURIER TRANSFORM Fourier Integral theorem (statement only), Fourier transform and its inverse, properties. Fourier sine and cosine transforms, their properties, convolution and Parseval’s identity.</p>				
<p>Text books</p> <ol style="list-style-type: none"> 1. Venkataraman M.K., Engineering Mathematics, National Publishing Company, Chennai. 2. Kandasamy P. et al, Engineering Mathematics, Vol.2 & 3, S. Chand & Co., New Delhi. 				
<p>Reference Books</p> <ol style="list-style-type: none"> 1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008. 2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 41st Edition, 2011. 3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010. 4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi. 5. Bali N. and Goyal M., Advanced Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 7th Edition, 2010. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T108	MATERIAL SCIENCE	3	1	-
<p>Course Objectives:</p> <ul style="list-style-type: none"> To understand the importance of Material Science as a subject that revolutionized modern day technologies To understand the significance of material science in the development of new materials and devices for all branches of Engineering To impart knowledge to the Engineering students about some of the important areas of Materials Science so as to enable them perceive the significant contributions of the subject in Engineering and Technology 				
<p>Course Outcomes:</p> <ul style="list-style-type: none"> Understand the crystal lattice and its structure of crystal planes, directions and to designate the miller indices of the cubic crystal. Applying the knowledge of x-ray diffraction to analyze defects in the various crystalline solids To learn about the effect of polarization in dielectric material and to explain the dielectric material suitable for different application. The outcome of third unit makes the student to understand about different magnetic materials and to apply the basic idea of magnetism and to know about the application of magnetic storage devices. Understand about advanced materials and convention materials applying the knowledge to synthesis and characterize the various nano materials to know their physical and chemical properties to meet out the demands for industrial application in the new era of engineering To understand the importance of material science as a subject that revolutionized modern day technologies and revolutionized modern day technologies which lead to the development of new materials and devices for all branches of engineering 				
<p>UNIT I - Crystal structure and Lattice Defects Crystal structure - Bravais Lattices, Crystal Systems — Coordination Number, Atomic Radius, Packing Factor for FCC & HCP structures – Miller Indices- Powder X Ray Diffraction Method. Lattice defects – Qualitative ideas of point, line, surface and volume defects.</p>				
<p>UNIT II – Dielectric properties Dielectric Polarization and Mechanism –Temperature dependence of polarization, Internal or local Field - Clausius-Mossotti relation. Basic ideas of Dielectric loss - frequency dependence of dielectric constant – Measurement of Dielectric constant and loss using Scherring bridge – Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric materials and Applications.</p>				
<p>UNIT III – Magnetic Properties Origin of atomic magnetic moment – Bohr magneton-Elementary Ideas of classification of magnetic materials (Dia, Para, Ferro, antiferro & Ferri). – Quantum theory of Para & Ferro Magnetism – Domain Theory of Hysteresis – Heisenberg Theory of Exchange Interaction (without derivation) – Qualitative ideas of Anti ferromagnetic Ordering – Structure and Properties of Ferrites – Properties of Soft & Hard Magnetic Materials – Applications. Magnetic data storage – Magnetic tapes, Hard disks, Magneto optical recording.</p>				
<p>UNIT IV – Semiconductors and superconductors Semiconductors -Derivation of Carrier concentration in intrinsic Semiconductors –Basic ideas of Electrical conductivity in intrinsic and extrinsic semiconductors (without derivations) -temperature dependence of carrier concentration and electrical conductivity in semiconductors (qualitative ideas), Hall effect in Semiconductors -- Application of Hall Effect, Basic Ideas of Compound Semiconductors (II-VI & III-V). Superconductivity - Basic concepts – transition temperature – Meissner effect – Type I and II superconductors – high temperature superconductors – 123 superconductor – Applications of superconductors.</p>				
<p>UNIT V – Advanced Materials Liquid Crystals – Types – Application as Display Devices. Metallic Glasses</p>				

– preparation by melt spinning. Twin roller system, properties and applications. Shape Memory alloys (SMA), Shape memory effect, Properties and applications of SMA Nanomaterials- Nano materials (one, Two & three Dimensional) –Methods of synthesis (PVD, CVD, Laser Ablation, Solgel, Ball-milling Techniques), Properties and applications of nanomaterials. carbon nanotubes– Properties and applications.

Text books

1. V Rajendran, Engineering Physics, 2 nd Edition, TMH, New Delhi 2011.
2. V Raghavan , Materials Science and Engineering- A First Course, 5th Edition, Prentice Hall of India, 2008.

Reference Books:

1. Ali Omar M, Elementary Solid State Physics, Addison Wesley Publishing Co., 2009.
2. William D Callister Jr., Material Science and Engineering, 6th Edition, John Wiley and sons, 2009.
3. Srivatsava J P, Elements of Solid State Physics, Prentice Hall of India, 2004.
4. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley & sons, Singapore, 2007.
5. Pillai S.O, Solid State Physics, 6th Edition – New Age International, 2005.
6. B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath, and James Murday, Text book of Nanoscience and Nanotechnology, Universities Press, Hyderabad 2012
7. Charles P Poole & Frank J Owens, Introduction to Nanotechnology, Wiley nterscience, 2003.
8. M Arumugam , Materials Science, Anuratha Printers, 2004.
9. M.N. Avadhanulu, Enginerring Physics- Volume-II, S.Chand &Co, New Delhi, 2009.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T109	ENVIRONMENTAL SCIENCE	3	1	-
Course Objectives: <ul style="list-style-type: none"> To know about the environment. To understand about environmental pollution. To apply the knowledge in understanding various environmental issues and problems 				
Course Outcomes: <ul style="list-style-type: none"> Basic Knowledge to understand what constitutes the environment, Knowledge of knowing the precious resources in the environment and the role of human being in maintaining a clean environment. Knowledge of knowing how to maintain ecological balance and preserve biodiversity. Knowledge of solving and minimizing global warming and pollution control. Knowledge of solving and minimizing water, land, thermal and radioactive pollution control. Developed skills in procedures and instrumental methods applied in analytical tasks of environmental chemistry. The focus of this course is to introduce students to thinking about environmental issues from an interdisciplinary perspective. 				
<p>UNIT I – Environment and Energy Resources Environmental segments – atmosphere, hydrosphere, lithosphere and biosphere. Atmospheric layers. Pollution definition and classification. Pollutants classification. Forest resources – use and over exploitation, deforestation, forest management. Water resources – use and conflicts over water, dams – benefits and problems. Mineral resources – mineral wealth of India, environmental effects of extracting and using mineral resources. Food resources – world food problems, environmental impact of modern Agriculture – fertilizer and pesticides. Energy resources – growing needs, renewable and non-renewable energy resources and use of alternate energy sources. From unsustainable to sustainable development.</p> <p>UNIT II - Ecosystem and Biodiversity Concept of an ecosystem - structure and function of an ecosystem. Producers, consumers, and decomposers. Energy flow in the ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of forest, grassland, desert and aquatic (fresh water, estuarine and marine) ecosystems. Biodiversity – definition, genetic species and ecosystem diversity. Value of biodiversity - consumptive use, productive use, social, ethical, aesthetic and option values. Hot spots of biodiversity. Threats to biodiversity, habitat loss, poaching of wildlife, human wildlife conflicts. Endangered and endemic species. Conservation of biodiversity – in-situ and ex-situ conservation of biodiversity.</p> <p>UNIT III - Air Pollution Definition and classification. Chemical and photochemical reaction in different layers of atmosphere. Causes, sources, effects and control measures of air pollutants - oxides of Nitrogen, oxides of Carbon, oxides of Sulfur, hydrocarbons, chloro-fluoro carbons and particulates. Mechanism and effects of air pollution phenomenon – Global Warming, Ozone Depletion, Acid Rain, Sulfurous Smog and Photochemical Smog.</p> <p>UNIT IV- Water and Land Pollution Water pollution – causes and effects of organic water pollutants – pesticides, insecticides, detergents and surfactants. Causes and effects of inorganic water pollutants – heavy metal pollution due to Hg, Pb, Cr & Cu. Water pollution control and monitoring – DO, COD, BOD & TOC. Land Pollution – Solid waste management – causes, effect and control measures of urban and industrial wastes. Thermal and radioactive pollution.</p> <p>UNIT V -Pollution Control and Monitoring Basic concepts and instrumentation of IR, UV-VIS, atomic absorption spectrometry, Gas Chromatography and Conductometry. Analysis of air pollutants – NO_x, CO_x, SO_x, H₂S, Hydrocarbons and particulates.</p>				

Text Books:

1. K. De, "Environmental chemistry" 7th Ed; New age international (P) Ltd, New Delhi,2010.
2. K. Raghavan Nambiar, "Text Book of Environmental Studies" 2ndEd, Scitech Publications (India) Pvt Ltd, India,2010.
3. G. S. Sodhi, Fundamental concepts of environmental chemistry, I Ed, Alpha Science International Ltd, India,2000.

Reference Books:

1. B.K. Sharma, "Environmental chemistry" 11th Ed, KRISHNA Prakashan Media (P) Ltd, Meerut,2007.
2. S.S.Dara, and D.D. Mishra "A text book of environmental chemistry and pollution control, 5th Ed, S.Chandand Company Ltd, New Delhi,2012.
3. Richard T. Wright, Environmental Science: Toward a Sustainable Future, 10thedition, Prentice Hall, 2008

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T110	BASIC CIVIL AND MECHANICAL ENGINEERING	3	1	-

Course Objectives:

- To appreciate the role of civil engineering in daily walks of life.
- To be able to differentiate the types of buildings according to national building code.
- To understand building components and their functions as well as different types of roads, bridges and dams
- To convey the basic principles of Mechanical Engineering and its relationship to other branches of engineering
- To explain the concepts of thermal systems used in power plants and narrate the methods of harnessing renewable energies To explain the role of basic manufacturing processes
- To develop an intuitive understanding of underlying working principles of mechanical machines and systems

Course Outcomes:

- Understand the building classification as per National building code.
- Get the idea about construction procedure for various components of the building.
- Students understand the principles of surveying, construction procedure for roads, bridges and dams.
- Student will be able know about the working of Internal and external combustion systems.
- Student will be able know about Non-Conventional Energy Systems.
- Student will be able to know about manufacturing process.

Part-A CIVIL ENGINEERING

UNIT I - Buildings, Building Materials Buildings-Definition-Classification according to NBC-plinth area, Floor area, carpet area, floor space index-construction materials-stone, brick, cement, cement-mortar, concrete, steel- their properties and uses.

UNIT II - Buildings and their components Buildings: Various Components and their functions. Soils and their classification. Foundation: function and types. Masonry- function and types. Floors: definition and types of floors. Roofs: definition f and types.

UNIT III - Basic Infrastructure Surveying: classification, general principles, types, Uses, instruments used. Roads-types: components, types and their advantage and disadvantages. Bridges: components and types of bridges. Dams: Purpose, types of dams. Water supply-sources and quality requirements, need and principles of rainwaterharvesting.

PART - B MECHANICAL ENGINEERING

UNIT - IV Internal and external combustion systems: IC engines – Classification – Working principles - Diesel and petrol engines: two stroke and four stroke engines – Merits and demerits. Steam generators (Boilers) – Classification – Constructional features (of only low pressure boilers) – Boiler mountings and accessories – Merits and demerits - Applications.

UNIT - V Power Generation Systems – Convectional and Non-Conventional: Hydraulic – Thermal – Nuclear power plants – Schemes and layouts (Description Only) Solar – wind –Geothermal - Wave – Tidal and Ocean Thermal Energy Conversion systems – Basic power plant schemes and layouts (Description only).

UNIT - VI Manufacturing Processes: Machines – Lathe – Drilling – Bending – Grinding – Shearing (Description only) Machining Processes – Turning – Planning – Facing – Blanking – Drilling –Punching – Shearing – Bending – Drawing – Filing – Sawing – Grinding. Moulding and Metal Joining - Pattern making – Green and dry sand moulding – Arc and Gas welding – Brazing – Soldering (process descriptiononly).

Text Books:

1. Purushothama Raj.P., Basic civil engineering, 3rd Edn., Dhanam Publications, Chennai,2001.
2. Natarajan, K V, Basic Civil Engineering, 11th Edition, Dhanalakshmi Publications Chennai,2001.
3. Lindberg, R.A.Process and Materials of Manufacture, PHI,1999.
4. H.N.Gupta, R.C.Gupta and Arun Mittal, Manufacturing Processes, New Age Publications,2001
5. Nagpal, Power Plant Engineering, Khanna Publishers, Delhi,1998.

Reference Books:

1. Rajput, R K, Engineering Materials, S Chand & Co. Ltd., New Delhi,2002.
2. Punmia, B.C., et. al., Surveying , Vol-I, Laxmi Publishers, New Delhi,2002.
3. Punmia, B.C., et.al Building Construction, Laxmi Publishers, New Delhi,2002.
4. El.Wakil, M.M., Power Plant Technology, Mc Graw Hill BookCo.,1985.
5. Hajra Choudhry, et. al., Workshop Technology Vol I and II, Media Promoters Publishers Pvt. Ltd., Bombay,2004.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T111	ENGINEERING MECHANICS	3	1	-
<p>Course Objectives:</p> <ul style="list-style-type: none"> To understand the vector and scalar representation of forces and moments, static equilibrium of particles and rigid bodies in twodimensions To comprehend the effect of friction onequilibrium To understand the laws of motion, the kinematics of motion and the interrelationship and to learn to write the dynamic equilibriumequation To emphasis the concepts through solvedexamples 				
<p>Course Outcomes:</p> <ul style="list-style-type: none"> Understand the basic laws of mechanics and resolution of forces using different methods. Learn and apply the knowledge on analysis of forces acting on the trusses and effect of friction force on bodies. Learn about the centroid and moment of inertia for plane and solid figures. Understand the three laws of motion, principles of dynamics for particles. The student will able to analyze the laws of motion for rigid bodies. 				
<p>UNIT I - Fundamental of Mechanics Basic Concepts Force System and Equilibrium, Definition of Force, Moment and Couple, Principle of Transmissibility, Varignon's theorem, Resultant of force system – Concurrent and non concurrent coplanar forces, Condition of static equilibrium for coplanar force system, stability of equilibrium, , applications in solving the problems on static equilibrium of bodies.</p> <p>UNIT II – Practical application of force system Structural member: definition, Degree of freedom, concept of free body diagrams, types of supports and reactions, types of loads, Analysis of Trusses-method of joints, method of sections. Friction: Introduction, Static dry friction, simple contact friction problems, ladders, wedges.</p> <p>UNIT III - Properties of Surfaces Properties of sections – area, centroids of lines, areas and volumes, moment of inertia first moment of inertia, second moment of inertia and product moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia.</p> <p>UNIT IV - Kinematics and Kinetics of Particles Equations of motion - Rectilinear motion, curvelinear motion, Relative motion, D'Alembert's principle, work- Energy equation – Conservative forces and principle of conservation of energy, Impulse – momentum, Impact – Direct central impact and oblique central impact.</p> <p>UNIT V - Kinematics and Kinetics of Rigid bodies Plane motion, Absolute motion, Relative motion, translating axes and rotating axes, work and energy, impulse and momentum</p>				
<p>Text Books:</p> <ol style="list-style-type: none"> Bhavikatti,S.S and K.G.Rajashekarappa, Engineering Mechanics, New Age International (P) Ltd, New Delhi,2008. Rajeseakaran, S and Sankara Subramanian., G., Engineering Mechanics, Vikas Publishing House Private Ltd., 2002. 				
<p>Reference Books:</p> <ol style="list-style-type: none"> Palanichamy, M.S. Nagan, S., Engineering Mechanics – Statics & Dynamics, TataMcGraw-Hill,2001. Beer, F.P and Johnson Jr. E.R, Vector Mechanics for Engineers, Vol. 1 Statics and Vol.2Dynamics, 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
T112	COMMUNICATIVE ENGLISH	3	1	-
<p>Course Objectives:</p> <ul style="list-style-type: none"> To improve the LSWR skills of I B.Techstudents To instill confidence and enable the students to communicate withease To equip the students with the necessary skills and develop their languageprowess 				
<p>Course Outcomes:</p> <ul style="list-style-type: none"> Understand the basic concepts of communication. The student also understands the importance of listening. Understands the comprehension, identifies the difference between Skimming and scanning, guess the meaning of the words, Identify to make notes. Students learnt the writing skills, how to write a paragraph in a proper manner, four modes of writing and how to make bibliographical entries Students learnt about the types of letters, report writing, notices and memo and also developed their skill in writing Students will be able to develop their spoken skills by making them to involve in many activities related to it. Develops the four skills- listening , speaking , reading and writing 				
<p>UNIT I – Basic Communication Theory Importance of Communication – stages of communication, modes of communication – barriers to communication – strategies for effective communication – Listening: Importance, types, barriers – Developing effective listening skills.</p>				
<p>UNIT II – Comprehension and Analysis Comprehension of technical and non-technical material – Skimming, scanning, inferring Note making and extension of vocabulary, predicting and responding to contextIntensive Reading and Reviewing</p>				
<p>UNIT III – Writing Effective sentences, cohesive writing, clarity and conciseness in writing – Introduction to Technical Writing – Better paragraphs, Definitions, Practice in Summary Writing – Four modes of writing – Use of dictionaries, indices, library references – making bibliographical entries with regard to sources from books, journals, internet etc.</p>				
<p>UNIT IV – Business Writing / Correspondence Report writing – Memoranda – Notice – Instruction – Letters – Resumes – Job applications</p>				
<p>UNIT V – Oral Communication Basics of phonetics – Presentation skills – Group Discussions – Dialogue writing – Short Extempore – Debates-Role Plays-Conversation Practice</p>				
<p>Text Books:</p> <ol style="list-style-type: none"> Ashraf M.Rizvi., Effective Technical Communication. Tata-McGraw,2005. Boove, Courtland R et al., Business Communication Today. Delhi. PearsonEducation,2002. Meenakshi Raman and Sangeeta Sharma., Technical Communication Principles And Practice,OUP, 2007. Robert J.Dixson. ,Complete Course in English, Prentice-Hall of India Pvt. Ltd., NewDelhi,2006. Robert J.Dixson., Everyday Dialogues in English, Prentice-Hall of India Pvt. Ltd., NewDelhi,2007. Sethi,J and Kamalesh Sadanand., A Practical Course in English Pronunciation, Prentice-Hall of India Pvt. Ltd, New Delhi,2007. McGraw – Hill International Edition,1997. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
P104	PHYSICS LABORATORY	-	-	3

LIST OF EXPERIMENTS

List of experiments (Any 10 Experiments)

1. Thermal conductivity – Lee’s DISC
2. Thermal conductivity - Radial flow
3. Spectrometer – Prism or Hollow prism
4. Spectrometer – Transmission grating
5. Spectrometer - Ordinary & Extraordinary rays
6. Newton’s rings
7. Air – wedge
8. Half shade polarimeter – Determination of specific rotatory power
9. Jolly’s experiment – determination of α
10. Magnetism: $i - h$ curve
11. Field along the axis of coil carrying current
12. Vibration magnetometer – calculation of magnetic moment & pole strength
13. Laser experiment: wavelength determination using transmission grating, reflection grating (vernier calipers) & particle size determination
14. Determination of optical absorption coefficient of materials using laser
15. Determination of numerical aperture of an optical fiber
16. Electrical conductivity of semiconductor – two probe / four probe method
17. Hall effect in semiconductor

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
P105	CHEMISTRY LABORATORY	-	-	3

LIST OF EXPERIMENTS

List of experiments (Any 10 Experiments)

1. Determination of dissolved oxygen in water.
2. Determination of total hardness of water by EDTA method.
3. Determination of carbonate and bicarbonate in water.
4. Estimation of chloride content in water.
5. Estimation of magnesium by EDTA.
6. Estimation of acetic acid in vinegar.
7. Estimation of ferrous by permanganometry.
8. Estimation of ferrous and ferric iron in a solution mixture by dichrometry.
9. Estimation of available chlorine in bleaching powder.
10. Estimation of copper in copper sulphate solution.
11. Estimation of calcium by permanganometry.
12. Estimation of iron by colorimetry.

Demonstration Experiments (Any two of the following)

1. Determination of COD of water sample.
2. Determination of lead by conductometry.
3. Percentage composition of sugar solution by viscometry.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
P106	Workshop Practice	-	-	3
<p>List of Exercises</p> <ol style="list-style-type: none"> 1. Fitting Study of tools and Machineries. Exercises on symmetric joints and joints with acute angle. 2. Welding Study of arc and gas welding equipment and tools – Edge preparation – Exercises on lap joint and V Butt joints – Demonstration of gas welding 3. Sheet metal work Study of tools and Machineries – exercises on simple products like Office tray and waste collection tray. 4. Carpentry Study of tools and Machineries – Exercises on Lap joints and Mortise joints <p>List of Exercises I</p> <p>Fitting</p> <ol style="list-style-type: none"> 1. Study of tools and Machineries 2. Symmetric fitting 3. Acute angle fitting <p>II Welding</p> <ol style="list-style-type: none"> 1. Study of arc and gas welding equipment and tools 2. Simple lap welding (Arc) 3. Single V butt welding (Arc) <p>III Sheet metalwork</p> <ol style="list-style-type: none"> 1. Study of tools and machineries 2. Frustum 3. Waste collection tray <p>IV Carpentry</p> <ol style="list-style-type: none"> 1. Study of tools and machineries 2. Half lap joint 3. Corner mortise joint. 				
<p>Reference Books</p> <ol style="list-style-type: none"> 2. Hajra Choudhry, et. al., Workshop Technology Vol. I and II, Media Promoters Publishers Pvt. Ltd., Bombay, 2004. 3. H.N.Gupta, R.C.Gupta and Arun Mittal, Manufacturing Processes, New Age Publications, 2001 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
P107	NCC / NSS	-	-	3
<p>NCC/NSS training is compulsory for all the Undergraduate students</p> <ol style="list-style-type: none"> 1. The above activities will include Practical/field activities/Extension lectures. 2. The above activities shall be carried out outside class hours. 3. In the above activities, the student participation shall be for a minimum period of 45hours. 4. The above activities will be monitored by the respective faculty incharge and the First Year Coordinator. 5. Pass /Fail will be determined on the basis of participation, attendance, performance and behaviour. If a candidate fails, he/she has to repeat the course in the subsequent years 6. Pass in this course is mandatory for the award of degree. 				

