SCHEME OF INSTRUCTION
BE (INFORMATION TECHNOLOGY)
AICTE MODEL CURRICULUM Proposed from the Academic year 2018-19

IT: SEMESTER – I (2018-19)

S. No.	Course Code	Course Title	Scheme of Instructions				Scheme of Examination			Credits
			L	T	Pr/ Drg	Contact Hours/ Week	CIE	SEE	Duration in Hours	
Theory Course										
1	**Three Week Induction Programme**						-	-	-	-
2	BS101MT	Mathematics-I	3	1	-	4	30	70	3	4
3	BS103PH	Physics	3	1	-	4	30	70	3	4
4	ES101EE	Basic Electrical Engineering	3	1	-	4	30	70	3	4
Practical/ Laboratory Course										
5	BS153PH	Physics Lab	-	-	3	3	25	50	3	1.5
6	ES151EE	Basic Electrical Engineering Lab	-	-	2	2	25	50	3	1
7	ES153CE	Engineering Graphics & Design	1	-	4	5	50	50	3	3
Total			**10**	**03**	**09**	**22**	**190**	**360**		**17.5**

IT: SEMESTER – II

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		
			L	T	P	Contact Hrs/Wk	CIE	SEE	Credits
1.	HS101EG	English	2	-	-	2	30	70	2
2.	BS102MT	Mathematics-II	3	1	-	4	30	70	4
3.	BS104CH	Chemistry	3	1	-	4	30	70	4
4.	ES102CS	Programming for Problem Solving	3	-	-	3	30	70	3
Practicals									
5.	HS151EG	English Lab			2		25	50	1
6.	BS154CH	Chemistry Lab			3	3	25	50	1.5
7	ES152CS	Programming for Problem Solving			4	4	25	50	2
8.	ES154ME	Workshop/ Manufacturing Process	1	-	4	5	50	50	3
Total			**12**	2	**13**	**25**	**245**	**480**	**20.5**

IT: SEMESTER – III (2019-2020)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	MC111PO	Indian Constitution	2	-	-	2	30	70	3	-
2	HS201EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
3	HS202CM	Finance and Accounting	3	-	-	3	30	70	3	3
4	BS207MT	Mathematics- III (Probability & Statistics)	3	-	-	3	30	70	3	3
5	ES214EC	Basic Electronics	3	-	-	3	30	70	3	3
6	ES216EC	Digital Electronics	3	-	-	3	30	70	3	3
6	PC221IT	Data Structures	3	-	-	3	30	70	3	3
7	PC222IT	Mathematical Foundations of Information Technology	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
8	ES251EC	Basic Electronics Lab	-	-	2	2	25	50	3	1
9	PC252IT	Data Structures Lab	-	-	2	2	25	50	3	1
10	PC253IT	IT Workshop Lab	-	-	2	2	25	50	3	1
			23	**-**	**06**	**29**	**285**	**640**		**24**

IT: SEMESTER – IV (2019-20)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	MC112CE	Environmental Sciences	2	-	-	2	30	70	3	-
2	MC113PY	Essence of Indian Traditional Knowledge	2	-	-	2	30	70	3	-
3	HS204ME	Operations Research	3	-	-	3	30	70	3	3
4	BS206BZ	Biology for Engineers	3	-	-	3	30	70	3	3
5	ES215EC	Signals and Systems	3	-	-	3	30	70	3	3
6	PC231IT	JAVA Programming	3	-	-	3	30	70	3	3
7	PC232IT	Database Systems	3	-	-	3	30	70	3	3
8	PC233IT	Computer Organization and Microprocessor	3	-	-	3	30	70	3	3
9	PC234IT	Data Communications	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
10	PC261IT	Microprocessor Lab	-	-	2	2	25	50	3	1
11	PC262IT	JAVA Programming Lab	-	-	2	2	25	50	3	1
12	PC263IT	Database Systems Lab	-	-	2	2	25	50	3	1
			25	**-**	**06**	**31**	**345**	**780**		**24**

IT - SEMESTER - V

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1.	PC 501 IT Core-7	Web Application Development	3	1	-	4	30	70	3	3
2.	PC 502 IT Core-8	Operating Systems	3	1	-	4	30	70	3	3
3.	PC 503 IT Core-9	Automata Theory	3	1	-	4	30	70	3	3
4.	PC 504 IT Core-10	Computer Networks	3	1	-	4	30	70	3	3
5.	PC 505 IT Core-11	Software Engineering	3	-	-	3	30	70	3	3
6.	PE-I	Professional Elective-I	3	-	-	3	30	70	3	3
7.	MC 901 EG	Gender Sensitization	3	-	-	3	30	70	3	0
Practical/Laboratory Course										
8.	PC531 IT	Computer Networks Lab	-	-	2	2	25	50	3	1
9.	PC532 IT	Operating Systems Lab	-	-	2	2	25	50	3	1
10.	PC534 IT	Web Application Development Lab	-	-	2	2	25	50	3	1
Total			**21**	**04**	**06**	**31**	**285**	**640**		**21**

Profession Elective – I	
Course Code	**Course Title**
PE 511 IT	Artificial Intelligence
PE 512 IT	Computer Graphics
PE 513 IT	Image Processing
PE514IT	Computational Number Theory

IT - SEMESTER - VI

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs/Wk	
Theory Course										
1.	PC 601 IT Core-12	Embedded Systems	3	1	-	4	30	70	3	3
2.	PC 602 IT Core-13	Design and Analysis of Algorithms	3	1	-	4	30	70	3	3
3.	PE-II	Professional Elective -II	3	-	-	3	30	70	3	3
4.	PE -III	Professional Elective -III	3	-	-	3	30	70	3	3
5	PE -IV	Professional Elective -IV	3	-	-	3	30	70	3	3
6.	OE - 1	Open Elective -1	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
7.	PC631 IT	Embedded Systems Lab	-	-	2	2	25	50	3	1
8.	PC632 IT	Design and Analysis of Algorithms Lab	-	-	2	2	25	50	3	1
8.	PW633 IT	Mini Project-I	-	-	2	2	25	50	3	1
9.	MC	NSS/Sports/Yoga	-	-	3	3	50	-	-	0
10.	SI 671 IT	Summer Internship*	-	-	-	-	-	-	-	-
Total			**18**	**2**	**9**	**29**	**305**	**570**		**21**

Profession Elective - II	
Course Code	**Course Title**
PE 611 IT	Data Mining
PE 612 IT	Compiler Construction
PE 616 IT	Distributed Systems
PE 617 IT	Advanced Computer Architecture

Profession Elective – III	
Course Code	**Course Title**
PE 623 IT	Object Oriented Analysis and Design
PE 624 IT	Multimedia
PE 625 IT	Machine Learning
PE 626 IT	Data Science Using R Programming

Profession Elective - IV	
Course Code	**Course Title**
PE 627CS	Computational Intelligence
PE 628 IT	Adhoc and Sensor Networks
PE 629 CS	Natural Language Processing
PE 630 IT	Information Storage and Management

Open Elective - I	
Course Code	**Course Title**
OE 601 CE	Disaster Management
OE 602 CE	Geo Spatial Techniques
OE 601 CS	Operating Systems**
OE 602 CS	OOP using Java**
OE 601 IT	Database Systems**
OE 602 IT	Data Structures**
OE 601 EC	Principles of Embedded Systems
OE 602 EC	Digital System Design using HDL Verilog
OE 601 EE	Reliability Engineering
OE 602 EE	Basics of Power Electronics
OE 601 ME	Industrial Robotics
OE 602 ME	Material Handling
OE 601 AE	Automotive Safety & Ergonomics

IT - SEMESTER - VII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	**PC 701 EC Core-14**	VLSI Design	3	1	-	4	30	70	3	3
2	**PC 702 IT** Core-15	Big Data Analytics	3	1	-	4	30	70	3	3
3	**PE-V**	Professional Elective-V	3	1	-	4	30	70	3	3
4	PE-IV	Professional Elective – VI	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
5	**PC 751 EC**	VLSI Design Lab	-	-	3	3	25	50	3	1
6	**PC 752 IT**	Big Data Analytics Lab	-	-	3	3	25	50	3	1
7	**PW 761 IT**	Project Work – I	-	-	4	4	50	-	-	2
8	**SI 762 IT**	Summer Internship	`	-	-	-	50	-	-	2
			12	**03**	**10**	**25**	**300**	**450**	**21**	**18**