III SEMESTER

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T31	Discrete Mathematics	3	1	-
<p>Course Perquisite:</p> <ul style="list-style-type: none"> • Basic knowledge and understanding of the concepts like elementary algebra and arithmetic are required for learning the concept of Discrete Mathematics. The concept is well explained with sufficient theory and mathematics 				
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To extend student's logical and mathematical maturity and ability to deal with abstraction. • To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems. • To understand the basic concepts of combinatory and graph theory. • To familiarize the applications of algebraic structures. • To understand the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering 				
<p>Course Outcomes:</p> <ul style="list-style-type: none"> • Have knowledge of the concepts needed to test the logic of a program. • Have an understanding in identifying structures on many levels. • Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science. • Be aware of the counting principles. • Be exposed to concepts and properties of algebraic structures such as groups, rings and fields. 				
<p>UNIT-I LOGIC AND PROOFS: Propositional logic – Propositional equivalences – Predicates and quantifiers – Nested quantifiers –Rules of inference – Introduction to proofs – Proof methods and strategy.</p> <p>UNIT-II COMBINATORICS: Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.</p> <p>UNIT- III GRAPHS: Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.</p> <p>UNIT-IV ALGEBRAIC STRUCTURES: Algebraic systems – Semi groups and monoids – Groups – Subgroups – Homomorphism's –Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.</p> <p>UNIT-V LATTICES AND BOOLEAN ALGEBRA:Partial ordering – Posets – Lattices as posets – Properties of lattices – Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011. 2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011. 				

Reference Books:

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.

Content Beyond Syllabus:

- Boolean Algebra to Switching Theory
- Tree concepts

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T32	DIGITAL CIRCUIT AND MICROPROCESSOR	3	1	-
Course Pre-requisite:				
<ul style="list-style-type: none"> Fundamental knowledge on internal working of computers, programming and problem solving skill 				
Course Objectives:				
<ul style="list-style-type: none"> To introduce the fundamentals of digital system design and computer design To lay strong foundation to the combinational and sequential logic. To understand I/O interfacing, instruction set of 8085 and 8086 microprocessor 				
Course Outcomes:				
<ul style="list-style-type: none"> Test the Digital Systems, Logic Families and logic gates and construct combinational logical circuit and sequential logical circuit Understand the inner working components of the microprocessors Develop assembly language programs, I/O interfacing using 8085 and 8086 				
<p>UNIT I - Review of Binary number systems: Binary, Decimal, Octal, Hexadecimal number systems – Number base conversions – Signed binary numbers – Arithmetic operations – Binary codes– Boolean Algebra & Theorems, Sum of Products and Product of Sums functions, Minimization of expressions using Karnaugh Maps and Quine-McCluskey method –universal gates and multilevel gates.</p> <p>UNIT II - Combinational Logic: Half & full adders/subtractors – Parallel Adders – Look-ahead carry adders - BCD adders/subtractors – Binary Multiplier – Code convertors – Decoders – Encoders – Parity encoders – Multiplexers – Implementation of combinational logic using Multiplexers - Demultiplexers - Magnitude comparators – Parity generator/checker. HDL for Combinational circuit</p> <p>UNIT III - Sequential Logic: Latches versus Flip Flops – SR, D, JK Flip Flops– Conversion of Flip flops – Counters: Asynchronous, synchronous– Shift Registers: types, applications – Analysis and design of clocked sequential circuits- State machine notations – state reduction techniques. HDL for Sequential Circuit</p> <p>Reconfigurable Digital Circuits: Types of Memories – Organization of ROM and RAM – Programmable Logic Devices (PLDs) – Programmable Logic Arrays (PLAs) – Programmable Array Logic (PAL) devices – Field Programmable Gate Arrays (FPGAs) - Combinational Logic implementation using PROMs, PLAs, PALs.</p> <p>UNIT IV - Intel 8085 Microprocessor: Introduction - Need for Microprocessors – Evolution – Intel 8085 Hardware Architecture – General Purpose and Special Purpose registers - Pin description – Instruction word size - Addressing modes – Instruction Set – Assembly Language Programming.</p> <p>Intel 8085 Interrupts: 8085 Interrupts – Software and Hardware Interrupts – 8259 Programmable Interrupt Controller</p> <p>UNIT V - I/O Interfacing: Memory and I/O interfacing - 8255 Programmable Peripheral Interface – 8251 USART, 8279 Keyboard/Display Interface. Intel 8086 Microprocessor: Introduction-Intel 8086 Hardware architecture – Pin description –Addressing modes - Instruction set.</p> <p style="text-align: right;">TOTAL PERIODS : 60</p>				
Text Books:				
<ol style="list-style-type: none"> M. Morris Mano and Michael D. Ciletti, “Digital Systems: With an Introduction to the Verilog HDL”, Fifth Edition, Prentice Hall of India, 2012 Ramesh S. Gaonkar, “Microprocessor Architecture, Programming and Applications with 8085”, Penram International Publications, Fifth Edition. 				
Reference Books:				
<ol style="list-style-type: none"> A. P. Godse and D. A. Godse, “Digital Systems Design”, Technical Publications, Pune, 2008. N. Senthil Kumar, M Saravanan and S. Jeevananthan, “Microprocessors and Microcontrollers” , Oxford University Press, First Edition 2010. A. P. Godse &D.A Godse, “Microprocessors and Microcontrollers”, Technical Publications, 4th Ed, 2008. A.Nagoor Kani, “Microprocessors and Microcontrollers”,Tata McGraw-Hill publications, 2nd edition. 				
Content Beyond Syllabus:				
<ul style="list-style-type: none"> Verilog Hardware Description Language Interfacing of DMA and Timer circuits with Processor 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T33	DATA STRUCTURES	3	1	-
Course Pre-requisite:				
<ul style="list-style-type: none"> • C Programming language 				
Course Objectives:				
<ul style="list-style-type: none"> • To acquaint students with data structures used when programming for the storage and manipulation of data. • The concept of data abstraction and the problem of building implementations of abstract data types are emphasized. • To understand the applications of graph theory in various domains 				
Course Outcomes:				
<ul style="list-style-type: none"> • Selection of relevant data structures and combinations of relevant data structures for the given problems in terms of memory and run time efficiency. • Apply data abstraction in solving programming problems. • Apply Graph theoretical approaches for solving real-life problems. 				
<p>UNIT – I Introduction: Algorithmic notation – Programming principles – Creating programs- Analyzing programs. Arrays: One dimensional array, multidimensional array, pointer arrays. Searching: Linear search, Binary Search, Fibonacci search. Sorting techniques: Internal sorting - Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort and Radix Sort.</p> <p>UNIT – II Stacks: Definition – operations - applications of stack. Queues: Definition - operations - Priority queues - De queues – Applications of queue. Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, linked stacks, Linked queues, Applications of Linked List – Dynamic storage management – Generalized list.</p> <p>UNIT – III Trees: Binary tree, Terminology, Representation, Traversals, Applications – Binary search tree – AVL tree. B Trees: B Tree indexing, operations on a B Tree, Lower and upper bounds of a B Tree - B + Tree Indexing – Trie Tree Indexing.</p> <p>-</p> <p>UNIT – IV Graph: Terminology, Representation, Traversals – Applications - spanning trees, shortest path and Transitive closure, Topological sort. Sets: Representation - Operations on sets – Applications.</p> <p>UNIT – V Tables: Rectangular tables - Jagged tables – Inverted tables - Symbol tables – Static tree tables - Dynamic tree tables - Hash tables. Files: queries - Sequential organization – Index techniques. External sorting: External storage devices – Sorting with tapes and disks.</p> <p style="text-align: right;">TOTAL PERIODS : 60</p>				
Text Books:				
<ol style="list-style-type: none"> 1. Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures”,Galgotia Book Source,Pvt. Ltd.,2004. 2. D. Samanta, “Classic Data Structures”, Second Edition, Prentice-Hall of India, Pvt. Ltd., India2012. 				
Reference Books:				
<ol style="list-style-type: none"> 1. Robert Kruse, C.L. Tondo and Bruce Leung, “Data Structures and Program Design in C”, Prentice-Hall of India, Pvt. Ltd., Second edition,2007. 2. MarkAllenWeiss”,DataStructuresandAlgorithmAnalysisinC”, PearsonEducation,Secondedition, 2006. 				
Content Beyond Syllabus:				
<ul style="list-style-type: none"> • Red Black Tree • Splay Tree 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T34	OOPS AND JAVA PROGRAMMING	3	1	-
Course Pre-requisite:				
<ul style="list-style-type: none"> Basic Programming Concepts 				
Course Objectives:				
<ul style="list-style-type: none"> To understand the concepts of object oriented programming To expertise the programming skills through JAVA language 				
Course Outcomes:				
<ul style="list-style-type: none"> Conceptualize the problem in terms of object oriented features. Design multi-threaded programs to simulate parallel execution. Design and develop real time applications using basic GUI components with event handling mechanism. Design generic programs and develop database oriented applications. Simulate client server applications -Design and develop a complete object oriented application 				
<p>UNIT I: INTRODUCTION OOPS Limitations of structured programming- Object-oriented paradigm, elements of object oriented programming–Merits and demerits of methodology-Datatypes-loops-pointers–arrays–structures – functions–Classes – Objects-Constructor and destructor</p> <p>UNIT II: OVERLOADING FUNCTIONS AND FILES Operator overloading–function overloading- Inheritance–multiple–multilevel–hierarchical-Virtual base class-friend function-Polymorphism–this pointer-virtual functions-pure virtual function-Input /Output streams-Files streams—manipulators – Templates</p> <p>UNIT III: INTRODUCTION OF JAVA Introduction to Java–Java vs. C++-datatypes –operators–Decision making-branching-loops-classes – objects-arrays-strings-methods-string handling - Constructors – Destructors</p> <p>UNIT IV: PACKAGES AND EXCEPTION HANDLING Inheritance-Packages–API packages– creating packages– adding class to package-interfaces– multiple inheritance –Exception handling-predefined and user defined.</p> <p>UNIT V: THREADS AND APPLETS (QUALITATIVE ANALYSIS) Multi threaded programming–creating threads-extending the thread class-life cycle of threads Applet Programming–applet life cycle-creating executable applet– passing parameters to applets Streams in Java</p> <p style="text-align: right;">TOTAL PERIODS : 60</p>				
TEXT BOOKS:				
<ol style="list-style-type: none"> E. Balaguruswamy,“Object Oriented Programming with C++”, (4th Edition), Tata McGraw Hill Publications Limited, 2008 (Unit I & II) E.Balaguruswamy,“Programming with Java-A Primer”(3rd Edition), Tata McGraw Hill Publications Limited, 2007. (Unit III, IV, V) Deitel and Deitel, “JAVA How to Program” Prentice Hall, 2006 				
REFERENCE BOOKS:				
<ol style="list-style-type: none"> Herbert Schildt, Dale Skrien, “Java Fundamentals – A Comprehensive Introduction”, Tata Mc Graw Hill,2013 John Dean, Raymond Dean, “ Introduction to Programming with JAVA –A Problem Solving Approach”, Tata Mc Graw Hill,2012 Ralph Bravaco, Shai Simonson, “Java Programming : From the Ground Up”,Tata McGraw Hill Edition,2012 				
Websites:				
<ol style="list-style-type: none"> https://docs.oracle.com/javase/tutorial/tutorialLearningPaths.html https://nptel.ac.in/courses/106/105/106105191/ 				
Content Beyond Syllabus:				
<ul style="list-style-type: none"> Selenium WebDriver using Java 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T35	PYTHON PROGRAMMING	3	1	-
Course Pre-requisite:				
<ul style="list-style-type: none"> Basics of Computer programming 				
Course Objectives:				
<ul style="list-style-type: none"> To acquaint students with data structures used when programming for the storage and manipulation of data. The concept of data abstraction and the problem of building implementations of abstract data types are emphasized. 				
Course Outcomes:				
<ul style="list-style-type: none"> Under the basic concepts of Python Programming Develop algorithmic solutions to simple computational problems Structure simple Python programs for solving problems Represent compound data using Python lists, tuples, dictionaries. 				
<p>UNIT I- INTRODUCTION: History , Features , Working with Python, Installing Python, basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; Arithmetic and Logical operators and Boolean expressions. Debugging, comments in the program; understanding error messages; Catching exceptions using try and except.</p> <p>UNIT II-DATA, EXPRESSIONS, STATEMENTS :Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.</p> <p>UNIT III-CONTROL FLOW, FUNCTIONS :Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, GCD, exponentiation, sum an array of numbers, linear search, binary search.</p> <p>UNIT IV-LISTS, TUPLES, DICTIONARIES :Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.</p> <p>UNIT V-FILES, MODULES, PACKAGES :Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.</p> <p style="text-align: right;">TOTAL PERIODS : 60</p>				
Text Books:				
<ol style="list-style-type: none"> The Complete reference - Python By Martin C. Brown, Tata McGraw hill edition 2010 Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist``, 2nd edition, Updated for Python 3, Shroff O'Reilly Publishers, 2016 Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python, Network Theory Ltd., 2011. 				
Reference Books:				
<ol style="list-style-type: none"> Budd T A, Exploring Python , 2011, Tata McGraw Hill Education 4. Learning Python, Fourth Edition, Mark Lutz, O'Reilly publication Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An 				

Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

Websites:

1. <http://greenteapress.com/thinkpython/>
2. <http://www.blog.pythonlibrary.org/2014/06/03/python-101-book-published-today/>
3. <https://docs.python.org/3/tutorial/>
4. <http://www.greenteapress.com/thinkpython/>

Content Beyond Syllabus:

- Writing GUIs in Python
- Python SQL Database Access

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T36	SOFTWARE ENGINEERING	3	1	-
Course Pre-requisite:				
<ul style="list-style-type: none"> • Computer programming 				
Course Objectives:				
<ul style="list-style-type: none"> • Identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements • Elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of a software project. • Understanding professional, ethical and social responsibility of a software engineer • Participate in design, development, deployment and maintenance of a medium scale software development project. 				
Course Outcomes:				
<ul style="list-style-type: none"> • Ability to apply basic knowledge and understanding of the analysis, synthesis and design of complex systems • Develop, maintain and evaluate large-scale software systems • Produce efficient, reliable, robust and cost-effective software solutions 				
<p>UNIT – IINTRODUCTION TO SOFTWARE ENGINEERING: The Software Engineering Discipline – Evolution and Impact – Software Development projects – Emergence of Software Engineering – Computer System Engineering – Software Life Cycle Models – classic Waterfall model – Iterative Lifecycle model – prototyping model – Evolutionary model – spiral model – Comparison of Life cycle models.</p> <p>UNIT – IISOFTWARE PROJECT MANAGEMENT AND REQUIREMENTS ANALYSIS: Responsibilities of a Software Project Manager – Project Planning – Metrics for Project Size Estimation – Empirical Estimation techniques – COCOMO – Halstead’s Software Science –Staffing Level Estimation – Scheduling – Organization and Team structures –Staffing – Risk Management – Software Configuration Management – Requirements Gathering and Analysis – Software Requirements specification – Formal System Specification – Axiomatic Specification - Algebraic Specification – 4GL.</p> <p>UNIT – IIISOFTWARE DESIGN AND FUNCTION ORIENTED SOFTWARE DESIGN: Outcome of a Design Process – Characteristics of a Good Software Design – Coupling and Cohesion –Approaches to Software Design – Object Oriented Vs Function Oriented Software Design approaches – Structured Analysis – Data Flow Diagrams – Applying DFD to Real time systems – Structured and Detailed Design.</p> <p>UNIT – IVOBJECT MODELLING AND OBJECT ORIENTED SOFTWARE DEVELOPMENT: Overview of OO concepts – UML – Use case model – Class diagrams – Interaction diagrams –Activity diagrams – state chart diagrams - Patterns – Types – Object Oriented Analysis and Design methodology – Interaction Modeling – OOD Goodness criteria.</p> <p>UNIT – VUSER INTERFACE DESIGN AND TESTING: Characteristics of a good User Interface – Types – Fundamentals of Component based GUI Development – A User Interface Design methodology – Coding – Software Documentation – Testing – Unit Testing – Black Box testing – White Box testing – Debugging – Program Analysis tools – Integration testing – Testing Object Oriented programs – System Testing – Issues</p> <p style="text-align: right;">TOTAL PERIODS : 60</p>				
Text Books:				
1. Rajib Mall, “Fundamentals of Software Engineering”, PHI Learning, fifth Edition, 2018.				

2. Ali Brahmi “Object Oriented Systems Development “ (unit-IV) –Tata McGraw Hill edition.

Reference Books:

1. Roger S. Pressman, “Software Engineering: A Practitioner's Approach”, McGraw-Hill International Edition, Eighth edition, 2009.
2. S. L. Pfleeger and J.M. Atlee, “Software Engineering Theory and Practice”, Pearson Education, Third edition, 2008.
3. Ian Sommerville, “Software Engineering”, Pearson Education, Eighth edition, 2008.

Content Beyond Syllabus:

Agile and RAD SDLC Models

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P31	DIGITAL CIRCUIT AND MICROPROCESSORLAB	-	-	3

LIST OF EXPERIMENTS

DIGITAL CIRCUITS

1. Study of logic gates.
2. Design and implementation of adders and subtractors using logic gates.
3. Design and implementation of multiplexer and demultiplexer using logic gates and study of IC 74150 and IC 74154.
4. Design and implementation of encoder and decoder using logic gates and study of IC 7445 and IC 74147.
5. Design and implementation of 3-bit synchronous and asynchronous up/down counter.
6. Implementation of SISO, SIPO, PISO and PIPO shift registers using flipflops.

8085 MICROPROCESSOR

7. Study of 8085 Microprocessor Trainer Kit and GNUSim for 8085
8. 8-bit Arithmetic Operations (Addition, Subtraction, Multiplication and Division)
9. Block Operations (Exchange, Fill, Reverse, Delete)
10. Finding the largest and smallest element in array
11. Sorting and Searching

8086 MICROPROCESSOR

12. Experiments Using 8086 Microprocessor with EMU
 - (a) Arithmetic Operations
 - (b) Sorting and Searching

TOTAL PERIODS : 45

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P32	DATA STRUCTURES LAB USING PYTHON	-	-	3

LIST OF EXPERIMENTS

1. Searching algorithms - sequential, binary and Fibonacci search algorithms on an ordered list. Compare the number of key comparisons made during these searches
2. Sorting algorithms :Insertion Sort, Selection Sort, BubbleSort,
3. Sorting algorithms: Shell Sort, Quick Sort, HeapSort.
4. Sorting algorithms: Merge Sort, and RadixSort
5. Sparse matrix representation and find its transpose.
6. Evaluation of arithmetic expression to postfix expression.
7. Queue, circular queue, priority queue, Dequeue.
8. Singly Linked List, Doubly Linked List, Circular LinkedList
9. Concatenation of linked lists.
10. Tree traversals
11. Graph traversals
12. Implementation of Dijkstra's algorithm
13. Implementation of Hashtables.

TOTAL PERIODS : 45

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P33	JAVA PROGRAMMING LAB	-	-	3

LIST OF EXPERIMENTS

Note: All these experiments to be done using JAVA.

1. Program to implement classes and objects.
2. Program to implement constructors and destructors with array of objects.
3. Program to demonstrate function over loading.
4. Program to implement different types of inheritances like multiple, Multilevel and hybrid.
5. I/O Program to demonstrate the use of abstract classes.
6. Program to demonstrate I/O streams and functions.
7. Program to perform all possible type conversions.
8. Program to demonstrate exception handling technique.
9. Program to implement networking concepts.
10. Program to implement RMI concepts.
11. Program to implement AWT concepts.
12. Program to implement swing concepts.
13. Program to design and implement applet.
14. Program to design and implement JDBC
15. Program to design an event handling event for simulating a simple calculator.

TOTAL PERIODS : 45

IV Semester

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T41	OPERATING SYSTEMS	3	1	-
Course Pre-requisite: <ul style="list-style-type: none"> • Computer Programming • Data Structures 				
Course Objectives: <ul style="list-style-type: none"> • Gives an idea about process synchronization, inter-process communication, scheduling, deadlock handling, and memory management. 				
Course Outcomes: <ul style="list-style-type: none"> • To understand the basic concepts and functions of Operating Systems • To know various threading models, process synchronization and deadlocks • Analyze the performance of various CPU scheduling algorithms (Analyze) • Discuss various memory management schemes • Knowledge about administrative tasks on Linux servers and distinguish iOS and Android OS 				
<p>UNIT I OPERATING SYSTEMS OVERVIEW: Introduction to operating systems – Computer system organization, architecture – Operating system structure, operations – Process, memory, storage management – Protection and security – Distributed systems – Computing Environments – Open- source operating systems – OS services – User operating-system interface – System calls – Types – System programs – OS structure – OS generation – System Boot – Process concept, scheduling – Operations on processes – Cooperating processes – Inter-process communication – Examples – Multithreading models – Thread Libraries – Threading issues – OS examples</p> <p>UNIT II PROCESS MANAGEMENT: Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple processor scheduling – Operating system examples – Algorithm Evaluation– The critical section problem – Peterson’s solution – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock detection – Recovery from deadlock</p> <p>UNIT III STORAGE MANAGEMENT: Memory Management – Swapping – Contiguous memory allocation – Paging – Segmentation – Example: The Intel Pentium - Virtual Memory: Background – Demand paging – Copy on write – Page replacement – Allocation of frames – Thrashing.</p> <p>UNIT IV I/O SYSTEMS: File concept – Access methods – Directory structure – File-system mounting – Protection – Directory implementation – Allocation methods – Free-space management – Disk scheduling– Disk management – Swap-space management – Protection</p> <p>UNIT V CASE STUDY: The Linux System – History – Design Principles – Kernel Modules – Process Management – Scheduling – Memory management – File systems – Input and Output – Inter-process Communication – Network Structure – Security – Windows 7 – History – Design Principles – System Components – Terminal Services and Fast User – File system – Networking.</p> <p style="text-align: right;">TOTAL PERIODS : 60</p>				
Text Books: <ol style="list-style-type: none"> 1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, “Operating System Concepts Essentials”, John Wiley & Sons Inc., Ninth edition, 2018. 				
Reference Books: <ol style="list-style-type: none"> 1. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Addison Wesley, 2001. 2. D M Dhamdhare, “Operating Systems: A Concept-based Approach”, Second Edition, Tata McGraw- Hill Education, 2007. 3. William Stallings, “Operating Systems: Internals and Design Principles”, 7th Edition, Prentice Hall, 2011. 				
Content Beyond Syllabus: <ul style="list-style-type: none"> • Real-time operating system scheduling • Memory Hierarchy 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T42	COMPUTER NETWORKS	3	1	-
Course Pre-requisite: <ul style="list-style-type: none"> • Computer Programming • Basics of Computers 				
Course Objectives: <ul style="list-style-type: none"> • Given an environment, after analyzing the channel characteristics, appropriate channel access mechanism and data link protocols are chosen to design a network. • Given various load characteristics and network traffic conditions, decide the transport protocols and timers to be used. 				
Course Outcomes: <ul style="list-style-type: none"> • Understand and describe the layered protocol model. • Describe, analyse and evaluate a number of datalink, network, and transport layer protocols. • Program network communication services for client/server and other application layouts. 				
UNIT – I Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN:Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.				
UNIT – II Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA				
UNIT – III Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping –ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols				
UNIT – IV Transport Layer: Process to Process Communication, User Datagram Protocol(UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.				
UNIT – V Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography				
TOTAL PERIODS : 60				
Text Books: <ol style="list-style-type: none"> 1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill. 2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India. 				
Reference Books: <ol style="list-style-type: none"> 1. Tanenbaum, A.S. and David J. Wetherall “Computer Networks”, 5th ed., Prentice Hall, 2011 2. Larry L. Peterson and Bruce S. Davie, “Computer Networks- A system approach”, 5th edition, ELSEVIER, 2012 3. Stallings, W., 'Data and Computer Communications', 10th Ed., Prentice Hall Int. Ed., 2013 4. James F. Kurose and Keith W. Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, Pearson Education, Third edition, 2006. 				
Content Beyond Syllabus: <ul style="list-style-type: none"> • Wireless Sensor Networks • Case study for developing a website and hosting it on the web 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T43	DATABASE MANAGEMENT	3	1	-
Course Pre-requisite:				
<ul style="list-style-type: none"> • Computer Programming, Python 				
Course Objectives:				
<ul style="list-style-type: none"> • To design databases for an application domain • To solve queries using Query languages • To understand normalization , transactions and concurrency control 				
Course Outcomes:				
<ul style="list-style-type: none"> • Classify modern and futuristic database applications based on size and complexity • Design a database from an Universe of Discourse, using ER diagrams • Map ER model into Relations and to normalize the relations • Analyze different ways of writing a query and justify which is the effective and efficient way 				
<p>UNIT – I Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.</p> <p>UNIT – II Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.</p> <p>UNIT – III Storage strategies: Indices, B-trees, hashing. Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.</p> <p>UNIT – IV Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.</p> <p>UNIT – V Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining. TOTAL PERIODS : 60</p>				
Text Books:				
1. Avi Silberschatz, Henry F. Korth and S.Sudarshan, “Database System Concepts”,McGraw-Hill International Inc., Sixth edition,2011.				
Reference Books:				
1 “Principles of Database and Knowledge – Base Systems”, Vol 1 by J. D. Ullman, Computer Science Press.				
2 “Fundamentals of Database Systems”, 5th Edition by R. Elmasri and S. Navathe, Pearson Education				
3 “Foundations of Databases”, Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley				
Websites				
1. http://db-book.com/				
2. http://nptel.ac.in/video.php?subjectId=106106093				
Content Beyond Syllabus:				
Database used by google – Bigtable, NoSQL, NewSQL				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T44	DESIGN AND ANALYSIS OF ALGORITHMS	3	1	-
Course Pre-requisite: <ul style="list-style-type: none"> • Programming language (C,C++,python) • Data Structures 				
Course Objectives: <ul style="list-style-type: none"> • To analyze time and space complexities of algorithms. • To acquaint students with algorithm techniques when programming for the storage and manipulation of data. • The concept of data abstraction and the problem of building implementations of abstract data types are emphasized. 				
Course Outcomes: <ul style="list-style-type: none"> • Selection of relevant algorithm technique and combinations of relevant data structures for the given problems in terms of memory and run time efficiency. • Apply data abstraction in solving programming problems. • Capable of categorizing the given problem into NP-Hard or NP-Complete. 				
<p>UNIT – I Algorithms: Definitions and notations: standard notations - asymptotic notations – worst case, best case and average case analysis; big oh, small oh, omega and theta notations; Analysis of Sorting and Searching: Heap, shell, radix, insertion, selection and bubble sort; sequential, binary and Fibonacci search. Recursive algorithms, analysis of nonrecursive and recursive algorithms, solving recurrence equations, analyzing control structures.</p> <p>UNIT – II Divide and Conquer Method: General Method – binary search –maximum and minimum– merge sort - quick sort – Strassen’s Matrix multiplication. Greedy Method: General method – knapsack problem – minimum spanning tree algorithms – single source shortest path algorithm – scheduling, optimal storage on tapes, optimal merge patterns.</p> <p>UNIT – III Dynamic Programming: General method – multi-stage graphs – all pair shortest path algorithm – 0/1 Knapsack and Traveling salesman problem – chained matrix multiplication. Basic Search and Traversal technique: Techniques for binary trees and graphs – AND/OR graphs – biconnected components – topological sorting.</p> <p>UNIT – IV Backtracking: The general method – 8-queens problem – sum of subsets – graph coloring – Hamiltonian cycle – Knapsack problem.</p> <p>UNIT – V Branch and Bound Method: Least Cost (LC) search – the 15-puzzle problem – control abstractions for LC-Search – Bounding – FIFO Branch-and-Bound - 0/1 Knapsack problem – Traveling Salesman Problem. Introduction to NP-Hard and NPCompleteness</p> <p style="text-align: right;">TOTAL PERIODS : 60</p>				
TEXT BOOKS: <ol style="list-style-type: none"> 1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, Galgotia Publications Pvt. Ltd., 2008. 				
REFERENCE BOOKS: <ol style="list-style-type: none"> 1. Gilles Brassard and Paul Bratley, “Fundamentals of Algorithms”, PHI, 1997. 2. Anany Levitin, “Introduction to Design and Analysis of Algorithms”, Pearson Education, 2005. 3. Thomas H. Corman, Charles E. Leiserson, Ronald and L. Rivest, “Introduction to Algorithms”, Prentice-Hall of India, Second edition, 2003. 4. Richard Johnsonbaugh and Marcus Schaefer, “Algorithms”, Pearson Education, 2004 				
Content Beyond Syllabus: <ul style="list-style-type: none"> • Introduction to Genetic algorithm, Tabu search, • Heuristic algorithms: A*, D*, Real-Time A* 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T45	DISTRIBUTED COMPUTING SYSTEMS	3	1	-
Course Pre-requisite: <ul style="list-style-type: none"> Operating Systems Computer Networks 				
Course Objectives: <ul style="list-style-type: none"> Understand foundations of Distributed Systems. Introduce the idea of communication between distributed objects and file system. Understand in detail the system level and support required for distributed system. 				
Course Outcomes: <ul style="list-style-type: none"> TO learn the characteristics of a distributed system along with its and design challenges Illustrate the mechanism of communication between distributed objects Describe the distributed file service architecture and the important characteristics of file systems. Discuss concurrency control algorithms applied in distributed transactions 				
<p>UNIT I Introduction: Goals – Types of Distributed systems – Architecture styles – System Architecture. Architectures Versus Middleware – Self Management in distributed systems - Processes – Threads– Virtualization – Clients – Servers – Code Migration.</p> <p>UNIT II Communication: Fundamentals - Remote Procedure Call – Stream oriented communication – Message oriented communication – Multicast communication. Naming – Names, Identifiers, and addresses – Flat Naming - Structured Naming – Attribute based Naming.</p> <p>UNIT III Synchronization: Clock Synchronization – Logical clocks - Mutual Exclusion – Global positioning of nodes - Election Algorithms. Consistency and Replication: Introduction – Data centric consistency models – Client centric consistency models – Replica management – Consistency protocols.</p> <p>UNIT IV Fault Tolerance: Introduction – Process resilience – Reliable client server communication –Reliable group communication – Distributed commit - Recovery Security – Introduction – Secure channels – Access control – Security management.</p> <p>UNIT V Distributed File Systems – Distributed web based systems – Distributed object based systems. File Models, File Accessing Models, File Sharing Semantics, File Caching Schemes, File Replication, Atomic Transaction</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
TEXT BOOKS: <ol style="list-style-type: none"> Andrew S. Tanenbaum and Maarten Van Steen, “Distributed Systems – Principles and Paradigms”, Prentice- Hall of India, Pvt. Ltd, Second edition, 2008. 				
REFERENCE BOOKS: <ol style="list-style-type: none"> Pradeep K Sinha, “Distributed Operating Systems, Prentice-Hall of India, NewDelhi, 2007. Jean Dollimore, Tim Kindberg, George Coulouris, “Distributed Systems -Concepts and Design”, Pearson Education, Fourth edition, 2005. George Coulour is, Jean Dollimore, Tim Kindberg: “ Distributed Systems” , Concept and Design, 3rd Edition, Pearson Education, 2005. M.L. Liu, “Distributed Computing Principles and Applications”, Pearson Education, 2004. 				
Content Beyond Syllabus: <ul style="list-style-type: none"> The Access Matrix Model, Advanced Models of protection , Data Security 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T46	CRYPTOGRAPHY	3	1	-
Course Pre-requisite: <ul style="list-style-type: none"> Discrete Mathematics Computer Networks 				
Course Objectives: <ul style="list-style-type: none"> Understand OSI security architecture and classic encryption techniques To Acquire fundamental knowledge on the concepts of finite fields and number theory To Understand various block cipher and stream cipher models Describe the Principles of public key cryptosystems, hash functions and digital signature To learn about various cryptographic techniques, which include private and public keys algorithms along with attacks types 				
Course Outcomes: <ul style="list-style-type: none"> The course shall be able to account for the cryptographic theories, principles and techniques that are used to establish security properties, analyze and use methods for cryptography, and reflect about limits and applicability of methods 				
<p>UNIT – I Basics Of Algebra And Number Theory: Integer Arithmetic, Modular Arithmetic, Algebraic structures, GF(2n) Fields, Matrices, Prime Numbers, Fermat’s and Euler’s Theorem, Primality Testing, Factorization, Chinese Remainder Theorem, Linear and Quadratic Congruence, Discrete Logarithms.</p> <p>UNIT – II Introduction to Security:-Security Goals – Security services (Confidentiality, Integrity, Authentication, Non-repudiation, Access control) – Security Mechanisms (Encipherment, Data Integrity, Digital Signature, Authentication Exchange, Traffic Padding, Routing Control, Notarization, Access control)-Security Principles. Introduction to Cryptography:-Kerckhoff’s Principle -Classification of Cryptosystems Cryptanalytic attacks- Cipher Properties (Confusion, Diffusion).</p> <p>UNIT – III Traditional Secret Key Ciphers:- Substitution Ciphers (mono alphabetic ciphers, poly alphabetic ciphers)-Transposition Ciphers-Stream and Block Ciphers. Modern Secret Key Ciphers:- Substitution Box-Permutation Box Product CiphersData Encryption Standard (DES) (Fiestel and Non-Fiestel Ciphers, Structure of DES, DES Attacks, 2-DES, 3-DES) - Advanced Encryption Standard (AES) (Structure, Analysis)-Cryptographic Hash Functions– Properties - Secure Hash Algorithm-Message Authentication Code (MAC).</p> <p>UNIT – IV Public Key Cryptosystems (PKC): - Types of PKC –Trapdoor - one way functions -RSA Cryptosystem (Integer Factorisation Trapdoor, Key Generation, Encryption, Decryption) - El Gamal Cryptosystem (Discrete Logarithm Trapdoor, Key Generation, Encryption, Decryption) - DiffieHellman Key Exchange Protocol, Man in the Middle attack on DiffieHellman Protocol.</p> <p>UNIT- V Digital Signature:-Signing – Verification - Digital signature forgery (Existential forgery, Selective forgery, Universal forgery) - RSA Digital Signature Scheme - ElGamal Signature Scheme - IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload- Intruders, Intrusion Detection, Distributed Denial of Service attacks</p> <p style="text-align: right;">TOTAL PERIODS : 60</p>				
TEXT BOOKS: <ol style="list-style-type: none"> Behrouz A. Forouzan, Dedeep Mukhopadhyay “Cryptography & Network Security”, Second Edition, Tata McGraw Hill, New Delhi, 2010 Douglas R. Stinson, “Cryptography: Theory and Practice”, Third Edition, CRC Press. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education, Fourth Edition, 2006. Atul Kahate, “Cryptography and Network Security”, 2nd Edition, Tata McGraw Hill, 2003 				

REFERENCE BOOKS:

1. Bernard Menezes, Network Security and Cryptography-Cengage Learning India, 2011
2. Bruce Schneier, “Applied Cryptography: Protocols, Algorithms, and Source Code in C”, Second Edition, John Wiley and Sons Inc, 2001.
3. Thomas Mowbray, “Cybersecurity : Managing Systems Conducting Testing, and Investigating Intrusions”, John Wiley, 2013
4. Wenbo Mao, “ Modern Cryptography- Theory & Practice”, Pearson Education, 2006.

Content Beyond Syllabus:

- To familiarize students on the topic called steganography which plays an important role in information security
- Familiarizing students on quantum cryptography

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P41	OPERATING SYSTEMS LAB	-	-	3
LIST OF EXPERIMENTS				
<ol style="list-style-type: none"> 1. Study of basic UNIX/Linux commands 2. Shell Programming. 3. Programs using the following system calls of UNIX/Linux operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir. 4. Programs using the I/O system calls of UNIX operating system: (open, read, write, etc). 5. Simulations of UNIX/Linux commands like ls, grep, etc. 6. Simulation of processes scheduling algorithms. 7. Simulation of synchronization problems using Semaphore. 8. Simulation of basic memory management schemes. 9. Simulation of virtual memory management schemes. 10. Simulation of disk scheduling algorithms 11. Simulation of file systems. 				
TOTAL PERIODS : 45				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P42	COMPUTER NETWORKS LAB	-	-	3

LIST OF EXPERIMENTS

1. Implementation of a socket program for Echo/Ping/Talk commands.
2. Creation of a socket between two computers and enable file transfer between them. Using (a.) TCP (b.) UDP
3. Implementation of a program for Remote Command Execution (Two M/Cs may be used).
4. Implementation of a program for CRC and Hamming code for error handling.
5. Writing a code for simulating Sliding Window Protocols.
6. Create a socket for HTTP for web page upload & Download.
7. Write a program for TCP module Implementation.(TCP services).
8. Write a program to implement RCP (Remote Capture Screen).
9. Implementation (using NS2/Glomosim) and Performance evaluation of the following routing protocols:
 - a. Shortest path routing
 - b. Flooding
 - c. Link State
 - d. Hierarchical
10. Broadcast /Multicast routing.
11. Implementation of ARP.
12. Throughput comparison between 802.3 and 802.11.
13. Study of Key distribution and Certification schemes.
14. Design of an E-Mail system
15. Implementation of Security Compromise on a Node using NS2 / Glomosim
16. Implementation of Various Traffic Sources using NS2 / Glomosim

TOTAL PERIODS: 45

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P43	DATABASE MANAGEMENT LAB	-	-	3
LIST OF EXPERIMENTS				
<ol style="list-style-type: none"> 1. Study of Database Concepts: Relational model – table – operations on tables – index – table space – clusters – synonym – view – schema – data dictionary – privilege – role – transactions. 2. Study of SQL: Primitive Data Types – User Defined data Types – Built-in Functions – Parts of Speech of create, alter, drop, select, insert, delete, update, commit, rollback, save point, grant, revoke. 3. Study of Query Types: Queries involving Union, Intersection, Difference, Cartesian product, Divide Operations – Sub Queries – Join Queries – Nested Queries – Correlated, Queries – Recursive Queries. 4. Study of Procedural Query Language: Blocks, Exception Handling, Functions, Procedures, Cursors, Triggers, Packages. 5. Application: Design and develop any two of the following: <ol style="list-style-type: none"> a. Library Information System b. Logistics Management System c. Students' Information System d. Ticket Reservation System e. Hotel Management System f. Hospital Management System g. Inventory Control h. Retail Shop Management i. Employee Information System j. Payroll System 				
				TOTAL PERIODS : 45

V Semester

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T51	IOT ARCHITECTURE AND PROTOCOLS	3	1	-
Course Pre-requisite: <ul style="list-style-type: none"> • Computer Networks 				
Course Objectives: <ul style="list-style-type: none"> • To Understand the Architectural Overview of IoT • To Understand the IoT Reference Architecture and Real World Design Constraints • To Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service) 				
Course Outcomes: <ul style="list-style-type: none"> • Ability to apply basic knowledge and understanding of Architecture and protocols. • Gain knowledge in network IEEE standards. 				
<p>UNIT I – OVERVIEW IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.</p> <p>UNIT II – REFERENCE ARCHITECTURE IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remotecontrol.</p> <p>UNIT III – IoT DATA LINK LAYER & NETWORK LAYER PROTOCOLS PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP</p> <p>UNIT IV – TRANSPORT & SESSION LAYER PROTOCOLS Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer HTTP, CoAP, XMPP, AMQP, MQTT</p> <p>UNIT V – SERVICE LAYER PROTOCOLS & SECURITY Service Layer -oneM2M, ETSI M2M,OMA, BBF – Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL, Application Layer.</p> <p>TOTAL PERIODS: 60</p>				
Text Books: <ol style="list-style-type: none"> 1. Internet Of Things (IoT) Technologies Applications Challenges And Solutions by BK Tripathy and J Anuradha, Taylor & Francis first Edition, 2017. 2. Internet of Things: Architectures, Protocols and Standards,by Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri, First edition 2018. 				
Reference Books: <ol style="list-style-type: none"> 1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press,2014. 2. Peter Waher, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM –MUMBAI, First Edition – 2015. 3. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer first edition – 2011. 				
Content Beyond Syllabus: <ul style="list-style-type: none"> • Edge Computing for architects - Implementing edge and IoT System from Sensors to clouds with communication systems, analytics and security 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T52	WEB TECHNOLOGIES	3	1	-
Course Pre-requisite: <ul style="list-style-type: none"> • Computer Programming • JAVA programming 				
Course Objectives: <ul style="list-style-type: none"> • To learn and program features of web programming languages. • To understand the basics of Web Designing using HTML, DHTML, and CSS • To learn the basics about Client side scripts and Server side scripts 				
Course Outcomes: <ul style="list-style-type: none"> • Ability to design and develop client side scripting techniques • Ability to build real world applications using client side and server side scripting languages 				
<p>UNIT – I Internet Principles and Components: History of the Internet and World Wide Web- – HTML - protocols – HTTP, SMTP, POP3, MIME, and IMAP. Domain Name Server, Web Browsers and Web Servers. HTML-Style Sheets-CSS-Introduction to Cascading Style Sheets-Rule-Features- Selectors- Attributes. Client-Side Programming: The JavaScript Language- JavaScript in Perspective-Syntax-Variables and Data Types- Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers and Regular Expression.</p> <p>UNIT – II Server Side Programming: servlet- strengths-Architecture-Life cycle- Generic and HTTP servlet-Passing parameters- Server Side Include- Cookies- Filters. JSP- Engines-Syntax- Components- Scriplets- JSP Objects-Actions-Tag Extensions- Session Tracking- J2EE - Introduction - Beans- EJB.</p> <p>UNIT – III XML: Introduction- Revolutions of XML-XML Basics – Defining XML Documents: DTD-XML Schema-Namespaces – XFiles: XLink – XPointer - XPath - XML with XSL – XSL-FO-Parsing XML using DOM-SAX-Formatting XML on the web.</p> <p>UNIT – IVPHP: Basics, String Processing and Regular Expressions, Form Processing and Business Logic, Using Cookies, Dynamic Content, Operator Precedence Chart</p> <p>UNIT –V: Database Connectivity with MySQL - Servlets, JSP, PHP. Case Studies- Student information system, Health Management System</p> <p>TOTAL PERIODS: 60</p>				
Text Books: <ol style="list-style-type: none"> 1. Deitel and Deitel, Goldberg, “Internet and World Wide Web – How to Program”, Pearson Education Asia, fifth editon - 2012. 2. Jeffery Jackson “Web Technologies – A computer science Perspective”, Pearson Education - second edition – 2008. 3. Uttam K.Roy, “Web Technologies”, Oxford University Press, first edition -2012. 				
Reference Books: <ol style="list-style-type: none"> 1. Rajkamal, “Web Technology”, Tata McGraw-Hill, first edition - 2001. 				
Content Beyond Syllabus: <ol style="list-style-type: none"> 1. HTML5 and Hybrid App Development 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T53	BIG DATA ANALYTICS	3	1	-
Course Pre-requisite: <ul style="list-style-type: none"> DataBase Management System Computer Networks 				
Course Objectives: <ul style="list-style-type: none"> To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce. To enable students to have skills that will help them to solve complex real-world problems in for decision support. 				
Course Outcomes: <ul style="list-style-type: none"> Understand the key issues in big data management and its associated applications in intelligent business and scientific computing. Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc. 				
<p>UNIT I : INTRODUCTION TO BIG DATA AND HADOOP Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.</p> <p>UNIT II : HDFS (Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.</p> <p>UNIT III: Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.</p> <p>UNIT IV: Hadoop Eco System Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.</p> <p>UNIT V : Data Analytics with R Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.</p>				
TOTAL PERIODS: 60				
Text Books: <ol style="list-style-type: none"> Tom White “ Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015. 				
Reference Books: <ol style="list-style-type: none"> Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press. Anand Rajaraman and Jef rey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012. 				
Content Beyond Syllabus: To optimize technology with enterprise solutions				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T54	BLOCKCHAIN TECHNOLOGIES	3	1	-
Course Pre-requisite: <ul style="list-style-type: none"> Data Structures and algorithm Cryptography 				
Course Objectives: <ul style="list-style-type: none"> To teach the concepts of blockchain technologies The primary objective of this course is to cover the technical aspects of crypto currencies, block chain technologies, and distributed consensus. To familiarize potential applications for Bit coin-like crypto currencies The course will enable an individual to learn, how these systems work and how to engineer secure software that interacts with the Bit coin network and other crypto currencies. 				
Course Outcomes: <ul style="list-style-type: none"> Understand emerging abstract models for Block chain Technology Analyse the concept of bit coin and mathematical background behind it Apply the tools for understanding the background of crypto currencies Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain Understanding of latest advances and its applications in Block Chain Technology. 				
UNIT I- INTRODUCTION Basic of Blockchain Architecture – Challenges – Applications – Block chain Design Principles -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).				
UNIT II- CRYPTOGRAPHIC FUNDAMENTALS Cryptographic basics for crypto currency - a short overview of Hashing, cryptographic algorithm – SHA 256, signature schemes, encryption schemes and elliptic curve cryptography- Introduction to Hyperledger- Hyperledger framework - Public and Private Ledgers.				
UNIT III-BIT COIN Bit coin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bit coin. Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their uses.				
UNIT IV-ETHEREUM Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges- comparing Bitcoin scripting vs. Ethereum Smart Contracts				
UNIT V- BLOCK CHAIN-RECENT TREND Blockchain Implementation Challenges- Zero Knowledge proofs and protocols in Block chain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash - attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms				
TOTAL PERIODS:60				
Text Books: <ol style="list-style-type: none"> Melanie Swan, “Block Chain: Blueprint for a New Economy”, O’Reilly, first edition – 2015. Daniel Drescher, “Block Chain Basics”, Apress; 1st edition, 2017 Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing, first edition – 2012. 				