Profession Elective – V	
Course Code	**Course Title**
PE 723 IT	Wireless and Mobile Communication
PE 724 IT	Semantic Web
PE 725 IT	Cloud Computing
PE 726 IT	Human Computer Interaction

Profession Elective – VI	
Course Code	**Course Title**
PE 727 IT	Internet of Things
PE 728 IT	Deep Learning
PE 729 IT	Digital Forensics
PE 730 IT	Crytpography and Network Security

IT - SEMESTER - VIII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	**OE-II**	**Open Elective – II**	3	-	-	3	30	70	3	3
2	**OE-III**	**Open Elective – III**	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
4	**PW861 IT**	Project Work – II	-	-	16	16	50	100	-	8
			06	**-**	**16**	**22**	**110**	**240**	**06**	**14**

Open Elective – II			**Open Elective – III**		
S. No.	Course Code	Course Title	S. No.	Course Code	Course Title
1	**OE 771 CE**	Green Building Technologies	1	**OE 781 CE**	Road Safety Engineering
2	**OE 772 CS****	Data Science Using R Programming	2	**OE 782 IT****	Software Engineering
3	**OE 773 EC**	Fundamentals of IoT	3	**OE 783 EC**	Principles of Electronic Communications
4	**OE 774 EE**	Non-Conventional Energy Sources	4	**OE 784 EE**	Illumination and Electric Traction systems
5	**OE 775 ME**	Entrepreneurship	5	**OE 785 ME**	Mechatronics
6	**OE 876 IT**	Cyber Security			

S.No	Course Work-Subject Area	Credits/Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	Humanities and Social Sciences (HS) - **AICTE -12**	-	**3** (1+1)	**6** **(3+3)**	**3** **(1)**		**-**	-	-	**12**
2.	Basic Sciences (BS) **AICTE -24**	9.5 (2+1)	9.5 (2+1)	**3** (1)	**3** (1)	-	-	-	-	**25**
3.	Engineering Sciences (ES) **AICTE-29**	**8** (2+1)	**8** (1+2)	**7** (2+1)	3 (1)	-	-	-	-	**26**
4.	Professional Subjects- Core (PC) **AICTE-49**	-	**-**	**8** (2+2)	**15** (4+3)	**18** (5+3)	**8** (2+2)	**9** (2+2)		**58**
5.	Professional Subject-Electives (PE*) **AICTE-18**	-	-	-	-	3 (1)	**9** (3)	**6** (2)		**18**
6.	Open Subjects-Electives (OE) **AICTE-12**	-	-	-	-	-	**3** (1)	-	**6** (2)	**09**
7.	Mini Project, Project Work-I and II and Internship **AICTE-15**	-	-	-	-	-	**1**	**4**	**8**	**13**
	TOTAL	**17.5**	**20.5**	**24**	**24**	**21**	**21**	**18**	**14**	**160**
8.	Mandatory Courses (MC) (*Non-Credit*) **8 Units**			**3** (1)	**6** **(2)**	3 (3U)				**12**

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum for the Academic Year 2019-2020)

and

Syllabi

B.E. III and IV Semester

of

Four Year DegreeProgramme

in

Information Technology

(With effect from the academic year 2019– 2020)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

2020

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Information Technology) III – SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	MC111PO	Yoga/Sports/NSS	2	-	-	2	30	70	3	-
2	HS201EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
3	HS202CM	Finance and Accounting	3	-	-	3	30	70	3	3
4	BS205MT	Mathematics III	3	-	-	3	30	70	3	3
5	ES214EC	Basic Electronics	3	-	-	3	30	70	3	3
6	ES216EC	Digital Electronics	3	-	-	3	30	70	3	3
6	PC221IT	Data Structures	3	-	-	3	30	70	3	3
7	PC222IT	Mathematical Foundations of Information Technology	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
8	ES251EC	Basic Electronics Lab	-	-	2	2	25	50	3	1
9	PC252IT	Data Structures Lab	-	-	2	2	25	50	3	1
10	PC253IT	IT Workshop Lab	-	-	2	2	25	50	3	1
			23	**-**	**06**	**29**	**285**	**640**		**24**

Course Code	Course Title						Core/Elective
MC111PO	**Indian Constitution**						**Mandatory**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

- To create awareness among students about the IndianConstitution.
- To acquaint the working conditions of union, state, local levels, their powers andfunctions.
- To create consciousness in the students on democratic values and principles articulated in the constitution.
- To expose the students on the relations between federal and provincialunits.
- To divulge the students about the statutoryinstitutions.

Course Outcomes

After completing this course, the student will

1. Know the background of the present constitution ofIndia.
2. Understand the working of the union, state and locallevels.
3. Gain consciousness on the fundamental rights andduties.
4. Be able to understand the functioning and distribution of financial resources between the centre and states.
5. Be exposed to the reality of hierarchical Indian social structure and the ways the grievances of the deprived sections can be addressed to raise human dignity in a democraticway.

UNIT-I

Evolution of the Indian Constitution: 1909 Act, 1919 Act and 1935 Act. Constituent Assembly: Composition and Functions; Fundamental features of the Indian Constitution.

UNIT-II

Union Government: Executive-President, Prime Minister, Council of Minister
State Government: Executive: Governor, Chief Minister, Council of Minister
Local Government: Panchayat Raj Institutions, Urban Government

UNIT-III

Rights and Duties: Fundamental Rights, Directive principles, Fundamental Duties

UNIT-IV

Relation between Federal and Provincial units: Union-State relations, Administrative, legislative and Financial, Inter State council, NITI Ayog, Finance Commission of India

UNIT-V

Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women

Suggested Readings:

1. Abhay Prasad Singh & Krishna Murari, Constitutional Government and Democracy in India, Pearson Education, New Delhi,2019
2. D.D. Basu, Introduction to the constitution of India, Lexis Nexis, NewDelhi
3. Subhash Kashyap, Our Parliament, National Book Trust, NewDelhi

4. Peu Ghosh, Indian Government &Politics, Prentice Hall of India, NewDelhi
5. B.Z. Fadia& Kuldeep Fadia, Indian Government &Politics, Lexis Nexis, NewDelhi

Course Code	Course Title						Core/Elective
HS201EG	**Effective Technical Communication in English**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

To expose the students to:

- Features of technicalcommunication
- Types of professionalcorrespondence
- Techniques of reportwriting
- Basics of manualwriting
- Aspects of data transfer andpresentations.

Course Outcomes

On successful completion of the course, the students would be able to:

1. Handle technical communicationeffectively
2. Use different types of professionalcorrespondence
3. Use various techniques of reportwriting
4. Acquire adequate skills of manualwriting
5. Enhance their skills of information transfer andpresentations

UNIT I

Definition and Features of Technical communication: Definition and features of technical communication (precision, relevance, format, style, use of visual aids), Differences between general writing and technical writing, Types of technical communication (oral and written)

UNIT II

Technical Writing-I (Official correspondence): Emails, IOM, Business letters, Business proposals.

UNIT III

Technical writing-II (Reports): Project report, Feasibility report, Progress report, Evaluation report.

UNIT IV

Technical writing- III (Manuals): Types of manuals, User manual, Product manual, Operations manual.

UNIT V

Information Transfer and Presentations: Non-verbal (bar diagram, flow chart, pie chart, tree diagram) to verbal (writing), Verbal (written) to non-verbal, Important aspects of oral and visual presentations.

Suggested readings:

1. Raman, Meenakshi & Sharma, Sangeeta. (2015). *Technical communication: Principles andPractice,* 3rd Edition, New Delhi.
2. Rizvi, Ashraf, M. (2017). *Effective Technical Communication* (2nd ed.). New Delhi, Tata McGraw HillEducation.
3. Sharma, R. C., & Mohan, Krishna. (2017). *Business Correspondence and Report Writing: A Practical Approach to Business & Technical Communication* (4th ed.). New Delhi, Tata McGraw HillEducation.

4. Tyagi, Kavita &Misra, Padma. (2011). *Advanced Technical Communication*. New Delhi, PHI Learning.
5. Jungk, Dale. (2004). *Applied Writing for Technicians*. New York, McGraw-Hill HigherEducation.