Reference Books:

1. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing.

Websites:

1. <https://developer.ibm.com/patterns/create-and-deploy-block-chain-network-usingfabric-sdk-java/>
2. <https://docs.docker.com/get-started/https://console.ng.bluemix.net/docs/services/block%2520chain/index.html>

Content Beyond Syllabus:

1. Smart Contract Application Development
2. Apps will be built on blockchain technology

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T55	ETHICAL HACKING & INFORMATION SECURITY	3	1	-
Course Pre-requisite:				
<ul style="list-style-type: none"> • Computer Networks 				
Course Objectives:				
<ul style="list-style-type: none"> • To provide an understanding of principal concepts, major issues, technologies and basic approaches in information security. • Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications. Introduce Student to learn technical foundation of cracking and ethical hacking 				
Course Outcomes:				
<ul style="list-style-type: none"> • To master information security governance, and related legal and regulatory issues • Learn various hacking methods and perform system security vulnerability testing. • Perform system vulnerability exploit attacks. • Learn various issues related to hacking. 				
<p>UNIT I: Introduction Security mindset, Computer Security Concepts (CIA), Threats, Attacks, and Assets, Software Security: Vulnerabilities and protections, malware, program analysis.</p> <p>UNIT II: Network Security: Network security issues, Sniffing, IP spoofing, Common threats, E-Mail security, IPSec, SSL, PGP, Intruders, Virus, Worms, Firewalls-need and features of firewall, Types of firewall, Intruder Detection Systems.</p> <p>UNIT III: Hacking Windows BIOS Passwords, Windows Login Passwords, Changing Windows Visuals, Cleaning Your Tracks, Internet Explorer Users, Cookies, URL Address Bar, Netscape Communicator, Cookies, URL History, The Registry, Baby Sitter Programs</p> <p>UNIT IV: Advanced Windows Hacking Editing your Operating Systems by editing Explorer.exe, The Registry, The Registry Editor, Description of .reg file, Command Line Registry Arguments, Other System Files, Some Windows & DOS Tricks, Customize DOS, Clearing the CMOS without opening your PC, The Untold Windows Tips and Tricks Manual, Exiting Windows the Cool and Quick Way, Ban Shutdowns: A Trick to Play, Disabling Display of Drives in My Computer, Take Over the Screen Saver, Pop a Banner each time Windows Boots, Change the Default Locations, Secure your Desktop Icons and Settings.</p> <p>UNIT V Getting Past the Password Passwords: An Introduction, Password Cracking, Cracking the Windows Login Password, The Glide Code, Windows Screen Saver Password, XOR, Internet Connection Password, Sam Attacks, Cracking Unix Password Files, HTTP Basic Authentication, BIOS Passwords, Cracking Other Passwords.</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
Text Books:				
<ol style="list-style-type: none"> 1. William Stallings; Lawrie Brown “Computer Security: Principles and Practice”, 4TH Edition 2018 Pearson Education. 2. Patrick Engbreton: “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”, 1st Edition, Syngress publication, 2011. 3. Ankit Fadia : “Unofficial Guide to Ethical Hacking”, 3rd Edition , McMillan India Ltd, 2006. 				
Reference Books:				
<ol style="list-style-type: none"> 1. Buchmann J. A., Introduction to Cryptography, Springer Verlag (2001). 2. Stallings William, Cryptography and Network Security, Pearson Education (2006). 3. Simpson/backman/corley, “Hands On Ethical Hacking & Network Defense International”, 2nd Edition, Cengageint, 2011 				
Content Beyond Syllabus:				
<ul style="list-style-type: none"> • Boot Sector Viruses (MBR or Master Boot Record) • Recognizing Master Boot Record (MBR) Modifications 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P51	IoT LABORATORY	3	1	-
<p>LIST OF EXPERIMENTS</p> <ol style="list-style-type: none"> 1. Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi. 2. Raspberry Pi Based Oscilloscope 3. Controlling Raspberry Pi with WhatsApp. 4. Setting up Wireless Access Point using Raspberry Pi 5. Fingerprint Sensor interfacing with Raspberry Pi 6. Raspberry Pi GPS Module Interfacing. 7. IoT based Web Controlled Home Automation using Raspberry Pi 8. Visitor Monitoring with Raspberry Pi and Pi Camera. 9. Interfacing Raspberry Pi with RFID. 10. Building Google Assistant with Raspberry Pi. 11. Installing Windows 10 IoT Core on Raspberry Pi. <p style="text-align: right;">TOTAL PERIODS: 45</p>				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P52	WEB TECHNOLOGIES LABORATORY	3	1	-
LIST OF EXPERIMENTS				
<ol style="list-style-type: none"> 1. Creation of HTML Files 2. Working with Client Side Scripting <ol style="list-style-type: none"> 1.1 VBScript 1.2 JavaScript 2. Configuration of web servers <ol style="list-style-type: none"> 2.1 Apache Web Server 2.2 Internet Information Server (IIS) 3. Working with ActiveX Controls in web documents. 4. Experiments in Java Server Pages <ol style="list-style-type: none"> 4.1 Implementing MVC Architecture using Servlets 4.2 Data Access Programming (using ADO) 4.3 Session and Application objects 4.4 File System Management 5. Working with other Server Side Scripting <ol style="list-style-type: none"> 5.1 Active Server Pages 5.2 Java Servlets 5.3 PHP 6. Developing Web Applications using XML. 7. Experiments in Ajax Programming 8. Developing any E-commerce application using PHP (Mini Project) 				
TOTAL PERIODS: 45				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P53	BIG DATA ANALYTICS LABORATORY	3	1	-
<p>LIST OF EXPERIMENTS</p> <p>Hadoop</p> <ol style="list-style-type: none"> 1. Install, configure and run Hadoop and HDFS 2. Implement word count / frequency programs using MapReduce 3. Implement an MR program that processes a weather dataset <p>R</p> <ol style="list-style-type: none"> 1. Implement Linear and logistic Regression 2. Implement SVM / Decision tree classification techniques 3. Implement clustering techniques 4. Visualize data using any plotting framework 5. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop /R. <p style="text-align: right;">TOTAL PERIODS: 45</p>				

VI SEMESTER

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T61	SMART CONTRACTS AND APPLICATION DEVELOPMENT	3	1	-
<p>Course Pre-requisite:</p> <ol style="list-style-type: none"> 1. Block Chain Technology 2. Data Structures and Algorithm 3. Computer Programming 4. Network Security 				
<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. Understand Blockchain platform 2. Basics of smart contracts, decentralized apps, and decentralized anonymous organizations (DAOs) 3. To understand and Create new crypto-currency (token/coin) 				
<p>Course Outcomes:</p> <ol style="list-style-type: none"> 1. Basic concepts of Smart Contracts. 2. Recognize different Smart Contracts' programming languages and their execution environments. 3. Identify the key features of different Smart Contracts' programming languages. 4. Implement Smart Contracts in Ethereum using Solidity. 				
<p>UNIT I: Introduction to Ethereum, concepts of Smart Contracts, Dapps, And DAOs, What is Ethereum Virtual Machine (EVM), Ethereum Technology Overview, Architectural Overview, Ethereum Block chain Platform, Current and Potential Uses of Ethereum.</p> <p>UNIT II: Introduction to Programming Smart Contracts, A Simple Smart Contract, Account Types, Gas, and Transactions, Accessing Contracts and Transactions, Mix, Dapps, Developer Tools, Ethereum Tests, Web3 Base Layer Services, Installing, Building, Testing, & Deploying Ethereum nodes.</p> <p>UNIT III: Introduction to Solidity Programming, Layout of a Solidity Source File, Structure of a Contract, Types, Units and Globally Available Variables, Input Parameters and Output Parameters, Control Structures, Function Calls, Creating Contracts via new, Order of Evaluation of Expressions, Assignment, Scoping and Declarations, Error handling: Assert, Require, Revert and Exceptions.</p> <p>UNIT IV: Solidity Programming –Contracts, Creating Contracts, Visibility and Getters, Function Modifiers, Constant State Variables, Functions, Inheritance, Abstract Contracts, Interfaces, Libraries.</p> <p>UNIT V: Introduction to Decentralized Apps (Dapps), Decentralized Application Architecture, Connecting to the Block chain and Smart Contract, Decentralized Apps – Coding Details, Voting Contract and App, Blind Auction Contract and App, Coding Style Guide, Design Patterns, Coding Style Guide, Code Layout, Naming Conventions, Common Design Patterns, Withdrawal from Contracts, State Machine.</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Andreas M. Antonopoulos, Dr. Gavin wood “Mastering Ethereum” O’Reilly Media Inc, 2019. 				
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Draft version of “S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, ‘Blockchain Technology: Cryptocurrency and Applications’, Oxford University Press, first edition -2019. 2. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, First Edition - 2017. 				
<p>Content Beyond Syllabus:</p> <ol style="list-style-type: none"> 1. Cryptocurrency , 2. Blockchain with AI technology 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T62	CLOUD COMPUTING AND VIRTUALIZATION	3	1	-
Course Pre-requisite: <ul style="list-style-type: none"> • Database Management System • Data Structures • Operating Systems • Computer Networks 				
Course Objectives: <ul style="list-style-type: none"> • To understand the concepts of virtualization and virtual machines • To gain expertise in server, network and storage virtualization. • To understand and deploy practical virtualization solutions and enterprise solutions • To gain knowledge on the concept of virtualization that is fundamental to cloud computing • To understand the various issues in cloud computing • To be able to set up a private cloud 				
Course Outcomes: <ul style="list-style-type: none"> • Employ the concepts of storage virtualization, network virtualization and its management • Apply the concept of virtualization in the cloud computing • Identify the architecture, infrastructure and delivery models of cloud computing • Develop services using Cloud computing. • Apply the security models in the cloud environment 				
UNIT I INTRODUCTION TO CLOUD COMPUTING History, Roots of Cloud Computing, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Importance of Virtualization in Cloud, Anatomy of Cloud, Cloud deployment models, Cloud delivery models, Stepping stones for the development of cloud.				
UNIT II CLOUD IMPLEMENTATION Exploring the Cloud Computing Stack, Connecting to the Cloud - Decision Factors for Cloud Implementations, Public, Private and Hybrid Cloud, Overview, Infrastructure as a Service (IaaS) Cloud Delivery Model, Platform as a Service (PaaS) Cloud Delivery Model, Software as a Service (SaaS) Cloud Delivery Model				
UNIT III INTRODUCTION TO VIRTUALIZATION History of Virtualization. Benefits of Virtualization, Types of Virtualization, Virtualization and cloud computing -Types of hardware virtualization: Full virtualization - partial virtualization - para virtualization Desktop virtualization: Software virtualization – Memory virtualization - Storage virtualization – Data virtualization – Network virtualization				
UNIT IV VIRTUALIZED DATA CENTER ARCHITECTURE VDC environments: Concept, Planning and Design, Business continuity and Disaster recovery principles. Managing VDC and Cloud environments and infrastructures. Security Concepts : Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control and Cryptographic Systems				
UNIT V : CASE STUDY Secure Data Analysis in GIS Database - Distributed Database - Secure Multi-Party Computation -Association Rule Mining Problem - Distributed Association Ruling Data Analysis in GIS System- Emergence of Green Computing in Modern Computing Environment.				
TOTAL PERIODS: 60				
Text Books: <ol style="list-style-type: none"> 1. Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, First Edition, John Wiley & Sons,2011. 				

2. Sosinsky B., “Cloud Computing Bible”, First Edition, Wiley Edition, 2011
3. Introduction to Virtualization and Cloud Computing by IBM ICE Publications

Reference Books:

1. GautamShroff, “Enterprise Cloud Computing Technology Architecture Applications”, Cambridge University Press; 1 edition,[ISBN: 978-0521137355], 2010
2. Greg Schulz, “Cloud and Virtual Data Storage Networking”, Auerbach Publications [ISBN: 978-1439851739], 2011.
3. Dac-Nhuong Le, Raghvendra Kumar, Gia Nhu Nguyen, Jyotir Moy Chatterjee “Cloud Computing and Virtualization” First edition 2015 O Wiley.

Content Beyond Syllabus:

- Cloud Simulation Tools

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T63	CYBER AND DIGITAL FORENSICS	3	1	-
Course Pre-requisite: <ul style="list-style-type: none"> • Computer Networks • Ethical Hacking & Information Security • Network Security and cryptography 				
Course Objectives: <ul style="list-style-type: none"> • Learn the security issues network layer and transport layer • Be exposed to security issues of the application layer • Learn computer forensics, tools and to analyze and validate forensics data 				
Course Outcomes: <ul style="list-style-type: none"> • Will gain the knowledge to implement various security attacks. • Will get the ideas in various ways to trace an attacker. • Will get the practical exposure to forensic tools 				
UNIT-I: Introduction to IT laws & Cyber Crimes – Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property, Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits, and Cyber Security. <p>Legal and Ethical Principles : Introduction to Forensics – The Investigative Process – Code of Ethics, Ethics of Investigations, Evidence Management – Collection, Transport, Storage, access control, disposition</p>				
UNIT-II: Forensic Science: Principles and Methods – Scientific approach to Forensics, Identification and Classification of Evidence, Location of Evidence, Recovering Data, Media File Forensic Steps, Forensic Analysis – Planning, Case Notes and Reports, Quality Control				
UNIT-III: Digital Forensics: Hardware Forensics – Hidden File and Anti- forensics - Network Forensics – Virtual Systems - Mobile Forensics Digital Watermarking Protocols: A Buyer-Seller Watermarking Protocol, an Efficient and Anonymous Buyer-Seller Watermarking Protocol, Extensions of Watermarking Protocols, Protocols for Secure Computation				
UNIT-IV: Application Forensics, Tools and Report Writing – Application Forensics, Email and Social Media Investigations, Cloud Forensics, Current Digital Forensic Tools, Report Writing for Investigations				
UNIT-V: Counter Measures: Defensive Strategies for Governments and Industry Groups, Tactics of the Military, Tactics of Private Companies, Information Warfare Arsenal of the future, and Surveillance Tools for Information Warfare of the Future. <p style="text-align: right;">TOTAL PERIODS: 60</p>				
Text Books: <ol style="list-style-type: none"> 1. Bill Nelson, Christopher Steuart, Amelia Philips, “Computer Forensics and Investigations”, Delmar Cengage Learning; 5th edition January 2015 2. Chuck Eastom, “Certified Cyber Forensics Professional Certification:”, McGraw Hill, July 2017 3. Nilakshi Jain, Dhananjay Kalbande, “Digital Forensic : The fascinating world of Digital Evidences” Wiley India Pvt Ltd 2017. 4. John R.Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Laxmi Publications, 2015. 				
Reference Books: <ol style="list-style-type: none"> 1. MarjieT.Britz, “Computer Forensics and Cyber Crime”: An Introduction”, 3rd Edition, Prentice Hall, 2013. 2. Clint P Garrison “Digital Forensics for Network, Internet, and Cloud Computing A forensic evidence guide for moving targets and data , Syngress Publishing, Inc. 2010 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T64	FOG AND EDGE COMPUTING	3	1	-
Course Pre-requisite:				
<ul style="list-style-type: none"> Knowledge in any programming language with problems solving skills with good understanding of Networking and IoT 				
Course Objectives:				
<ul style="list-style-type: none"> To become familiar with the concepts of Fog and Edge computing To understand the architecture and its components and working of components and its performance To explore Fog and Edge computing on security, multimedia and smart data To create a model in fog and edge computing scenario 				
Course Outcomes:				
<ul style="list-style-type: none"> Understand the use of IoT architecture with its entities and protocols via edge and fog, up to the cloud. Get familiar on security & privacy issues related to area of fog & edge computing, IoT, and big data. Exploit fog and edge computing in implementing real time applications 				
UNIT I - INTRODUCTION TO FOG AND EDGE COMPUTING Fog and Edge Computing(FEC)-Definition-FEC Completing the Cloud - Advantages of FEC-Hierarchy of FEC-Business Models-Opportunities and Challenges- Addressing the Challenges in Federating Edge Resources – Introduction – The networking challenge- The management challenge				
UNIT II – MIDDLEWARE Introduction-Need for Fog and Edge Computing Middleware- Design Goals-State-of-the-Art Middleware Infrastructures-System Model-Proposed Architecture-Case Study Example-Future Research Directions. Lightweight Container Middleware for Edge Cloud Architectures-Introduction-Clusters for Lightweight Edge Clouds-Architecture Management – Storage and Orchestration- IoT Integration- Security Management for Edge Cloud Architectures -Future Research Directions				
UNIT III – DATA MANAGEMENT AND PREDICTIVE ANALYSIS IN FOGCOMPUTING Introduction to data management- Fog Data Management-Future Research Directions- Predictive Analysis to Support Fog Application Deployment-Introduction-Motivating Example: Smart Building- Predictive Analysis with FogTorch- Motivating Example (continued)-Future Research Directions - Survey of ML Techniques for Defending IoT Devices - Machine Learning in Fog Computing - Future Research Directions				
UNIT IV – OPTIMIZATION PROBLEMS IN FOG AND EDGE COMPUTING The Case for Optimization in Fog Computing- Formal Modeling- Framework for Fog Computing Metrics -Optimization Opportunities along the Fog Architecture - Optimization Opportunities along the Service Life Cycle - Toward a Taxonomy of Optimization Problems in Fog Computing -optimization Techniques				
UNIT V – CASE STUDIES Smart Surveillance Video Stream Processing at the Edge for Real-Time -Smart Transportation Applications-Intelligent Traffic Lights Management (ITLM) System -Fog Orchestration Challenges and Future Directions.				
TOTAL PERIODS: 60				
Text Books:				
1. Rajkumar Buyya, Satish Narayana Srirama, “Fog and Edge Computing: Principles and Paradigms”, Wiley series on Parallel and Distributed Computing.				
Reference Books:				
1. Fog Computing: A Platform for Internet of Things and Analytics, Flavio Bonomi, Rodolfo Milito, Preethi Natarajan and Jiang Zhu, Springer International.				
2. Fog Computing and Its Role in the Internet of Things, FlavioBonomi, Rodolfo Milito, Jiang Zhu, Sateesh Addepalli, MCC’12, August 17, 2012, Helsinki, Finland				
3. A Survey of Fog Computing: Concepts, Applications and Issues , Shanhe Yi, Cheng Li, Qun				
4. Li, Mobidata’15, June 21, 2015, Hangzhou, China.				
Content Beyond Syllabus:				
<ul style="list-style-type: none"> Modeling and Simulation of Fog and Edge Computing Environments Using CloudSim, OPNET, OMNet++, iFogSim Toolkit 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P61	SMART CONTRACTS APPLICATION DEVELOPMENT LAB	3	1	-

LIST OF EXPERIMENTS

1. Study of bitcoin and P2P Payment gateway.
2. Study of Hyperledger Architecture and its features.
3. Create a simple Ethereum network model.
4. Write a simple chaincode API model.
5. Generate the crypto material for the various participants in the bootstrapping network.
6. Generate the genesis block for the Orderer node and start ordering service (solo node) in the bootstrapping network.
7. Generated the configuration transaction block to create a new channel in the bootstrapping network.
8. Sign the configuration block and create the new channel.
9. Make peers of all the organizations join the channel that we created in the bootstrapping network.
10. Study of Hyperledger Explorer and Hyperledger Composer Solution.