Course Code	Course Title						Core/Elective
HS202CM	**Finance and Accounting**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The course will introduce the students

- To provide basic understanding of Financial and Accounting aspects of a businessunit
- To provide understanding of the accounting aspects ofbusiness
- To provide understanding of financialstatements
- To provide the understanding of financialsystem
- To provide inputs necessary to evaluate the viability ofprojects
- To provide the skills necessary to analyse the financialstatements

Course Outcomes

After successful completion of the course the students will be able to

1. Evaluate the financial performance of the businessunit.
2. Take decisions on selection ofprojects.
3. Take decisions on procurement offinances.
4. Analyse the liquidity, solvency and profitability of the businessunit.
5. Evaluate the overall financial functioning of anenterprise.

UNIT-I

Basics of Accounting: Financial Accounting–Definition- Accounting Cycle – Journal - Ledger and Trial Balance-Cash Book-Bank Reconciliation Statement (including Problems)

UNIT-II

Final Accounts: Trading Account-Concept of Gross Profit- Profit and Loss Account-Concept of Net Profit-Balance Sheet (including problems with minor adjustments)

UNIT-III

Financial System and Markets: Financial System-Components-Role-Considerations of the investors and issuers- Role of Financial Intermediaries. Financial Markets-Players- Regulators and instruments - Money Markets Credit Market- Capital Market (Basics only)

UNIT-IV

Basics of Capital Budgeting techniques: Time Value of money- Compounding- Discounting- Future Value of single and multiple flows- Present Value of single and multiple Flows- Present Value of annuities-Financial Appraisal of Projects– Payback Period, ARR- NPV, Benefit Cost Ratio, IRR (simple ratios).

UNIT-V

Financial statement Analysis: Financial Statement Analysis- Importance-Users-Ratio Analysis-liquidity, solvency, turnover and profitability ratios.

Suggested Readings:

1. Satyanarayana. S.V. and Satish. D., Finance and Accounting for Engineering, PearsonEducation
2. Rajasekharan, Financial Accounting, PearsonEducation
3. Sharma. S.K. and Rachan Sareen, Financial Management, SultanChand

4. Jonathan Berk, Fundamentals of Corporate Finance, PearsonEducation
5. Sharan, Fundamentals of Financial Management, PearsonEducation

Course Code	Course Title						Core/Elective
BS205MT	**Mathematics – III**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce the solution methodologies for second order Partial Differential Equations with applications inengineering
- To provide an overview of probability and statistics toengineers

Course Outcomes

After completing this course, the student will be able to:

1. Solve field problems in engineering involvingPDEs.
2. Theycanalsoformulateandsolveproblemsinvolvingrandomvariablesandapplystatistical methods for analysing experimentaldata.

UNIT - I

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

UNIT - II

Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, one dimensional diffusion equation and its solution by separation of variables.

UNIT - III

Discrete random variables, expectation of discrete random variables, moments, variance of a sum, continuous random variables & their properties, distribution- functions, anddensities.

UNIT - IV

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis – Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.

UNIT - V

Test of significance; Large sample test for single proportion, difference of properties, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances – Chi- square test for goodness of fit and independence of attributes.

Suggested Readings:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers,2000.
2. Advanced Engineering Mathematics, R.K. Jain & Iyengar, NarosaPublications.
3. Engineering Mathematics, P. Sivaramakrishna Das & C. Vijaya Kumar, Pearson India Education Services Pvt.Ltd.
4. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications,2010.

5. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons,2006.
6. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
7. S. Ross, "A First Course in Probability", Pearson Education India,2002.
8. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley,1968.
9. T. Veerarajan, "Engineering Mathematics", Tata McGraw-Hill, New Delhi,2010.
10. Mathematical Statistics, S.C. Gupta & V.K. Kapoor, S. ChandPub.

Course Code	Course Title						Core/Elective
ES214EC	**Basic Electronics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course is to impart knowledge of

- To understand the characteristics of diodes and transistorconfigurations
- To understand the design concepts of biasing of BJT andFET
- To understand the design concepts of feedback amplifiers andoscillators
- To study the design concepts of OP Amp and dataconverters

Course Outcomes

After completing this course, the student will be able to:

1. Study and analyse the rectifiers and regulatorcircuits.
2. Study and analyse the performance of BJTs, FETs on the basis of their operation andworking.
3. Ability to analyse& design oscillatorcircuits.
4. Ability to analyse different logic gates & multi-vibratorcircuits.
5. Ability to analyse different data acquisitionsystems

UNIT-I

PN Junction Diode: Characteristics, Half wave rectifier, Full wave rectifier, filters, ripple, regulation, TIF and efficiency, Zener diode and Zener diode regulators. CRT construction and CRO applications

UNIT-II

Transistors: BJT construction and working, modes of operation, configurations of BJT (CB, CE, CC), small signal h-parameter model of CE, CE amplifier analysis. Construction and working of JFET, V-I characteristics of JFET.

UNIT-III

Feedback concepts: Types of negative feedback – modification of gain, bandwidth, input and output impedances, applications.

Oscillators: RC Phase shift, Wein bridge, LC and crystal Oscillators (Qualitative treatment only).

UNIT-IV

Operational Amplifier: OP-AMP Block diagram, Ideal OP-AMP, DC and AC Characteristics, Inverting and Non-Inverting Amplifiers, Adder/Subtractor, Integrator,Differentiator.

Logic gate circuits - Introduction to Digital systems- AND, NAND, NOR, XOR gates, Binary half adder, full adder.

UNIT-V

Data Acquisition Systems: Construction and Operation of transducers- Strain guage LVDT, Thermocouple, Instrumentation systems.

Data Converters: R-2R Ladder DAC, Successive approximation and Flash ADC.

Suggested Readings:

1. Robert Boylestad L. and Louis Nashelsky, *Electronic Devices and Circuit Theory*, PHI,2007

2. HelfrickDandDavidCooper,*ModernElectronicInstrumentationandMeasurementsTechniques,* 1st edition, Prentice Hall of India, 2006.

3. Salivahanan, Suresh Kumar and Vallavaraj, *Electronic Devices and Circuits,* 2nd edition, Tata McGraw-Hill,2010.

Course Code	Course Title						Core/Elective
ES216EC	**Digital Electronics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To learn the principles of digital hardware and support given by it to thesoftware.
- To explain the operation and design of combinational and arithmetic logiccircuits.
- To design hardware for real worldproblems.

Course Outcomes

At the end of this course the students will be able to

1. Understand the deign process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logicalfunctions.
2. Understand the number representation and design combinational circuits like adders, MUXetc.
3. Design Combinational circuits using PLDS and write VHDL code for basic gates and combinationalcircuits.
4. Analyse sequential circuits using flip-flops and design registers,counters.
5. Represent a sequential circuit using Finite State machine and apply state minimization techniques to design aFSM

UNIT – I

Design Concepts: Digital Hardware, Design process, Design of digital hardware. Introduction to logic circuits – Variables and functions, Logic gates and networks. Boolean algebra, Synthesis using gates, Design examples. Optimized implementation of logic functions using K-Map and Quine-McCluskey Tabular method

UNIT – II

Number representation: Addition and Subtraction of signed and unsigned numbers.

Combinational circuit building blocks: Half adder, Full adder, Multiplexers. Decoders. Encoders. Code converters, BCD to 7-segment converter, Arithmetic comparator circuits.

UNIT – III

Design of combinational circuits using Programmable Logic Devices (PLDs): General structure of a Programmable Array Logic (PAL), Programmable Logic Arrays(PLAs), Structure of CPLDs and FPGAs, 2-input and 3-input lookup tables (LUTs)

Introduction to Verilog HDL: Verilog code for basic logic gates, adders, decoders

UNIT – IV

Sequential Circuits: Basic Latch, Gated SR Latch, gated D Latch, Master-Slave edge triggered flip-flops, T Flip-flop, JK Flip-flop, Excitation tables. Registers, Counters, Verilog code for flip-flops

UNIT – V

Synchronous Sequential Circuits: Basic Design Steps, Finite State machine(FSM) representation using Moore and Mealy state models, State minimization, Design of FSM for Sequence Generation and Detection, Algorithmic State Machine charts.