TOTAL PERIODS: 45

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P62	CLOUD COMPUTING LAB	3	1	-
<p style="text-align: center;">LIST OF EXPERIMENTS:</p> <ol style="list-style-type: none"> 1. Study of NIST model of cloud computing. 2. Create Virtualization environment and install various operating system. 3. Implement IaaS using your resources. 4. Simulate identity management in your private cloud using open stack 5. Explore Storage as a Service for remote file access using web interface. 6. Deploy web applications on commercial cloud. 7. To create and access VM instances and demonstrate various components such as EC2, S3, Simple DB, DynamoDB using AWS. 8. Case Study on Fog Computing Objective : To have a basic understanding of implementation/applications of fog computing. 9. Title: Mini Project Objective: Using the concepts studied throughout the semester students shall be able to <ol style="list-style-type: none"> 1. Create their private cloud for the institute using the available resources. 2. Apply security concepts to secure a private cloud. 3. Implement efficient load balancing. 4. Compare various virtualization technologies with given resource. 5. Create cloud applications such as messenger, photo editing website, your own social media etc. <p style="text-align: right;">TOTAL PERIODS: 45</p>				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P63	CYBER SECURITY LAB	3	1	-
LIST OF EXPERIMENTS				
Part A: Ethical hacking				
1. Working with Trojans, Backdoors and sniffer for monitoring network communication				
2. Denial of Service and Session Hijacking using Tear Drop, DDOS attack.				
3. Penetration Testing and justification of penetration testing through risk analysis				
4. Password guessing and Password Cracking.				
5. Malware – Keylogger, Trojans, Keylogger countermeasures				
6. Understanding Data Packet Sniffers				
7. Windows Hacking – NT LAN Manager, Secure 1 password recovery				
8. Implementing Web Data Extractor and Web site watcher.				
9. Email Tracking.				
10. Configuring Software and Hardware firewall.				
11. Firewalls, Packet Analyzers, Filtering methods.				
Part B: Cyber Forensic				
1. Study of different wireless network components and features of any one of the Mobile Security Apps.				
2. Study of the features of firewall in providing network security and to set Firewall Security in windows.				
3. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)				
4. Study of different types of vulnerabilities for hacking a websites / Web Applications.				
5. Analysis the Security Vulnerabilities of E-commerce services.				
6. Analysis the security vulnerabilities of E-Mail Application.				
TOTAL PERIODS: 45				

VII Semester

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T71	PROFESSIONAL ETHICS & HUMAN VALUES	3	1	-
Course Pre-requisite: NIL				
Course Objectives: <ul style="list-style-type: none"> • To emphasize into awareness on Engineering Ethics and Human Values. • To understand social responsibility of an engineer. • To appreciate ethical dilemma while discharging duties in professional life. 				
Course Outcomes: <ul style="list-style-type: none"> • The student should be able to apply ethics in society, • Students discuss the ethical issues related to engineering • Students able to realize the responsibilities and rights in the society. 				
<p>UNIT I: HUMAN VALUES Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage – Empathy – self confidence – Discrimination- Character.</p> <p>UNIT II: ENGINEERING ETHICS Senses of Engineering Ethics - Variety of Moral Issued - Types of Inquiry - Moral Dilemmas - Moral Autonomy - Kohlberg's Theory - Gilligan's Theory - Consensus And Controversy – Models of Professional Roles - Theories about Right Action - Self-Interest –Professional Ideals and Virtues - Uses of Ethical Theories. Valuing Time – Co-Operation – Commitment</p> <p>UNIT III: ENGINEERING AS SOCIAL EXPERIMENTATION Engineering as Experimentation - Engineers as Responsible Experimenters - Codes of Ethics – Importance of Industrial Standards - A Balanced Outlook on Law – Anticorruption- Occupational Crime -The Challenger Case Study.</p> <p>UNIT IV: ENGINEER’S RIGHTS AND RESPONSIBILITIES ON SAFETY Collegiality and Loyalty- Respect for Authority – Collective Bargaining – Confidentiality- Conflict of Interest – Occupational Crime – Professional Rights – IPR- Safety and Risk - Assessment of Safety and Risk - Risk Benefit Analysis and Reducing Risk - The Three Mile Island, Bhopal Gas Plant and Chernobyl as Case Studies.</p> <p>UNIT V: GLOBAL ISSUES Multinational Corporations - Environmental Ethics - Computer Ethics - Weapons Development - Engineers as Managers - Consulting Engineers - Engineers as Expert Witnesses and Advisors - Moral Leadership - Sample Code of Conduct.</p> <p style="text-align: right;">TOTAL PERIODS : 60</p>				
TEXT BOOKS: <ol style="list-style-type: none"> 1. Mike Martin and Roland Schinzinger,—Ethics in Engineeringl, McGraw-Hill, 2005 Charles E Harris, Michael S. Protchard and Michael J Rabins, —Engineering Ethics – Concepts and Casesl, Wadsworth Thompson Learning, 2000. 2. Govindarajan M, Natarajan S, Senthil Kumar V. S, —Engineering Ethicsl, Prentice Hall of India,2004. 				
REFERENCE BOOKS: <ol style="list-style-type: none"> 1. Charles D. Fleddermann —Engineering Ethicsl, Pearson Education / Prentice Hall, New Jersey,2004 2. Charles E Harris, Michael S. Protchard and Michael J Rabins —Engineering Ethics – Concepts and Casesl, Wadsworth Thompson Learning,2000 3. John R Boatright —Ethics and the Conduct of Businessl, Pearson Education,2003. 4. Edmund G Seebauer and Robert L Barry, —Fundamentals of Ethics for Scientists and Engineersl, Oxford Press ,2000 5. R. Subramanian —Professional Ethics — Oxford University Press, Reprint,2015. 				
Content Beyond Syllabus: <ul style="list-style-type: none"> • Corporate Social responsibility 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T72	WIRELESS COMMUNICATION NETWORKS	3	1	-
Course Pre-requisite:				
<ul style="list-style-type: none"> • Computer Networks 				
Course Objectives:				
<ul style="list-style-type: none"> • Understand basic sensor network concepts • Knowledge about physical layer, network layer, and transport layer, their issues, and analyze Medium Access Control Protocols • Comprehend characteristics and protocols and implement conventional protocols • Understand the network management and Middleware services 				
Course Outcomes:				
<ul style="list-style-type: none"> • Recognize the technological trends of wireless sensor networks • Evaluate the challenges in building wireless sensor networks and solutions to those • Analyze and deploy application specific Wireless Sensor Network through available technologies 				
<p>UNIT I – FUNDAMENTALS OF SENSOR NETWORKS Introduction to computer and wireless sensor networks and Overview of the syllabus. Motivation for a network of Wireless Sensor nodes- Sensing and sensors-challenges and constraints - node architecture-sensing subsystem, processor subsystem communication interfaces- prototypes, Application of Wireless sensors- Introduction of Tiny OS Programming and TOSSIM Simulator.</p> <p>UNIT II- COMMUNICATION CHARACTERISTICS AND DEPLOYMENT MECHANISMS Wireless Transmission Technology and systems-Radio Technology Primer-Available Wireless Technologies - Hardware- Telosb, Micaz motes- Time Synchronization Clock and the Synchronization Problem - Basics of time synchronization-Time synchronization protocols - Localization- Ranging Techniques- Range based Localization-Range Free Localization- Event driven Localization</p> <p>UNIT III- MAC LAYER Overview-Wireless Mac Protocols-Characteristics of MAC protocols in Sensor networks – Contention free MAC Protocols- characteristics- Traffic Adaptive Medium Access-Y-MAC, Low energy Adaptive Clustering - Contention based MAC Protocols Power Aware Multi-Access with signaling, Sensor MAC-Timeout MAC-Data gathering MAC- Case study –Implementation and Analysis of MAC player protocol in TinyOS.</p> <p>UNIT IV- ROUTING IN WIRELESS SENSOR NETWORKS Design Issues in WSN routing- Data Dissemination and Gathering-Routing Challenges in WSN - Flooding-Flat Based Routing – SAR, Directed Diffusion, Hierarchical Routing- LEACH, PEGASIS - Query Based Routing- Negotiation Based Routing- Geographical Based Routing- Transport layer- Transport protocol Design issues Performance of Transport Control Protocols. Case study- Implementation and analysis of Routing protocol or transport layer protocol in Tiny OS</p> <p>UNIT V - MIDDLEWARE AND SECURITY ISSUES WSN middleware principles-Middleware architecture-Existing middleware - operating systems for wireless sensor networks-performance and traffic management - Fundamentals of network security-challenges and attacks - Protocols and mechanisms for security. Case study- Handling attacks in Tiny OS</p> <p style="text-align: right;">TOTAL PERIODS : 60</p>				
TEXT BOOKS:				
<ol style="list-style-type: none"> 1. William Stallings “Wireless Communications & Networks, 2/edition” pearson edition 2009. 2. Vijay K. Garg, “Wireless Communications and Networks”, Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian reprint). 				
REFERENCE BOOKS:				
<ol style="list-style-type: none"> 1. Walteneus Dargie, Christian Poellabauer , “Fundamentals of Wireless Sensor Networks, Theory and Practice”, Wiley Series on wireless Communication and Mobile Computing, 2011 				

2. Kazem Sohraby, Daniel manoli , “Wireless Sensor networks- Technology, Protocols and Applications”, Wiley InterScience Publications 2010.
3. Bhaskar Krishnamachari , “ Networking Wireless Sensors”, Cambridge University Press, 2005 4. C.S Raghavendra, Krishna M.Sivalingam, Taiebznati , “Wireless Sensor Networks”, Springer Science 2004.

Online Resource:

1. <https://link.springer.com/book/10.1007%2F978-3-030-40305-8>
2. <https://omnet-manual.com/omnet-tutorial-for-wireless-sensor-network/>
3. <http://wislab.cz/training-how-to-build-wireless-sensor-network>
4. <https://computers.tutsplus.com/tutorials/building-a-wireless-sensor-network-in-your-home--cms-19745>

Content Beyond Syllabus:

- Implementation of VANET ,Cognitive radio network

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T73	NETWORK SECURITY	3	1	-
Course Pre-requisite: Computer Networks				
Course Objectives: <ul style="list-style-type: none"> To introduce various encryption and authentication techniques for network security. To understand the number theory used for network security To develop experiments on algorithm used for security 				
Course Outcomes: <ul style="list-style-type: none"> To Analyze the number theory used for network security Analyze the design concept of internet security and authentication Can be able to develop experiments on algorithm used for security 				
<p>UNIT I – CONVENTIONAL AND MODERN ENCRYPTION Model of network security – Security attacks, services and attacks – OSI security architecture – Classical encryption techniques – SDES – Block cipher Principles DES – Strength of DES – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – RC4 - Differential and linear cryptanalysis – Placement of encryption function – traffic confidentiality.</p> <p>UNIT II – PUBLIC KEY ENCRYPTION Number Theory – Prime number – Modular arithmetic – Euclid’s algorithm - Fermet’s and Euler’s theorem – Primality – Chinese remainder theorem – Discrete logarithm – Public key cryptography and RSA – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve cryptography.</p> <p>UNIT III – AUTHENTICATION: Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS.</p> <p>UNIT IV – SECURITY PRACTICE Authentication applications – Kerberos – X.509 Authentication services - E-mail security – IP security - Web security 179 CS-Engg&Tech-SRM-2013</p> <p>UNIT V – SYSTEM SECURITY Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security</p> <p style="text-align: right;">TOTAL PERIODS : 60</p>				
TEXT BOOKS: 1. William Stallings, “Cryptography & Network Security”, Pearson Education, Fourth Edition 2010.				
REFERENCE BOOKS: <ol style="list-style-type: none"> Charlie Kaufman, Radia Perlman, Mike Speciner, “Network Security, Private communication in public world”, PHI Second Edition, 2002. Bruce Schneier, Neils Ferguson, “Practical Cryptography”, Wiley Dreamtech India Pvt Ltd, First Edition, 2003. Douglas R Simson “Cryptography – Theory and practice”, CRC Press, First Edition, 1995. 				
Online Resource : <ol style="list-style-type: none"> www.williamstallings.com/Security2e.html www.ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6857Fall2003/Course Home/index.html 				
Content Beyond Syllabus: Creating a Security Policy				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P71	WIRELESS COMMUNICATION LAB	-	-	3

LIST OF EXPERIMENTS

1. Evaluate the impact of path loss and shadowing in estimation of received signal power in mobile cellular communication using fading channel mobile communication virtual lab.
2. Calculate the boundary coverage probability in a cellular system using fading channel mobile communication virtual lab.
3. Demonstrate the impact the received power levels for hand-off in case of mobile cellular communication using fading channel mobile communication virtual lab.
4. Estimate the impact of sectoring in increasing cellular system capacity using fading channel mobile communication virtual lab.
5. Examine the impact of co-channel interference on the value of SIR in mobile cellular communication using fading channel mobile communication virtual lab.
6. Setting up of LTE 2x2 MIMO system for establishing two way communication.
7. Study of pure ALOHA and slotted ALOHA protocols for WLAN System.
8. Configure ZigBee module as an end device and, set up a communication link with two ZigBee modules.
9. Study of RFID system and its applications.
10. Using IE3D, design a rectangular micro strip patch antenna for inset feed for operating frequency of 1.88 GHz, relative permittivity of 4.4 and length of 31 mils.
11. Using GPS system, study the graphical representation of geographical position using Survey plotting.
12. Study the PN sequence and examine Gold code with variable sequence length and analyze its correlation. Also set up voice communication using DSSS scheme using CDMA trainer kit (ST2131-A).

TOTAL PERIODS : 45

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS P72	NETWORK SECURITY LAB	-	-	3

LIST OF EXPERIMENTS

1. Study of different wireless network components and features of any one of the Mobile Security Apps.
2. Study of the features of firewall in providing network security and to set Firewall Security in windows.
3. Study of different types of vulnerabilities for hacking a websites / Web Applications.
4. Analysis the Security Vulnerabilities of E-commerce services.
5. Analysis the security vulnerabilities of E-Mail Application
6. Eavesdropping Attacks and its prevention using SSH
7. Isolating WLAN Traffic using Separate Firewall for VPN Connection
8. Virtual Private Network Over WAN
9. ICMP Ping
10. Subnetting and OSI Model
11. RIP
12. OSPF
13. **VPNTOTAL PERIODS : 45**

VIII Semester

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T81	CYBER LAWS AND SECURITY POLICIES	3	1	-
Course Pre-requisite: Ethical Hacking & Information Security, Network Security, Professional Ethics & Human Values				
Course Objectives:				
<ul style="list-style-type: none"> • To understand the computer security issues • To make secure system planning, policies • Exhibit knowledge to Information security policies and procedures • To understand Organizational and Human Security 				
Course Outcomes:				
<ul style="list-style-type: none"> • The students will understand the importance of professional practice, Law and Ethics in their personal lives and professional careers. • The students will learn the rights and responsibilities as an employee, team member and a global citizen 				
UNIT- I : Introduction to Computer Security: Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates and legislation, Privacy considerations, International security activity.				
UNIT-II: Secure System Planning and administration, Introduction to the orange book, Security policy requirements, accountability, assurance and documentation requirements, Network Security, The Red book and Government network evaluations.				
UNIT-III : Information security policies and procedures: Corporate policies- Tier 1, Tier 2 and Tier3 policies – process management-planning and preparation-developing policies-asset classification policy developing standards.				
UNIT- IV: Information security: fundamentals-Employee responsibilities- information classification Information handling- Tools of information security- Information processing-secure program administration.				
UNIT-V : Organizational and Human Security: Adoption of Information Security Management Standards, Human Factors in Security- Role of information security professionals.				
TOTAL PERIODS : 60				
TEXT BOOKS:				
<ol style="list-style-type: none"> 1. Debby Russell and Sr. G. T Gangemi, “Computer Security Basics (Paperback)”, 2nd Edition, O’Reilly Media, 2006 2. Thomas R. Peltier, “Information Security policies and procedures: A Practitioner’s Reference”, 2nd Edition Prentice Hall, 2004. 				
REFERENCE BOOKS:				
<ol style="list-style-type: none"> 1. Kenneth J. Knapp, “Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions”, IGI Global, 2009. 2. Thomas R Peltier, Justin Peltier and John blackley, ”Information Security Fundamentals”, 2nd Edition, Prentice Hall, 1996 3. Jonathan Rosenoer, “Cyber law: the Law of the Internet”, Springer-verlag, 1997 4. James Graham, “Cyber Security Essentials” Averbach Publication T & F Group 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS T82	ENERGY HARVESTING AND POWER MANAGEMENT FOR IOT	3	1	-
Course Pre-requisite:				
<ul style="list-style-type: none"> IoT Architecture and Protocols 				
Course Objectives:				
<ul style="list-style-type: none"> Understand the various energy sources and energy harvesting based sensor networks Learn about the various Piezoelectric materials and Non-linear techniques Understand the various Power sources for WSN Learn about the applications of Energy harvesting systems. 				
Course Outcomes:				
<ul style="list-style-type: none"> The students able to design IoT-based systems for real-world problems. The Students understands the role of power management in a successful IoT deployment. To manage power efficiently for remote devices and long-lived devices. 				
UNIT I – ENERGY HARVESTING SYSTEMS Introduction – Energy sources – energy harvesting based sensor networks – photovoltaic cell technologies – generation of electric power in semiconductor PV cells – types				
UNIT II - PIEZO-ELECTRIC ENERGY HARVESTING ANDELECTROMECHANICAL MODELING Piezoelectric materials – transducers – harvesters – microgenerators – strategies for enhancing the performance of energy harvesters. Electromechanical modeling of Lumped parameter model and coupled distributed parameter models and closed-form solutions				
UNIT III- ELECTROMAGNETIC ENERGY HARVESTING AND NON-LINEAR TECHNIQUES Basic principles – micro fabricated coils and magnetic materials – scaling – power maximations – micro and macro scale implementations. Non-linear techniques – vibration control & steady state cases				
UNIT IV- ENERGY HARVESTING WIRELESS SENSORS Power sources for WSN – Power generation – conversion – examples – case studies. Harvesting microelectronic circuits – power conditioning and losses				
UNIT V - SELECTED APPLICATIONS OF ENERGY HARVESTING SYSTEMS Case studies for implanted medical devices – Bio-MEMS based applications – harvesting for RF sensors and ID tags – powering wireless SHM sensor nodes				
TOTAL PERIODS : 60				
TEXT BOOK:				
1. Energy Harvesting Systems for IoT Applications: Generation, Storage, and Power Management Hardcover –by Yen Kheng Tan (Author), Mark Wong (Author), first edition 2019.				
REFERENCE BOOKS:				
1. Danick Briand, Eric Yeatman, Shad Roundy ,“Micro Energy Harvesting”Danick Briand, Eric Yeatman, Shad RoundyJohn Wiley & Sons, 21-Apr-2015				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 01	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE	4	-	-
<p>Course Objectives:</p> <ul style="list-style-type: none"> To introduce the concepts of mathematical logic, sets, relations, and functions. To perform the operations associated with sets, functions, and relations. To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context. To use Graph Theory for solving problems 				
<p>Course Outcomes:</p> <ul style="list-style-type: none"> Apply the graphs and trees concepts to different applications. Apply the Number Theory to different applications using theorem. Knowledge of networking for various fields and applications. 				
<p>UNIT I MATRIX ALGEBRA Matrices - Rank of a matrix - Solving system of equations – Eigen values and Eigenvectors - Cayley - Hamilton theorem - Inverse of a matrix.</p>				
<p>UNIT II BASIC SET THEORY Basic definitions - Venn diagrams and set operations - Laws of set theory - Principle of inclusion and exclusion – Partitions - Permutation and combination – Relations - Properties of relations - Matrices of relations - Closure operations on relations - Functions - Injective, subjective and objective functions.</p>				
<p>UNIT III MATHEMATICAL LOGIC Propositions and logical operators - Truth table - Propositions generated by a set - Equivalence and implication - Basic laws - Some more connectives - Functionally complete set of connectives - Normal forms - Proofs in propositional calculus - Predicate calculus.</p>				
<p>UNIT IV FORMAL LANGUAGES Languages and grammars - Phrase structure grammar - Classification of grammars -Pumping lemma for regular languages - Context free languages.</p>				
<p>UNIT V FINITE STATE AUTOMATA Finite state automata - Deterministic finite state automata (DFA) - Non deterministic finite state automata (NFA) - Equivalence of DFA and NFA - Equivalence of NFA and Regular Language.</p>				
TOTAL PERIODS: 60				
<p>Text Books:</p> <ol style="list-style-type: none"> Lidl and pitz., Applied Abstract Algebra, Springer - Verlag, New York, 1984. 				
<p>Reference Books:</p> <ol style="list-style-type: none"> K.H. Rosen, Discrete Mathematics and its Applications, Mc-Graw Hill Book Company, 1999. http://www.mhhe.com/rosen. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 02	MATHEMATICS FOR NETWORK ENGINEERING	4	-	-
Course Objectives: <ul style="list-style-type: none"> To learn the theoretical foundations in computer net working To understand the fundamental concepts in networking, graph theory and coding theory 				
Course Outcomes: <ul style="list-style-type: none"> Apply the graphs and trees concepts to different applications. Apply the Number Theory to different applications using theorem. Be aware of networking for various fields and applications. 				
<p>UNIT-I: Graph, First theorem of Graph Theory, regular graph, subgraph, Paths, Cycles, Matrix representation, Trees, Bridges, Theorems, spanning trees, Directed graphs, Indegree and Outdegree</p> <p>UNIT-II:Euclidean Algorithm, Fundamental Theorem of Arithmetic and Applications, Dirichlet Progressions, Irrational Numbers, Fermat Factorization, Linear. Diophantine Equations, Congruence, Linear Congruence</p> <p>UNIT-III: Chinese Remainder Theorem, Wilson's and Fermat's Little Theorem, Euler's Theorem, Properties of the Euler Phi Function. The Binary Symmetric Channel, Error Correction, Error Detection, Linear Codes, Representation Through Generator and Parity-Check Matrices, Syndrome Decoding 10 15</p> <p>UNIT-IV: Hamming Codes, Introduction to Finite Fields and Double-Error Correcting Codes, Irreducible Polynomials, Primitivity, Singleton Bound, MDS Codes, Hamming Sphere, Packing Bound, PerfectCodes</p> <p>UNIT-V:Shortest Path Model, Systematic Method, Dijkstra's Algorithm, Floyd's Algorithm, Minimum Spanning Tree Problem, Prim Algorithm, Kruskal's Algorithm, Maximal Flow Problem</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
Text Books: <ol style="list-style-type: none"> John Clark and Derek Allan Holton, "A first look at Graph Theory", World Scientific,1991. Balakrishnan R. and Ranganathan K, "A text book of Graph Theory" Spring Verlag,2000. 				
Reference Books: <ol style="list-style-type: none"> Harary F., "Graph Theory" Perseus Books,1994 Rosen K.H, "Elementary Number Theory", 6th Ed, Addison-Wesley,2010 Dudley U., "A guide to elementary number theory", The mathematical association of America, 2004. Andrews G. E. "Number Theory", Dover Publications,1971. Bose R., "Information Theory Coding and Cryptography" , Tata Mc Graw Hill,2007 Roth R.M, "Introduction to Coding Theory", CUP,2006. MacWilliams F.J, Sloane N.J.A., "The Theory of Error Correcting Codes", North Holland,1977. Paneerselvam R., Operations Research, Prentice Hall of India Private Limited, New Delhi2004. Ravindra K. Ahuja, Thomas L. Magnanti, James B.Orlin, "Network Flows –Theory, Algorithms and Applications", 1st Edition, Prentice Hall,1993 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 03	INFORMATION CODING TECHNIQUES	4	-	-
Course Perquisite: <ul style="list-style-type: none"> Digital System and Design Graphics and Multimedia 				
Course Objectives: <ul style="list-style-type: none"> To have a complete understanding of error–control coding. To understand encoding and decoding of digital data streams. To introduce methods for the generation of these codes and their decoding techniques. To have a detailed knowledge of compression and decompression techniques. To introduce the concepts of multimedia communication. 				
Course Outcomes: <ul style="list-style-type: none"> Learn the coding techniques. Learn the cryptographic algorithms. Study the code generation process. 				
<p>UNIT I INFORMATION ENTROPY FUNDAMENTALS Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.</p> <p>UNIT II DATA AND VOICE CODING Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).</p> <p>UNIT III ERROR CONTROL CODING Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.</p> <p>UNIT IV COMPRESSION TECHNIQUES Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.</p> <p>UNIT V AUDIO AND VIDEO CODING Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
Text Books: <ol style="list-style-type: none"> Simon Haykin, “Communication Systems”, John Wiley and Sons, 4th Edition, 2001. Fred Halsall, “Multimedia Communications, Applications Networks Protocols and Standards”, Pearson Education, Asia 2002; Chapters: 3,4,5. 				
Reference Books: <ol style="list-style-type: none"> Mark Nelson, “Data Compression Book”, BPB Publication 1992. Watkinson J, “Compression in Video and Audio”, Focal Press, London, 1995. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 04	GRAPH THEORY AND OPTIMIZATION TECHNIQUES	4	-	-
Course Objectives: <ul style="list-style-type: none"> • Student should be able to understand graphs ,linear programming problems and statistical concepts. • Students should be able to apply the concepts in solving the Engineering problems 				
Course Outcomes: <ul style="list-style-type: none"> • Understand the various types of graph Algorithms and graph theory properties. • Analyze the NP – complete problems. • Distinguish the features of the various tree and matching algorithms • Appreciate the applications of digraphs and graph flow. 				
UNIT I - BASICS OF GRAPH THEORY Graphs - Data structures for graphs - Subgraphs - Operations on Graphs Connectivity – Networks and the maximum flow - Minimum cut theorem - Trees - Spanning trees - Rooted trees – Matrix representation of graphs.				
UNIT II - CLASSES OF GRAPHS Eulerian graphs and Hamiltonian graphs - Standard theorems - Planar graphs - Euler's formula - Five colour theorem - Coloring of graphs - Chromatic number (vertex and edge) properties and examples - Directed graphs				
UNIT III- GRAPH ALGORITHM Computer Representation of graphs - Basic graph algorithms - Minimal spanning tree algorithm - Kruskal and Prim's algorithm - Shortest path algorithms - Dijkstra's algorithm - DFS and BFS algorithms.				
UNIT IV - OPTIMIZATION TECHNIQUES Linear programming – Graphical methods – Simplex method (Artificial variables not included) – Transportation and assignment problems.				
UNIT V – STATISTICS Tchebyshev’s inequality – Maximum likelihood estimation – Correlation – Partial correlation – Multiple correlations.				
TOTAL PERIODS: 60				
Text Books: <ol style="list-style-type: none"> 1. Narsingh Deo, “Graph Theory with Applications to Engineering and Computer Science”, PHI1974. 				
Reference Books: <ol style="list-style-type: none"> 2. Rao S.S., “Engineering Optimization: Theory and Practice”, New Age International Pvt. Ltd.,3rd Edition1998. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 05	OPERATING SYSTEMS: ADMINISTRATION AND SECURITY	4	-	-
Course Perquisite: <ul style="list-style-type: none"> Data Structures Operating System 				
Course Objectives: <ul style="list-style-type: none"> Gives an idea about process synchronization, inter-process communication, scheduling, deadlock handling, and memory management. 				
Course Outcomes: <ul style="list-style-type: none"> Explain various threading models, process synchronization and deadlocks Analyze the performance of various CPU scheduling algorithms (Analyze) Discuss various memory management schemes Explain I/O management and file systems Explain administrative tasks on Linux servers and distinguish iOS and Android OS 				
<p>UNIT I OPERATING SYSTEMS OVERVIEW Introduction to operating systems – Computer system organization, architecture – Operating system structure, operations – Process, memory, storage management – Protection and security – Distributed systems – Computing Environments – Open- source operating systems – OS services – User operating-system interface – System calls – Types – System programs – OS structure – OS generation – System Boot – Process concept, scheduling – Operations on processes – Cooperating processes – Inter-process communication – Examples – Multithreading models – Thread Libraries –Threading issues – OS examples</p> <p>UNIT II PROCESS MANAGEMENT Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiprocessor scheduling – Operating system examples – Algorithm Evaluation – The critical section problem – Peterson’s solution – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock detection – Recovery from deadlock</p> <p>UNIT III STORAGE MANAGEMENT Memory Management – Swapping – Contiguous memory allocation – Paging – Segmentation –Example: The Intel Pentium - Virtual Memory: Background – Demand paging – Copy on write – Page replacement – Allocation of frames – Thrashing.</p> <p>UNIT IV I/O SYSTEMS File concept – Access methods – Directory structure – File-system mounting – Protection – Directory implementation – Allocation methods – Free-space management – Disk scheduling – Disk management – Swap-space management – Protection</p> <p>UNIT V CASE STUDY The Linux System – History – Design Principles – Kernel Modules – Process Management – Scheduling – Memory management – File systems – Input and Output – Inter-process Communication– Network Structure – Security – Windows 7 – History – Design Principles – System Components –Terminal Services and Fast User – File system – Networking.</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				