Suggested Readings:

1. Moris Mano and Michael D CIletti, Digital Design, Pearson, fourthedition,2008
2. ZviKohavi, Switching and Finite Automata Theory, 3rd ed., Cambridge University Press-New Delhi, 2011.
3. R. P Jain, Modern Digital Electronics,4th ed., McGraw Hill Education (India) Private Limited,2003
4. Ronald J.Tocci, Neal S. Widmer &Gregory L.Moss, "Digital Systems: Principles and Applications," PHI, 10/e,2009.
5. Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis," 2nd Edition, Pearson Education,2006.

Course Code	Course Title						Core/Elective
PC221IT	**Data Structures**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To develop proficiency in the specification, representation, and implementation of abstract data types and datastructures.
- To discuss the linear and non-linear data structures and theirapplications.
- To introduce the creation, insertion and deletion operations on binary search trees and balanced binary search trees.
- To introduce various internal sorting, searching techniques and their timecomplexities

Course Outcomes

After completing this course, the student will be able to:

1. Implement linear, non-linear data structures and balanced binarytrees
2. Understand the basic data structures arrays and linkedlists.
3. Analyse time complexity of both iterative and recursivefunctions.
4. Define ADT necessary for solving problems based on Stacks andQueues.
5. Develop solutions using binary trees, advanced search trees, tries andgraphs.
6. Use hash functions and handlecollisions.
7. Understand various kinds of sorting techniques and apply appropriate techniques for solving a given problem.

UNIT-I

Introduction to C++ and Algorithms: Object oriented Design, Data Abstraction and Encapsulation, Basics of C++: Program organization in C++, Input/output in C++, Classes and Constructors, Access Modifiers, Dynamic Memory Allocation in C++, Templates in C++, Exception Handling.

Algorithms: Introduction, Algorithm Specifications, Recursive Algorithms, Performance Analysis of an algorithm- Time and Space Complexity, Asymptotic Notations.

UNIT-II

Arrays: Abstract Data Types and the C++ Class, Array as an Abstract Data Type, Polynomial Abstract Data Type, Sparse Matrices, Representation of Arrays, String Abstract Data Type.

Stacks and Queues: Templates in C++, Stack Abstract Data Type, Queue Abstract Data type, Sub typing and Inheritance in C++, Evaluation ofExpressions.

UNIT-III

Linked Lists: Singly Linked Lists and Chains, Representing Chains in C++, Template Class Chain, Circular Lists, Available Space Lists, Linked Stacks and Queues, Polynomials, Doubly Linked Lists.

Hashing: Static Hashing, Hash Tables, Hash Functions, Overflow Handling, Theoretical Evaluation of Overflow Techniques

UNIT-IV

Trees: Introduction, Binary Trees, Binary Tree Traversal and Tree Iterators, Copying Binary Trees, Threaded Binary Trees, Heaps, Efficient Binary Search Trees: AVLTrees.

UNIT-V

Sorting and Searching: Insertion sort, Quick sort, Best computing time for Sorting, Merge sort, Heap sort, shell sort, Sorting on Several Keys, List and Table Sorts, Summary of Internal Sorting, Linear and Binary Search algorithms

Graphs: Graph Abstract Data Type, Elementary Graph operations (DFS and BFS), Minimum Cost Spanning Trees (Prim's and Kruskal's Algorithms).

Suggested readings:

1. Ellis Horowitz, Dinesh Mehta, S. Sahani. Fundamentals of Data Structures in C++, Universities Press.2007.
2. Data Structures with C++ by John R. Hubbard (Schaum's Outlines Series)2001
3. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education2006.
4. Michael T. Goodrich, Roberto Tamassia, David Mount, Data Structures and Algorithms in C++, Wiley India Pvt. Ltd,2004.

Course Code	Course Title						Core/Elective
PC222IT	**Mathematical Foundations of Information Technology**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To explain with examples, the basic terminology of functions, relations, andsets.
- To perform the operations associated with sets, functions, andrelations.
- To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology incontext.
- To describe the importance and limitations of predicatelogic.
- To relate the ideas of mathematical induction to recursion and recursively definedstructures.
- To use Graph Theory for solvingproblems.