Text Books:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, “Operating System Concepts Essentials”, John Wiley & Sons Inc., 2010.

Reference Books:

1. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Addison Wesley, 2001.
2. Charles Crowley, “Operating Systems: A Design-Oriented Approach”, Tata McGraw Hill Education”, 1996.
3. D M Dhamdhere, “Operating Systems: A Concept-based Approach”, Second Edition, Tata McGraw- Hill Education, 2007.
4. William Stallings, “Operating Systems: Internals and Design Principles”, Seventh Edition, Prentice Hall, 2011.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 06	EMBEDDED SYSTEMS	4	-	-
Course Prerequisite:				
<ul style="list-style-type: none"> Digital Circuit and Microprocessor 				
Course Objectives:				
<ul style="list-style-type: none"> To understand the Embedded concepts and Embedded system Architecture To learn the architecture and programming of ARM Cortex Microcontroller To select a proper Microcontroller for an application To understand the usage of the development and debugging tools To learn and apply the knowledge of Memory systems and Peripherals 				
Course Outcomes:				
<ul style="list-style-type: none"> Describe the architecture and programming of ARM processor. Outline the concepts of embedded systems Explain the basic concepts of CORTEX design. Use the system design techniques to develop CORTEX programming and Debugging 				
<p>UNIT I – INTRODUCTION TO EMBEDDED CONCEPTS Introduction to embedded systems, Application Areas, Categories of embedded systems, Overview of embedded system architecture, Specialties of embedded systems, recent trends in embedded systems, Architecture of embedded systems, Hardware architecture, Software architecture, Application Software, Communication Software.</p>				
<p>UNIT II – OVERVIEW OF ARM AND CORTEX-M3 Background of ARM Architecture, Architecture Versions, Processor Naming, Instruction Set Development, Thumb-2 and Instruction Set Architecture. Cortex-M3 Basics: Registers, General Purpose Registers, StackPointer, Link Register, Program Counter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Reset Sequence. Cortex-M3 Instruction Sets: Assembly Basics, Instruction List, Instruction Descriptions. Cortex-M3 Implementation Overview: Pipeline, Block Diagram, Bus. Interfaces on Cortex-M3, I-Code Bus, DCode Bus, System Bus, External PPB and DAP Bus</p>				
<p>UNIT III – CORTEX EXCEPTION HANDLING AND INTERRUPT EXCEPTIONS: Exception Types, Priority, Vector Tables, Interrupt Inputs and Pending Behavior, Fault Exceptions, Supervisor Call and Pendable Service Call. NVIC: Nested Vectored Interrupt Controller Overview, Basic Interrupt Configuration, Software Interrupts and SYSTICK Timer. Interrupt Behavior: Interrupt/Exception Sequences, Exception Exits, Nested Interrupts, Tail-Chaining Interrupts, Late Arrivals and Interrupt Latency.</p>				
<p>UNIT IV – CORTEX-M3/M4 PROGRAMMING: Cortex-M3/M4 Programming: Overview, Typical Development Flow, Using C, CMSIS (Cortex Microcontroller Software Interface Standard), Using Assembly. Exception Programming: Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation. Memory Protection Unit and other Cortex-M3 features: MPU Registers, Setting Up the MPU, Power Management, Multiprocessor Communication.</p>				
<p>UNIT V – CORTEX-M3/M4 DEVELOPMENT AND DEBUGGING TOOLS TM32L15xxx ARM Cortex M3/M4 Microcontroller: Memory and Bus Architecture, Power Control, Reset and Clock Control. STM32L15xxx Peripherals: GPIOs, System Configuration Controller, NVIC, ADC, Comparators, GP Timers, USART. Development and Debugging Tools: Software and Hardware tools like Cross Assembler, Compiler, Debugger, Simulator, In-Circuit Emulator (ICE), Logic Analyzer etc.</p>				

Text Books:

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Second Edition, Elsevier Inc. 2010.
2. Andrew N Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide Designing and Optimizing System Software", Elsevier Publications, 2006

Reference Books:

1. Steve Furber, "ARM System-on-Chip Architecture", 2nd Edition, Pearson Education, India ISBN: 9788131708408, 8131708403, 2015
2. Dr. K.V.K. Prasad, "Embedded / Real-Time Systems: Concepts, Design and Programming Black Book", New ed (MISL-DT) Paperback – 12 Nov 2003 5.
3. David Seal "ARM Architecture Reference Manual", Addison Wesley, England; Morgan Kaufmann Publishers, 2001

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 07	GRAPHICS AND MULTIMEDIA SYSTEMS	4	-	-
Course Perquisite:				
<ul style="list-style-type: none"> • Computer Programming 				
Course Objectives:				
<ul style="list-style-type: none"> • To develop, design and implement two and three dimensional graphical structures • To enable students to acquire knowledge Multimedia compression and animations • To learn Creation, Management and Transmission of Multimedia objects. 				
Course Outcomes:				
<ul style="list-style-type: none"> • Get acquainted Graphics and Multimedia domains. • To explore the fundamentals and underlying theories of Multimedia and animation to design and develop 2D/3D animations. • Understands the visual effects for the creative media. 				
<p>UNIT I Illumination and Color Models: Light sources – basic illumination models – halftone patterns and dithering techniques; Properties of light – Standard primaries and chromaticity diagram; Intuitive colour concepts – RGB colour model – YIQ colour model – CMY colour model – HSV colour model – HLS colour model; Colour selection. Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.</p> <p>UNIT II Two-Dimensional Graphics: Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.</p> <p>UNIT III Three-Dimensional Graphics: Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations – Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces</p> <p>TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.</p> <p>UNIT IV- Multimedia System Design & Multimedia File Handling: Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases. Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio– Video image and animation – Full motion video – Storage and retrieval technologies.</p> <p>UNIT V: Hypermedia Multimedia authoring and user interface – Hypermedia messaging -Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards – Integrated document management – Distributed multimedia systems.</p> <p>CASE STUDY: BLENDER GRAPHICS Blender Fundamentals – Drawing Basic Shapes – Modelling– Shading & Textures</p>				
				TOTAL PERIODS: 60
Text Books:				
1. Donald D. Hearn, M. Pauline Baker and Warren Carithers, “Computer Graphics with OpenGL”, Fourth Edition, Pearson Education, 2010.				

2. Ze-Nian Li and Mark S.Drew, “Fundamentals of Multimedia”, First Edition, Pearson Education, 2007.

Reference Books:

1. F.S.Hill, “Computer Graphics using OpenGL”, Second edition, Pearson Education, 2003.
2. Prabhat K Andleigh, Kiran Thakrar, “Multimedia systems design”, First Edition, PHI, 2007

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 08	SOFTWARE TESTING	4	-	-
Course Perquisite: <ul style="list-style-type: none"> Software Engineering, Object Oriented analysis and Design 				
Course Objectives: <ul style="list-style-type: none"> To learn the introduction of Software Testing. To study the Test Cases, Design and level of testing. To learn how to manage Test Cases and Test Automation 				
Course Outcomes: <ul style="list-style-type: none"> Design test cases suitable for a software development for different domains. Identify suitable tests to be carried out. Prepare test planning based on the document and test cases designs Use automatic testing tools and to Develop and validate a test plan. 				
<p>UNIT I – INTRODUCTION Testing as an Engineering Activity – Testing as a Process – Testing axioms – Basic definitions – Software Testing Principles – The Tester’s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention strategies</p> <p>UNIT II – TEST CASE DESIGN Test case Design Strategies – Using Black Bod Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – Statebased testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Evaluating Test Adequacy Criteria.</p> <p>UNIT III – LEVELS OF TESTING The need for Levers of Testing – Unit Test – Unit Test Planning –Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing –Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.</p> <p>UNIT IV – TEST MANAGEMENT People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.</p> <p>UNIT V – TEST AUTOMATION Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
Text Books: <ol style="list-style-type: none"> Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, 				

Pearson Education, 2006.

2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007.

Reference Books:

1. Ilene Burnstein, Practical Software Testing, Springer International Edition, 2003.
2. Aditya P. Mathur, Foundations of Software Testing _ Fundamental Algorithms and Techniques, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.
3. Roger S. Pressman, "Software Engineering. A Practitioners Approach", McGraw Hill International Edition, Seventh edition, 2009.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 09	OBJECT ORIENTED ANALYSIS AND DESIGN	4	-	-
Course Perquisite: <ul style="list-style-type: none"> Object Oriented Programming Software Engineering 				
Course Objectives: <ul style="list-style-type: none"> To understand the fundamentals of object modeling To understand and differentiate Unified Process from other approaches. To design with static UML diagrams and implementation diagrams. To improve the software design with design patterns. 				
Course Outcomes: <ul style="list-style-type: none"> Express software design with UML diagrams and Design software using OO concepts. Identify various scenarios based on software requirements Transform UML based software design into pattern based design using design patterns Understand the various testing methodologies for OO software 				
UNIT I UNIFIED PROCESS AND USE CASE DIAGRAMS Introduction to OOAD with OO Basics – Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases				
UNIT II STATIC UML DIAGRAMS Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes –Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition – Relationship between sequence diagrams and use cases – When to use Class Diagrams				
UNIT III DYNAMIC AND IMPLEMENTATION UML DIAGRAMS Dynamic Diagrams – UML interaction diagrams – System sequence diagram – Collaboration diagram – When to use Communication Diagrams – State machine diagram and Modelling –When to use State Diagrams – Activity diagram – When to use activity diagrams Implementation Diagrams – UML package diagram – When to use package diagrams – Component and Deployment Diagrams – When to use Component and Deployment diagrams.				
UNIT IV APPLYING DESIGN PATTERNS System sequence diagrams – Relationship between sequence diagrams and use cases Logical architecture and UML package diagram – Logical architecture refinement – UML class diagrams – UML interaction diagrams – Applying GoF design patterns.				
UNIT V CODING AND TESTING Mapping design to code – Testing: Issues in OO Testing – Class Testing – OO Integration Testing – GUI Testing – OO System Testing.				
TOTAL PERIODS: 60				
Text Books: <ol style="list-style-type: none"> Craig Larman, —Applying UML and Patterns: An Introduction to Object-Oriented Analysis an Design and Iterative Development, Third Edition, Pearson Education, 2005. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999 				
Reference Books: <ol style="list-style-type: none"> Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, —Design patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995. Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Language, Third edition, Addison Wesley, 2003. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 10	FREE AND OPEN SOURCE SOFTWARE	4	-	-
<p>Course Objectives:</p> <ul style="list-style-type: none"> • Be exposed to the context and operation of free and open source software (FOSS) communities and associated software projects. • Be familiar with participating in a FOSS project • Learn scripting language (Python or Perl) and programming language (Ruby) 				
<p>Course Outcomes:</p> <ul style="list-style-type: none"> • Install and run open-source operating systems. • Gather information about Free and Open Source Software projects from software releases and from sites on the internet. • Build and modify one or more Free and Open Source Software packages. 				
<p>UNIT I : PHILOSOPHY Notion of Community–Guidelines for effectively working with FOSS community–, Benefits of Community based Software Development –Requirements for being open, free software, open source software –Four degrees of freedom – FOSS Licensing Models – FOSS Licenses – GPL- AGPL- LGPL – FDL – Implications – FOSS examples.</p> <p>UNIT II: LINUX : Linux Installation and Hardware Configuration – Boot Process-The Linux Loader (LILO) – The Grand Unified Bootloader (GRUB) – Dual-Booting Linux and other Operating System – Boot-Time Kernel Options- X Windows System Configuration-System Administration – Backup and Restore Procedures- Strategies for keeping a Secure Server.</p> <p>UNIT III: FOSS PROGRAMMING PRACTICES GNU debugging tools, Using source code versioning and managing tools, Review of common programming practices and guidelines f GNU/Linux and FOSS, Documentation.</p> <p>UNIT IV: PROGRAMMING TECHNIQUES: Application programming – Basics of X Windows server architecture – QT programming – GTK + Programming- Python programming – Open source equivalent of existing Commercial software</p> <p>UNIT V: PROJECTS AND CASE STUDIES Linux for portable Devices, Creation of Bootable CD and USB from command line, Case Studies – Samba, Libre office, Assistive technology.</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, Linux in a nutshell, Sixth edition, OReilly media, September 2009. 				
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Dennis Matotek, James Turnbull, Peter Livetdink Pro Linux System Administration: Learn to Build Systems for Your Business Using Free and Open Source Software, Apress ,Second edition 2017. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E11	SOFTWARE DEFINED NETWORKS	4	-	-
Course Perquisite:				
<ul style="list-style-type: none"> • Computer Networks 				
Course Objectives:				
<ul style="list-style-type: none"> • To learn the fundamentals of software defined networks. • To understand the separation of the data plane and the control plane. • To study about the SDN Programming and various applications of SDN 				
Course Outcomes:				
<ul style="list-style-type: none"> • Analyze the evolution of software defined networks • Learn the various components of SDN and their uses • Knowledge of SDN in the current networking scenario • Design and develop various applications of SDN 				
<p>UNIT I SDN BACKGROUND AND MOTIVATION Evolving network requirements-The SDN Approach: Requirements, SDN Architecture, Characteristics of Software-Defined Networking, SDN and NFV-Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives.</p> <p>UNIT II SDN DATA PLANE AND OPENFLOW SDN data plane: Data plane Functions, Data plane protocols, Openflow logical network Device: Flow table Structure, Flow Table Pipeline, The Use of Multiple Tables, Group Table- OpenFlow Protocol.</p> <p>UNIT III SDN CONTROL PLANE SDN Control Plane Architecture: Control Plane Functions, Southbound Interface, Northbound Interface, Routing, ITU-T Model- OpenDaylight-REST-Cooperation and Coordination Among Controllers.</p> <p>UNIT IV SDN APPLICATION PLANE SDN Application Plane Architecture: Northbound Interface, Network Applications, User Interface- Network Services Abstraction Layer: Abstractions in SDN, Frenetic- Traffic Engineering Measurement and Monitoring Security- Data Center Networking- Mobility and Wireless.</p> <p>UNIT V NETWORK FUNCTIONS VIRTUALIZATION Background and Motivation for NFV- Virtual Machines- NFV Concepts: Simple Example of the Use of NFV, NFV Principles, High-Level NFV Framework, NFV Benefits and Requirements- NFV Reference Architecture: NFV Management and Orchestration.</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
Text Books:				
<ol style="list-style-type: none"> 1. William Stallings, “Foundations of Modern Networking”, Pearson Ltd.,2016. 2. Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black,Morgan Kaufmann Publications, 2014 3. SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O’Reilly, 2013 4. Fei Hu, Editor, Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014. 5. Doug Marschke, Jeff Doyle, Pete Moyer, “Software Defined Networking (SDN): Anatomy of OpenFlow® Volume I”. Lulu Publishing Services, 2015 				
Reference Books:				

1. Feamster, Nick, Jennifer Rexford, and Ellen Zegura. "The road to SDN: an intellectual history of programmable networks." ACM SIGCOMM Computer Communication Review 44.2 (2014): 87-98.
2. Kreutz, Diego, et al. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 (2015): 14-76.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 12	DATA WAREHOUSE AND DATA MINING	4	-	-
Course Perquisite:				
<ul style="list-style-type: none"> Database Management System 				
Course Objectives:				
<ul style="list-style-type: none"> Concepts of data warehouse and data mining, Acquainted with the tools and techniques used for Knowledge Discover in Databases. 				
Course Outcomes:				
<ul style="list-style-type: none"> Apply data mining techniques and methods to large data sets. Use data mining tools in more precise way. Compare and contrast the various classifiers in efficient manner. 				
<p>UNIT I DATA WAREHOUSING Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.</p> <p>UNIT II BUSINESS ANALYSIS Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.</p> <p>UNIT III DATA MINING Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.</p> <p>UNIT IV ASSOCIATION RULE MINING AND CLASSIFICATION Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction – Basic Concepts – Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.</p> <p>UNIT V CLUSTERING AND TRENDS IN DATA MINING Cluster Analysis – Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods – Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data – Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
Text Books:				
<ol style="list-style-type: none"> Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Person Education, 2007. K.P. Soman, Shyam Diwakar and V. Aja, “Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006. 				
Reference Books: .				
<ol style="list-style-type: none"> G. K. Gupta, “Introduction to Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, 2006. Daniel T.Larose, “Data Mining Methods and Models”, Wiley-Interscience,2006 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 13	PATTERN RECOGNITION TECHNIQUES IN CYBER CRIME	4	-	-
Course Perquisite:				
<ul style="list-style-type: none"> Machine Learning 				
Course Objectives:				
<ul style="list-style-type: none"> Pattern classification algorithm for a pattern recognition problem and implementation using modern computing tools Cybercrime techniques and how to apply in pattern recognition. 				
Course Outcomes:				
<ul style="list-style-type: none"> Identify and describe existing pattern recognition and machine learning approaches in Cyber crime using different human interaction modalities (voice, gesture, etc.) To evaluate and select the best machine learning approach for the recognition of specific activity 				
UNIT-I: INTRODUCTION: Basics of pattern recognition - Design principles of pattern recognition system- Learning and adaptation- Pattern recognition approaches.				
UNIT-II:CLASSIFIERS BASED ON BAYESIAN DECISION THEORY: Introduction-Bayesian Decision Theory Continuous Features-Minimum error rate- classification- classifiers, discriminant functions, and decision surfaces; The normal density- Discriminant functions for the normal density Maximum likelihood estimation-Bayesian Estimation- Bayesian parameter estimation- Gaussian Case-general theory-Hidden Markov Models.				
UNIT-III: NONPARAMETRIC TECHNIQUE AND NON-METRIC METHODS: Density Estimation - Parzen Windows - K-Nearest Neighbor Estimation - Nearest Neighbor Rule- Fuzzy clustering. NonMetric Methods- Introduction-Decision Trees- CART- Other Tree Methods- Recognition with Strings-Grammatical Methods.				
UNIT-IV: MALWARE ANALYSIS AND NETWORK TRAFFIC ANALYSIS: Anomaly detection– data driven methods – feature engineering – detection with data and algorithms – challenges using ML- response and mitigation – Malware Analysis: defining – feature generation – classification - Network Traffic Analysis- Theory – ML and network security – building predictive model to classify network attack.				
PROTECTING CONSUMER WEB AND PRODUCTION SYSTEMS: Types of abuse and data that can stop them – learning for abuse problems- large attacks - production systems - ML for system maturity and scalability – data quality – model quality – performance – maintainability – monitoring and alerting – security and reliability – adversarial machine learning.				
UNIT-V:CYBER CRIME: Facing the Cybercrime Problem Head-on- Emerging Cybercrime Techniques- Understanding the People on the Scene- The Computer Investigation Process- Acquiring Data, Duplicating Data, and Recovering Deleted Files- Understanding Network Intrusions and Attacks- Understanding Cybercrime Prevention- Implementing Cybercrime Detection Techniques				
TOTAL PERIODS: 60				
Text Books:				
<ol style="list-style-type: none"> Abhijit S. Theodoridis and K. Koutroumbas, “Pattern Recognition”, 4th Ed, Academic Press, 2009. Clarence Chio David Freeman “Machine Learning and Security: Protecting Systems with Data and Algorithms”,& quot; Reilly Media, Inc.& quot;; 2018 				

3. "Scene of the Cybercrime" 2nd Edition by Debra Littlejohn Shinder, Michael Cross, 2002.
4. Earl Gose, Richard Johnsonbaugh, Steve Jost- "Pattern Recognition and Image Analysis" – Pearson Education, 2007.

Reference Books:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, John Wiley, 2006.
2. "A Brief History of Cyber Crime" written by: R. Elizabeth C. Kitchen edited by: M.S. Smith, 2010.
3. Homayoon Beigi ,Fundamentals of Speaker Recognition, Springer,2011

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 14	VISUAL PROGRAMMING	4	-	-
Course Perquisite: <ul style="list-style-type: none"> • C programming language with problems solving techniques with Basic knowledge of Visual programming. 				
Course Objectives: <ul style="list-style-type: none"> • To understand the various types of applications • To get expertise in visual programming • To understand the functionalities of middleware platform • To make the students to get familiar with the industry project platforms and to write codes. 				
Course Outcomes: <ul style="list-style-type: none"> • An ability to analyze and apply the programming skills in various application development • An ability to use the programming techniques, skills, and modern engineering tools necessary for engineering practice. • An ability to design and develop a Windows programming and Visual Programming 				
UNIT I Windows Programming Fundamentals – MFC – Windows – Graphics – Menus – Mouse and keyboard – Bitmaps – Palettes – Device-Independent Bitmaps UNIT II Controls – Modal and Modeless Dialog – Property – Data I/O – Sound – Timer UNIT III Memory management – SDI – MDI – MFC for Advanced windows user Interface – status bar and Toolbars – Tree view – List view – Threads UNIT IV ODBC – MFC Database classes – DAO - DLLs – Working with Images UNIT V COM Fundamentals – ActiveX control – ATL – Internet Programming. <p style="text-align: right;">TOTAL PERIODS: 60</p>				
Text Books: <ol style="list-style-type: none"> 1. Charles Petzold, “Windows Programming”, Microsoft press, 1996 2. Richard C.Leinecker and Tom Archer, “Visual C++ 6 Programming Bible”, Wiley DreamTech Press, 2006. 3. Harvey M. Deitel, Paul J. Deitel, Tem R. Nieto, Contributor Paul J. Deitel, and Tem R. Nieto, “Visual Basic .NET – How to Program”, Prentice Hall, Second edition, 2001. 				
Reference Books: <ol style="list-style-type: none"> 1. A Programmer’s Introduction to Visual Basic.Net by Craig Utley, SAMS Publications 2. Visual basic Shell Programming by Hamilton pub. O’ Reilly. 3. Visual basic Oracle 8 Programmer’s reference by Tretsch pub. O’ Reilly 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E15	XML WEB SERVICES	4	-	-
Course Perquisite:				
<ul style="list-style-type: none"> • Data Structures and Algorithm • Java Programming • Web Technologies Concepts and Networking Concepts 				
Course Objectives:				
<ul style="list-style-type: none"> • To understand the well formed Xml documents by using DOM, SAX, XSL, XFORMS, XSLT • To Learn the principles of interoperability with other platforms using major protocols, including SOAP, WSDL, and UDDI • To Understand the concepts of E-Commerce and E-Business Applications 				
Course Outcomes:				
<ul style="list-style-type: none"> • Understand Web Services and its Infrastructure • Building a Web Service • Deploying and Publishing Web Services 				
<p>UNIT I - XML TECHNOLOGY FAMILY XML – benefits – Advantages of XML over HTML – EDI – Databases – XML based standards – DTD –XML Schemas – X – Files – XML processing – DOM – SAX – presentation technologies – XSL –XFORMS – XHTML – voice XML – Transformation – XSLT – XLINK – XPATH – XQ.</p>				
<p>UNIT II - ARCHITECTING WEB SERVICES Business motivations for web services – B2B – B2C – Technical motivations – limitations of CORBA and DCOM – Service – oriented Architecture (SOA) –Architecting web services – Implementation view –web services technology stack – logical view – composition of web services – deployment view – from application server to peer to peer – process view – life in the runtime.</p>				
<p>UNIT III - WEB SERVICES BUILDING BLOCK Transport protocols for web services – messaging with web services – protocols – SOAP – describing web services – WSDL – Anatomy of WSDL – manipulating WSDL – web service policy – Discovering web services – UDDI – Anatomy of UDDI – Web service inspection – Ad – Hoc Discovery – Securing web services.</p>				
<p>UNIT IV - IMPLEMENTING XML IN E – BUSINESS B2B – B2C Applications – Different types of B2B interaction – Components of e – business XML systems – eb XML – Rosetta Net Applied XML in vertical industry – web services for mobile devices.</p>				
<p>UNIT V - XML AND CONTENT MANAGEMENT Semantic Web – Role of Meta data in web content – Resource Description Framework – RDF schema – Architecture of semantic web – content management workflow – XLANG – WSFL .</p>				
TOTAL PERIODS: 60				
Text Books:				
<ol style="list-style-type: none"> 1. Ron Schmelzer et al, “XML and Web Services Unleashed”, Pearson Education, 2011. 2. Frank P.Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002. 				
Reference Books:				
<ol style="list-style-type: none"> 1. Keith Ballinger, “.NET Web Services Architecture and Implementation”, Pearson Education, 2003. 2. Henry Bequet and Meeraj Kunnumpurath, “Beginning Java Web Services”, A press, 2004. 3. Russ Basiura and Mike Batongbacal, “Professional ASP .NET Web Services”, A press, 2009. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E16	SOFTWARE PROJECT MANAGEMENT	4	-	-
Course Perquisite:				
<ul style="list-style-type: none"> • Software Engineering 				
Course Objectives:				
<ul style="list-style-type: none"> • To understand the fundamental principles of Software Project Management and project automation • To understand about the failures of software projects and how failure probability can be reduced effectively. • To learn the project scheduling, tracking, risk analysis, Quality Management and project cost estimation using different techniques 				
Course Outcomes:				
<ul style="list-style-type: none"> • Identify the different project contexts and suggest an appropriate management strategy • Practice the role of professional ethics in successful software development • Identify and describe the key phases of project management • Determine appropriate project management approach through an evaluation of the business context and scope of the project. 				
<p>UNIT – I CONVENTIONAL SOFTWARE MANAGEMENT: The Waterfall Model, Conventional software Management Performance. Evolution of Software Economics: Software Economics, Pragmatic Software Cost Estimation. Improving Software Economics: Reducing Software Product Size, Improving software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality, Peer Inspections.</p> <p>UNIT – II CONVENTIONAL AND MODERN SOFTWARE MANAGEMENT: Principles of Conventional Software Engineering, Principles of Modern Software Management, Transitioning to an Iterative Process. Life Cycle Phases: Engineering and Production Stages, Inception. Elaboration, Construction, Transition Phases. Artifacts of The Process: The Artifact Sets. Management Artifacts, Engineering Artifacts, Programmatic Artifacts. Model Based Software Architectures: A Management Perspective and Technical Perspective.</p> <p>UNIT – III:SOFTWARE PROCESS WORKFLOWS: Inter Trans Workflows. Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic Status Assessments. Interactive Process Planning: Work Breakdown Structures, Planning Guidelines, Cost and Schedule Estimating. Interaction Planning Process. Pragmatic Planning.</p> <p>UNIT – IV PROJECT ORGANIZATIONS AND RESPONSIBILITIES: Line-of-Business Organizations, Project Organizations, and Evolution of Organizations. Process Automation: Automation Building Blocks, The Project Environment.</p> <p>UNIT – V PROJECT CONTROL AND PROCESS INSTRUMENTATION: Server Care Metrics, Management Indicators, Quality Indicators, Life Cycle Expectations Pragmatic Software Metrics, Metrics Automation. Tailoring the process: Process Discriminates, Example. Modern Project Profiles Next Generation Software economics, Modern Process Transitions. Case Study: The Command Center Processing and Display System –Replacement (CCPDS-R)</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
Text Books:				
1. Software Project Management, Walker Rayce, 2010,PEA.				

2. Bob Hughes and Mike Cotterell , “Software Project Management”, Tata McGraw Hill, Third Edition, 2004

Reference Books:

1. “A Guide to Distributed Development, Projects, and Outsourcing”, Christof EbertNovember 2011, Paperback.
2. Software Engineering and Management, Shere K. D, 1998,PHI.
3. Software Project Management: A Concise Study, S. A. Kelkar,PHI.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 17	ENTREPRENEURSHIP DEVELOPMENT	4	-	-

Course Perquisite:

- Professional Ethics & Human Values

Course Objectives:

- Study of this subject provides an understanding of the scope of an entrepreneur.
- To enable students to understand key areas of development, financial assistance by the institutions.
- To Learn methods of taxation and tax benefits,etc.

Course Outcomes:

- Have the ability to discern distinct entrepreneurial traits
- Know the parameters to assess opportunities and constraints for new business ideas
- Understand the systematic process to select and screen a business idea
- Design strategies for successful implementation of ideas

UNIT I ENTREPRENEURSHIP Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS Small Enterprises – Definition, Classification – Characteristics, Ownership Structures –Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL PERIODS: 60

Text Books:

1. S.S.Khanka “Entrepreneurial Development” S.Chand & Co. Ltd. Ram Nagar NewDelhi,1999.
2. Kuratko & Hodgetts, “Enterprenuership – Theory, process and practices”, Thomson learning 6th edition.

Reference Books:

1. Hisrich R D and Peters M P, “Entrepreneurship” 5th Edition Tata McGraw-Hill,2002.
2. Mathew J Manimala,” Enterprenuership theory at cross roads: paradigms and praxis”Dream tech 2nd edition2006.
3. Rabindra N. Kanungo “Entrepreneurship and innovation”, Sage Publications, NewDelhi,1998.
4. EDII “ Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development” Institute of India, Ahmadabad,1986.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 18	APPLIED CRYPTOGRAPHY	4	-	-
Course Perquisite: <ul style="list-style-type: none"> Discrete Mathematics Cryptography and Digital Forensics 				
Course Objectives: <ul style="list-style-type: none"> Understand OSI security architecture and classical encryption techniques. Acquire fundamental knowledge on the concepts of finite fields and number theory. Understand various block cipher, stream cipher models and applications of Digital Signature in payments etc., 				
Course Outcomes: <ul style="list-style-type: none"> Understand the OSI security architecture and classical encryption techniques. To know the principles of public key cryptosystems, hash functions and digital signature. To learn the applications of Digital Signature in payments etc., 				
UNIT I INTRODUCTION & MATHEMATICAL FOUNDATION Definitions – Cryptography, cryptanalysis, cryptology, classical cryptosystem- shift cipher, affine cipher, vigenere cipher, substitution, transposition techniques, Types of attacks in OSI security architecture-Number Theory concepts – Modular Arithmetic , Properties, Euclidean algorithm, Fermat’s and Euler’s theorem, Chinese Remainder Theorem, Primitive roots, Discrete Logarithms				
UNIT II BLOCK CIPHERS AND MODES OF OPERATION Simplified DES - Data Encryption Standard-Block cipher principles-block cipher modes of operationAES-TripleDES-Blowfish-RC5				
UNIT III PUBLIC KEY CRYPTOGRAPHY Principles and characteristics - Need for public key cryptography - Primality Testing - Miller Rabin Test - Diffie Hellman Key Exchange-MITM Attack - RSA, Fast Modular Exponentiation Algorithms, RandomNumberGeneration-FiniteFields–PolynomialArithmetic-ECC-KeyManagement				
UNIT IV HASH FUNCTIONS AND DIGITAL SIGNATURES Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – El Gamal – Schnorr - Blind Signatures for unreachable payments				
UNIT V APPLICATIONS Authentication – Kerberos , Zero Knowledge Proofs, System Security - Firewalls, Types, Design considerations, Intrusion Detection Systems, IP Security - IPSec (AH and ESP),Web Security - SSL, TLS, Secure Electronic Transaction, Bitcoin, Email Security - PGP, Tor (The Onion Router)				
TOTAL PERIODS: 60				
Text Books: <ol style="list-style-type: none"> William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013. (UNIT I,II,III,IV). Bruce Schneier and Neils Ferguson, —Practical Cryptography, First Edition, Wiley Dreamtech India Pvt Ltd, 2003. Charlie Kaufman, Radia Perlman and Mike Speciner, —Network Security, Prentice Hall of India, 2002. (UNIT V). 				
Reference Books: <ol style="list-style-type: none"> Douglas R Simson —Cryptography – Theory and practice, First Edition, CRC Press, 1995. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 19	INTRUSION DETECTION AND PREVENTION SYSTEM	4	-	-
Course Perquisite: <ul style="list-style-type: none"> • Operating Systems • Computer Networks 				
Course Objectives: <ul style="list-style-type: none"> • To apply Intrusion Detection tools and techniques to improve the security of an enterprise. • Apply knowledge in the creation and evaluation of new Intrusion Detection Systems • Analyze intrusion detection alerts and logs to distinguish attack types from false alarms. 				
Course Outcomes: <ul style="list-style-type: none"> • Fundamental concepts of Network Protocol Analysis and demonstrate the skill to capture and analyze network packets. • Use various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems. 				
<p>UNIT- I: INTRODUCTION: Understanding Intrusion Detection – Intrusion detection and prevention basics – IDS and IPS analysis schemes, Attacks, Detection approaches –Misuse detection – anomaly detection – specification based detection – hybrid detection THEORETICAL FOUNDATIONS OF DETECTION: Taxonomy of anomaly detection system – fuzzy logic – Bayes theory – Artificial Neural networks – Support vector machine – Evolutionary computation – Association rules – Clustering.</p> <p>UNIT- II: ARCHITECTURE AND IMPLEMENTATION: Centralized – Distributed – Cooperative Intrusion Detection – Tiered architecture.</p> <p>UNIT- III: JUSTIFYING INTRUSION DETECTION: Intrusion detection in security – Threat Briefing –Quantifying risk – Return on Investment (ROI) .</p> <p>UNIT- IV: APPLICATIONS AND TOOLS: Tool Selection and Acquisition Process – Bro Intrusion Detection – Prelude Intrusion Detection – Cisco Security IDS – Snorts Intrusion Detection – NFR security.</p> <p>UNIT- V: LEGAL ISSUES AND ORGANIZATIONS STANDARDS: Law Enforcement / Criminal Prosecutions – Standard of Due Care – Evidentiary Issues, Organizations and Standardizations.</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
Text Books: <ol style="list-style-type: none"> 1. Rafeeq Rehman : “ Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID,” 1st Edition, Prentice Hall , 2003 				
Reference Books: <ol style="list-style-type: none"> 1. Ali A. Ghorbani, Wei Lu, “Network Intrusion Detection and Prevention: Concepts and Techniques”, Springer, 2010. 2. Carl Enrolf, Eugene Schultz, Jim Mellander, “Intrusion detection and Prevention”, McGraw Hill, 2004 3. Paul E. Proctor, “The Practical Intrusion Detection Handbook “,Prentice Hall , 2001. 4. Ankit Fadia and Mnu Zacharia, “Intrusion Alert”, Vikas Publishing house Pvt., Ltd, 2007. 5. Earl Carter, Jonathan Hogue, “Intrusion Prevention Fundamentals”, Pearson Education, 2006. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 20	WIRELESS SENSOR PROTOCOLS AND PROGRAMMING	4	-	-
Course Perquisite: <ul style="list-style-type: none"> • Computer Networks, • Computer Networks Lab 				
Course Objectives: <ul style="list-style-type: none"> • An understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards. • An ability to evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks 				
Course Outcomes: <ul style="list-style-type: none"> • Understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards. • Demonstrate an ability for multiple access techniques for Wireless Communication • Ability to evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks 				
<p>UNIT I: OVERVIEW OF WIRELESS COMMUNICATION, cellular communication, different generations and standards in cellular communication system, satellite communication including GPS, wireless local loop, cordless phone, paging systems, RFID.</p> <p>UNIT II: RECENT WIRELESS TECHNOLOGIES: multicarrier modulation, OFDM, MIMO system, diversity multiplexing trade-off, MIMO-OFDM system, smart-antenna; beam forming and MIMO, cognitive radio, software defined radio, communication relays, spectrum sharing.</p> <p>UNIT III: MULTIPLE ACCESS TECHNIQUES IN WIRELESS COMMUNICATION: contention-free multiple access schemes (FDMA TDMA, CDMA, SDMA and Hybrid), contention-based multiple access schemes (ALOHA and CSMA).</p> <p>UNIT IV: WIRELESS PERSONAL AREA NETWORKS: (Bluetooth, UWB and ZigBee), wireless local area networks (IEEE 802.11, network architecture, medium access methods, WLAN standards), wireless metropolitan area networks (WiMAX).</p> <p>UNIT V: AD-HOC WIRELESS NETWORKS: Design Challenges in Ad-hoc wireless networks, concept of cross layer design, security in wireless networks, energy constrained networks. MANET and WSN. Wireless system protocols : mobile network layer protocol (mobile IP, IPv6, dynamic host configuration protocol), mobile transport layer protocol (traditional TCP, classical TCP improvements), support for mobility (wireless application protocol).</p> <p style="text-align: right;">TOTAL PERIODS: 60</p>				
Text Books: <ol style="list-style-type: none"> 1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005. 2. Sanjay Kumar, “Wireless Communication the Fundamental and Advanced Concepts” River Publishers, Denmark, 2015(Indian reprint). 				
Reference Books: <ol style="list-style-type: none"> 1. Vijay K Garg, “Wireless Communications and Networks”, Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian reprint) 2. J. Schiller, “Mobile Communication” 2/e, Pearson Education, 2012. 3. Iti Saha Misra, “Wireless Communication and Networks : 3G and Beyond”, 2/e, McGraw Hill Education (India) Private Ltd, New Delhi, 2013. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 21	INFORMATION SECURITY AND RISK MANAGEMENT	4	-	-
Course Perquisite: <ul style="list-style-type: none"> • Computer Networks • Cryptography • Ethical Hacking & Information Security • Cyber and Digital Forensics 				
Course Objectives: <ul style="list-style-type: none"> • Understand the fundamental of risk management and information security • To present a system and management view of information security: what it is, what drives the requirements for information security • To integrate into systems design process, and life cycle security management of information systems. 				
Course Outcomes: <ul style="list-style-type: none"> • Information security risk management framework and methodologies • Identify and model information security risks • Use qualitative and quantitative risk assessment methods • Articulate information security risks as business consequences 				
UNIT-I RISK I: IDENTIFYING AND CATEGORIZING RISKS: Risk Management – Risk Identification – Risk Assessment -Documenting the Results				
UNIT-II RISK II: RISK MANAGEMENT: Introduction – Control Strategies – Managing Risk – Feasibility and Cost Benefit Analysis – Risk Control Practices.				
UNIT-III SECURITY POLICY: Purpose of security policies -Enterprise Information – Issue Specific – System Specific – Guidelines				
UNIT-IV: SECURITY MANAGEMENT OF DEPLOYED SYSTEMS: Organizing For Security - Within an Organization – Components – Security Roles- Education – Training and Awareness – Security Management Models: Access Control – Architecture Models – Management Models - Benchmarking – Performance Measures.				
UNIT-V: CONTINGENCY PLANNING: Fundamentals - Components: Business Impact - Incident Response - Disaster Recovery – Business Continuity - Timing and Sequence - Crisis Management - Business Resumption Planning – Testing Contingency Planning.				
TOTAL PERIODS: 60				
Text Books: <ol style="list-style-type: none"> 1. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. “Introduction to information security and cyber laws”. Dreamtech Press. ISBN: 9789351194736, 2015. 2. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Vikas Publishing House, New Delhi, 2003. 3. Management of Information Security by Michael E. Whitman and Herbert J. Mattord, 2nd Edition, 				
Reference Books: <ol style="list-style-type: none"> 1. Security Engineering, Ross Anderson, ISBN 978-0470068526 2. Stuart Mc Clure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Tata McGrawHill, 2003 3. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002. 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 22	DESIGN AND TESTING OF DIGITAL SYSTEMS	4	-	-
Course Perquisite: <ul style="list-style-type: none"> Digital system and Microprocessor Software Engineering 				
Course Objectives: <ul style="list-style-type: none"> To impart knowledge on combinational and sequential circuits To design digital circuits with logic devices and VHDL To design sequential circuits and perform fault modeling and simulation 				
Course Outcomes: <ul style="list-style-type: none"> Simulate the combinational circuits using gates, programming logic devices and VHDL Design the sequential circuits and perform fault modeling and simulation Apply testability algorithms to test combinational and sequential circuits 				
UNIT I COMBINATIONAL CIRCUIT DESIGN AND SIMULATION USING GATES: Review of Combinational Circuit Design-Design of Circuits with limited gate fan-in Gate delays and timing diagrams-Hazards in Combinational Logic-Simulation and testing of Logic circuits-Multiplexer, three-state buffers and Decoder/Encoders				
UNIT II COMBINATIONAL CIRCUITS DESIGN WITH PROGRAMMABLE LOGIC DEVICES AND VHDL: Designing with ROMs-Programmable Logic devices-Complex Programmable Logic Devices-Field Programmable gate Arrays-VHDL Description of combinational Circuits VHDL models for Multiplexers-VHDL Modules and Operators-Signals, constants and Arrays-IEEE Standard Logic.				
UNIT III - SEQUENTIAL CIRCUITS DESIGN: Sequential Parity Checker-Analysis by Signal Tracing and Timing charts-State Tables and Graphs-Construction and Interpretation of Timing Charts-General Models-Code converter-design Example-Design of Sequential Circuits using ROMs and PLAs				
UNIT IV FAULT MODELING AND SIMULATION: Keyboard basics - Keyboard scanning algorithm - Character LCD modules - LCD module display Configuration - Time-of-day clock - Timer manager - Interrupts - Interrupt service routines - Interrupt-driven pulse width modulation. Triangle waves analog vs. digital values - Auto port detect - Capturing analog information in the timer interrupt service routine - Automatic, multiple channel analog to digital data acquisition.				
UNIT V TESTING FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS: Basic Issues-ATG for SSFs in Combinational Circuits- Fault oriented ATG-Common Concepts, Algorithms and Selection Criteria-ATG for SSFs in Sequential Circuits				
TOTAL PERIODS: 60				
Text Books: <ol style="list-style-type: none"> Charles H. Roth, Jr.Larry L.Kinney, “Fundamentals of Logic design” Cenage Learning, 6th Edition, 2010 Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, “Digital Systems Testing and Testable Design”, Jaico Publishing House, 2001 Morris Mano, M.D.Ciletti, “Digital Design” , Pearson Edition, 2013 				
Reference Books: <ol style="list-style-type: none"> M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and 				

Mixed-Signal VLSI Circuits", Kluwer Academic Publishers

2. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002
3. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall International
4. Peatman, "Design of digital Systems", McGraw-Hill, 1984
5. Adamski and Barkalov, "Design of Digital Systems and Devices, Springer Science & Business Media, 2011

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 23	MULTIMEDIA SECURITY & FORENSICS	4	-	-
Course Prerequisite:				
<ul style="list-style-type: none"> Digital forensics 				
Course Objectives:				
<ul style="list-style-type: none"> Knowledge of web application vulnerabilities and tools for cyber security Secure both clean and corrupted systems Understand key terms and concepts in cyber law, intellectual property and cyber crimes, trademarks and domain theft. Determine computer technologies, digital evidence collection, and evidentiary reporting in forensic acquisition. 				
Course Outcomes:				
<ul style="list-style-type: none"> Design and develop various applications of digital watermarking Analyze the main properties and classifications of digital watermarking systems Design of digital watermarking systems modelling Selected digital watermarking algorithms (e.g. LSB based approach and those in DCT domain) Security of digital watermarking systems 				
UNIT-I: DIGITAL RIGHTS MANAGEMENT (DRM) FRAMEWORK: Requirements of a DRM system, Architectures, Dimensions to content protection: Tracing (fingerprinting), authentication, Encryption, Key management and access control..				
UNIT-II: DIGITAL WATERMARKING: Information Theory: Mutual Information and Channel Capacity - Watermarking with Side Information - Using Perceptual Models – Robust Watermarking - Affine-Resistant Watermarking. Image Watermarking, Video Watermarking, Audio Watermarking, Watermarking for CG-models, Watermarking for Binary Images, Watermarking for 3D Contents, Data Hiding through watermarking techniques.				
UNIT-III CONTENT AUTHENTICATION TECHNIQUES: Data authentication, One way hash functions, Message authentication codes (MACs); Multimedia authentication: Perceptual hashes; Parameterization; Watermarking based authentication: Notion of semi-fragility, Construction and design of semi-fragile watermarks, Privacy preserving protocols: Zero knowledge protocols, Anonymous fingerprinting, Public key watermarking, Non-perfect secret sharing constructions for anonymous fingerprinting with shared access control.				
UNIT IV FORENSICS Multimedia encryption - Digital Watermarking Security Attacks - Digital Forensics taxonomy - goals/ requirements - Forensic Data Acquisition - Forensics Analysis and Validation.				
UNIT-V: CRYPTOGRAPHY AND MULTIMEDIA ENCRYPTION: Introduction to Cryptography, Multimedia Processing in the Encryption Domain, Privacy preserving Information Processing, Information Theory and Digital Forensics, Forgeries Detection, New ways for making Forgeries.				
TOTAL PERIODS: 60				
TextBooks:				
1. Michael Digital Watermarking and Steganography, 2nd Edition, by Cox, Miller, Bloom, Fridrich, and Kalker, 2008				

2. W. Zeng, H. Yu and C. Lin, Multimedia Security Technologies for Digital Rights Management, Elsevier, UK, 2006.

Reference Books:

1. Multimedia Security Handbook, Borko Furht, Darko Kirovski, CRC Press, 2004
2. Multimedia Security Technologies for Digital Rights Management, Wenjun Zeng, Heather Yu, Ching-Yung Lin, Elsevier, 2006
3. Advanced Techniques in Multimedia Watermarking: Image, Video and Audio Applications: Image, Video and Audio Applications, Al-Haj, Ali Mohammad

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 24	PRINCIPLES OF MODERN CRYPTOGRAPHY	4	-	-
Course Perquisite: <ul style="list-style-type: none"> • Cryptography • Cyber and Digital Forensics 				
Course Objectives: <ul style="list-style-type: none"> • To gain knowledge about the mathematics of the cryptographic algorithms • To get an insight into the working of different existing cryptographic algorithms • To get an insight into the working of Authentication Mechanisms and Key Management 				
Course Outcomes: <ul style="list-style-type: none"> • Apply the knowledge about the mathematics of the cryptographic algorithms • Able to apply different existing cryptographic algorithms • Students came to know about the working of Authentication Mechanisms and Key Management 				
UNIT-I:INTRODUCTION: Security Goals, Cryptographic attacks, Services and Mechanism, Techniques for Security Goals Implementation – Mathematics of Cryptography – Modular Arithmetic, Congruence and Matrices				
UNIT-I: TRADITIONAL SYMMETRIC KEY CIPHERS : Mathematics of Symmetric Key Cryptography – Algebraic Structures - Introduction to Modern Symmetric Key Ciphers- DES, Blowfish, IDEA, AES, RC5, - Modes of operation of Modern Symmetric Key Ciphers				
UNIT-III: MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence - Asymmetric Key Cryptography – RSA, ElGamal Cryptosystem, Elliptic Curve Cryptosystem, Public Key Infrastructure and Digital Certificates				
UNIT IV: MESSAGE INTEGRITY AND MESSAGE AUTHENTICATION: Random Oracle Model, Message Authentication – Cryptographic Hash Functions – MD5, SHA-512 - Digital Signature – Process, Services, Attacks on Digital Signature, Digital Signature Schemes – RSA, El Gamal, Elliptic Curve – Variations and Applications				
UNIT V: ENTITY AUTHENTICATION: Password based Authentication, Challenge Response Protocols, Zero Knowledge Protocols, Biometrics – Key Management – Symmetric key Distribution, Kerberos, Symmetric Key Agreement, Public Key Distribution, Hijacking.				
TOTAL PERIODS: 60				
Text Books: <ol style="list-style-type: none"> 1. Michael Stinson. D. Cryptography: Theory and Practice, third edition, Chapman & Hall/CRC, 2010 2. Modern cryptography: theory & practice, Wembo Mao, Pearson Education; First Edition, 2004 				
Reference Books: <ol style="list-style-type: none"> 1. Jonathan Katz Yehuda Lindell “Introduction To Modern Cryptography” Second Edition Chapman & Hall/CRC Cryptography And Network Security 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 25	FOUNDATIONS OF MODERN NETWORKING	4	-	-
<p>Course Perquisite:</p> <ul style="list-style-type: none"> • Digital system and microprocessor • Computer network • Cloud computing • Information security • Internet of things • Data structures • Database management systems. 				
<p>Course Objectives:</p> <ul style="list-style-type: none"> • To understand the state-of-the-art in network protocols architectures and applications. • To Analyze existing network protocols and networks. • To understand the principles behind the Modern Network approaches such as SDN NFV and IoT • To analyze Data Center topologies and virtualized environment 				
<p>Course Outcomes:</p> <p>Upon completion of the course, the student should be able to:</p> <ul style="list-style-type: none"> • Justify the position that traditional network architectures are inadequate for modern networking needs. • Understand the principles behind the Modern Network approaches such as SDN NFV and IoT • Acquire knowledge on Virtualization and NFV architectures, use cases and other modern network approaches • Acquire knowledge on IoT devices and security mechanisms used in Modern Network approaches • Demonstrate scholarship of knowledge through performing in a group to identify, formulate and solve a problem related to Computer Networks 				
<p>UNIT-I MODERN NETWORKING: Networking Ecosystem -Network Architecture – 4G/5G – Cloud Computing - Internet Of Things - Types of Network and Internet Traffic - Demand: Big Data, Cloud Computing, and Mobile Traffic - Requirements: QoS and QoE - Routing Congestion Control - SDN and NFV - Modern Networking Elements</p> <p>UNIT-II SOFTWARE DEFINED NETWORKS: Network Requirements - The SDN Approach - SDN- and NFV related Standards - SDN Data Plane - OpenFlow Logical Network Device - OpenFlow Protocol – SDN Control Plane Architecture - REST API - SDN Application Plane</p> <p>UNIT-III VIRTUALIZATION: Background and Motivation for NFV - Virtual Machines - NFV Concepts - NFV Reference Architecture - NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration - NFV Use Cases - SDN and NFV</p> <p>UNIT-IV THE INTERNET OF THINGS: Components: The IoT Era - Scope of the Internet of Things - Components of IoT-Enabled Things - IoT World Forum Reference Model - ITU-T IoT Reference Model -IoTivity - Cisco IoT System - ioBridge - SDN and NFV over IoT Deployment- DevOps</p> <p>UNIT-V SECURITY: Security Requirements - SDN Security - NFV Security - ETSI Security</p>				

Perspective - IoT Security - The Patching Vulnerability - IoT Security and Privacy Requirements Defined by ITU-T – An IoT Security Framework - The Impact of the New Networking on IT Careers

TOTAL PERIODS: 60

Text Books:

1. “Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud” William Stallings
Publisher: Addison-Wesley 2015
2. SDN and NFV Simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization 1st Edition by Jim Doherty

Reference Books:

1. Network Function virtualization with a touch of SDN by Paresh Shah, Syed Farrukh Hassan, Rajendra Chayapathi
2. Software Defined Networks A Comprehensive Approach 1st Edition by Paul Goransson Chuck Black

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 26	NETWORK PROTOCOLS	4	-	-
Course Prerequisite: <ul style="list-style-type: none"> Computer Networks 				
Course Objectives: <ul style="list-style-type: none"> To learn the different network architectures and protocols. To learn the various TCP/IP protocols. To learn the various network security technologies and protocols. To understand VOIP protocols. To understand WAN and LAN protocols. 				
Course Outcomes: On Completion of the course, the students should be able to: <ul style="list-style-type: none"> Understand the different network architectures and protocols. Design different TCP/IP protocols. Understand various network security technologies and protocols. Understand VOIP protocols. Understand the WAN and LAN protocols. 				
UNIT-I: APPLICATION LAYER PROTOCOLS: TCP/IP, HTTP, SHTTP, LDAP, MIME,- POP& POP3, RMONSNTP- SNMP. Presentation Layer Protocols-Light Weight Presentation Protocol Session layer protocols – RPC protocols-transport layer protocols- ITOT,RDP,RUDP,TALI,TCP/UDP, compressed TCP. Network layer Protocols – routing protocols-border gateway protocol-exterior gateway protocol-internet protocol IPv4- IPv6- Internet Message Control Protocol- IRDP				
UNIT II: DATA LINK LAYER PROTOCOL: ARP – In ARP – IPCP – IPv6CP – RARP – SLIP .Wide Area Network Protocols- ATM protocols – Broadband access Protocols – Point to Point Protocols – Other WAN Protocols- security issues.				
UNIT-III: LOCAL AREA NETWORK AND LAN PROTOCOLS: ETHERNET Protocols – VLAN protocols –Wireless LAN Protocols – Metropolitan Area Network Protocol – Storage Area Network and SAN Protocols -FDMA, WIFI and WIMAX Protocols- security issues - Mobile IP – Mobile Support Protocol for IPv4 and IPv6 – Resource Reservation Protocol - Multi-casting Protocol – BGMP – IGMP – MSDP.				
UNIT-IV: ISO PROTOCOLS: Application Layer- ISO ACSE: Association Control Service Element –ISO CMIP: Common Management Information Protocol - CMOT: CMIP over TCP/IP - ISO FTAM – ISO ROSE - ISO RTSE - ISO VTP - ISO-PP - ISO-SP - ISO-TP: OSI - TP0, TP1, TP2, TP3, TP4 – Network Layer CLNP: Connectionless Network Protocol (ISO-IP) -ISO CONP - ES-IS: IDRIP - IS-IS – Cisco Protocols: CDP: Cisco Discovery Protocol - CGMP – DTP – EIGRP - HSRP IGRP - ISL & DISL –RGMP - TACACS – VTP – XOT - Novell NetWare and Protocols - IPX - NCP - NLSP – SPX -IBM SMB – APPC - SNA NAU - NetBIOS – NetBEUI – APPN – DLSw - QLLC – SDLC -AppleTalk - SS7/C7 Protocols – BISUP – DUP - ISUP - MTP2 and MTP3: - SCCP – TCAP – TUP –CIFS - Microsoft SOAP - Xerox IDP - Toshiba FANP.				
UNIT-V: WIRELESS PERSONAL AREA NETWORK: IEEE 802.15 and Bluetooth – WPAN Communication Protocols – IEEE 802.16- IEEE 802.16A.WCDMA – Services – WCDMA Products – Networks- device addressing – System Addressing – Radio Signaling Protocol – Multimedia Signaling Protocol.				

Text Books:

1. Jielin Dong, "Networks Protocols Handbook", Jawin Technologies Inc., 2005.
2. Bruce Potter and Bob Fleck, "802.11 Security", O'Reilly Publications, 2002.
3. Lawrence Harte, "Introduction to WCDMA", Althos Publishing, 2004.

Reference Books:

1. Ralph Oppliger "SSL and TSL: Theory and Practice", Arttech House, 2009.
2. Jessica Fridrich, "Steganography in Digital Media: Principles, Algorithms, and Applications", Cambridge university press, 2010.
3. Lawrence Harte, "Introduction to CDMA- Network services Technologies and Operations", Althos Publishing, 2004.
4. Lawrence Harte, "Introduction to WIMAX", Althos Publishing, 2005.

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 27	SMART CONVERGENT TECHNOLOGIES	4	-	-
<p>Course Objectives:</p> <ul style="list-style-type: none"> • Describe the various technologies used in telecommunications • Explain the application of technologies, architectures, and protocols used in the telecommunications industry. • Describe 1G, 2G, 3G, 4G, LTE, WiMAX and their role in present and future Mobility. 				
<p>Course Outcomes:</p> <ul style="list-style-type: none"> • Students will come to know latest Telecommunications Technology. • Students will get the depth knowledge about various Networking. • Various Cellular Services And Standards canbe learned. 				
<p>UNIT I – INTRODUCTION TO TELECOMMUNICATIONS AND TRANSMISSION: Human–Machine Interactions - Embedded Devices - Intelligent Wearable - Traffic Patterns - The Electromagnetic Spectrum - Analog and Digital, Multiplexing Media: Twisted-Pair - Coaxial Cable-Microwave – Satellites - Fiber Optics - Data Communication Traffic - Data Transmission - OSI and TCP/IP Reference Models</p>				
<p>UNIT II - INTRODUCTION TO THE INTERNET AND IP TELEPHONY: Internet and Routing Protocols- Internet Architecture, and Infrastructure - Subnetting: IPv4, IPv6; DNS, QoS- Service Providers - IPT Network Architecture, QoS - VoIP Call Signaling Protocols - Digital Voice, ENUM-VPNs: Layer 3, 2, Security- Unified communications- IP voice and IPTV- The Broadband Infrastructure - Quality of Service-Virtualization- Cloud Computing</p>				
<p>UNIT III - FIBRE OPTIC NETWORKS, WIRED AND WIRELESS BROADBAND: Optical Networking Elements : Switches, Edge, Core - DSL - Cable TV Networks, Packet Cable- Fiber Solutions- Wireless Broadband- HANs PANs, CANs, MANs- Broadband PLT - Antennas- Wireless Bandwidth - Spectrum Utilization- Spread Spectrum</p>				
<p>UNIT IV - CELLULAR SERVICES AND STANDARDS: Cellular: 2G, 2,5G, 3G, 4G. 5G - WiMax,LTE - mobile security - Digital Cellular Radio -Enhanced Data Services - Broadband Wireless 3G Standards : : UMTS, TD-SCDMA,CDMA Solutions</p>				
<p>UNIT V - WIRELESS NETWORK ARCHITECTURE, WIRELESS AND MOBILITY: BFWA-WLANs -IEEE 802.11a,b,g,n - IEEE 802.16, WiMax, WiBro and Mobile-Fi - VoWLAN - Integration of WLANs and Cellular Networks, RFIDMesh Networks - Mobile IP, IP Multimedia Subsystem - Applications,Mobile Video,Mobile TV, and Content</p>				
<p>TOTAL PERIODS: 60</p>				
<p>Text Books:</p> <ol style="list-style-type: none"> 1. LIDO Telecommunications Essentials: by Lillian Goleniewski, 2ndedition, Addison-Wesley Professional, Copyright: 2007 				
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Internet of Things: Converging Technologies for Smart Environments and IntegratedEcosystem , Dr. Ovidiu Vermesan, Dr. Peter Friess River Publishers Series in Communications, June 2013 				

Subject Code	Subject Name	Lectures (Periods)	Tutorials (Periods)	Practical (Periods)
CS E 28	SOFTWARE ARCHITECTURE AND INTEROPERABILITY	4	-	-
Course Perquisite: <ul style="list-style-type: none"> • Software Engineering • Object Oriented Programming 				
Course Objectives: <ul style="list-style-type: none"> • To learn importance of software architecture • To learn about architectural life cycle • To learn More Interoperability Challenges to Cope Today • To know about various architecture model 				
Course Outcomes: <ul style="list-style-type: none"> • Analyze Software Engineering problems in terms of architectural thinking • Generate architectural alternatives for a problem and select among them • Know how to do an assessment of an architecture • Describe a software architecture using various documentation approaches and architectural description languages • To design and motivate software architecture for large scale software systems 				
UNIT – I Concepts of Design: Characteristics of design activities – Elements of design – Software quality models and their effects – Quality Attributes – Basic rules of software design –Design process.				
UNIT – II Software Architecture: Architecture – Software Architecture – Architectural styles – Visual Notation-Active and passive elements – Data, control and relationships –composition and decompositions – Data Flow Style – Call and Return – Independent components – Data centered and virtual machine.				
UNIT – III Styles in design and design space: Choices of styles and their combination –Hierarchical styles – Simultaneously heterogeneous style – Locationally heterogeneous style– Theory of design spaces –Design Space of elements – Design Space of Styles.				
UNIT – IV Architecture Evaluation: Concept of Scenario – Evaluating modifiability – Evaluating Performance –SAAM Method – The process : Analysis and Evaluation of modifiability				
UNIT – V Architecture Evaluation Methods: ATAM – Analysis Process – Analysis Activities – Quality Models –Construction of quality models – Derivation of quality features.				
TOTAL PERIODS: 60				
Text Books: <ol style="list-style-type: none"> 1. Len Bass, Paul Clements, Rick Kazman, “Software Architecture in Practice”, 3rd edition Pearson,2013. 2. Mary Shaw, David Garlan, “Software Architecture: Perspectives on an Emerging Discipline”, Prentice Hall, 1996. 				
Reference Books: <ol style="list-style-type: none"> 1. Dr. OvidiuVermesan, Dr. Peter Friess, Internet of Things: Converging Technologies for Smart Environmentsand Integrated Ecosystems, River Publishers Series In Communications,2013. 2. Taylor R. N, Medvidovic N, Dashofy E. M, “Software Architecture: Foundations, Theory, and Practice”, Wiley, 2009. 				