Course Outcomes

After completing this course, the student will be able to:

1. Illustrate by examples the basic terminology of functions, relations, and sets and demonstrate knowledge of their associatedoperations.
2. Understand basics of counting, apply permutations and combinations to handle different types ofobjects.
3. Describe and use recursively-defined relationships to solve problems using generatingfunctions.
4. Analyse semi group, monoid group and abelian group with suitable examples and appreciate group theory applications in computerarithmetic.
5. Demonstrate in practical applications the use of basic counting principles of permutations, combinations, inclusion/exclusion principle and the pigeonholemethodology.
6. Represent and Apply Graph theory in solving computer scienceproblems

UNIT-I

Mathematical Logic: Statements and notations, Connectives, Well-formed formulas, Truth Tables, tautology, equivalence implication, Normal forms, Quantifiers, universal quantifiers. Predicates: Predicative logic, Free & Bound variables, Rules of inference, Consistency, proof of contradiction, Automatic Theorem Proving.

UNIT-II

Relations: Properties of Binary Relations, equivalence, transitive closure, compatibility and partial ordering relations, Lattices, Hasse diagram. Functions: Inverse Function Composition of functions, recursive Functions, Lattice and its Properties, Algebraic structures: Algebraic systems Examples and general properties, Semi groups and monads, groups sub groups' homomorphism, Isomorphism.

UNIT-III

Elementary Combinatorics: Basis of counting, Combinations & Permutations, with repetitions, Constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, the principles of Inclusion – Exclusion. Pigeon hole principles and itsapplication.

UNIT-IV

Recurrence Relation: Generating Functions, Function of Sequences Calculating Coefficient of generating function, Recurrence relations, Solving recurrence relation by substitution and Generating funds. Characteristics solution of in homogeneous Recurrence Relation.

UNIT-V

Graph Theory: Representation of Graph, DFS, BFS, Spanning Trees, planar Graphs. Graph Theory and Applications, Basic Concepts Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers.

Suggested Readings:

1. Elements of Discrete Mathematics- A Computer Oriented Approach- C L Liu, D P Mohapatra. Third Edition, Tata McGrawHill.
2. Discrete Mathematics for Computer Scientists & Mathematicians, J.L. Mott, A. Kandel, T.P. Baker, PHI.
3. Discrete Mathematics and its Applications, Kenneth H. Rosen, Fifth Edition.TMH.
4. Discrete Mathematical Structures Theory and Application-Malik & Sen,Cengage.
5. Discrete Mathematics with Applications, Thomas Koshy,Elsevier
6. Logic and Discrete Mathematics, Grass Man & Trembley, PearsonEducation

Course Code	Course Title						Core/Elective
ES251EC	**Basic Electronics Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To understand the characteristics of diodes and transistorconfigurations
- To understand the design concepts of biasing of BJT andFET
- To understand the design concepts of feedback amplifiers andoscillators
- To study the design concepts of OP Amp and dataconverters

Course Outcomes

After completing this course, the student will be able to:

1. Ability to design diode circuits & understand the application of Zenerdiode.
2. Ability to analyse characteristics of BJTs &FETs.
3. Ability to understand the different oscillatorcircuits.
4. Ability to understand operation of HWR & FWR circuits with & withoutfilters.
5. Ability tom design Analog-to-Digital converters & Digital-to-Analogconverters.

List of Experiments:

1. CRO-Applications, Measurements of R, L and C using LCR meter, Colour code method and solderingpractice.
2. Characteristics of Semiconductors diode (Ge, Si andZener)
3. Static Characteristics of BJT-CommonEmitter
4. Static Characteristics of BJT-CommonBase
5. Static Characteristics ofFET
6. RC-Phase ShiftOscillator
7. Hartley and ColpittsOscillators
8. Common EmitterAmplifier
9. AstableMultivibrator
10. Full-wave rectifier with and without filters usingBJT
11. Operational AmplifierApplications
12. Strain GaugeMeasurement
13. Analog-to-Digital and Digital to AnalogConverters

SuggestedReading:

1. MaheshwariandAnand,*LaboratoryExperimentsandPSPICESimulationsinAnalogElectronics,* 1st edition, Prentice Hall of India, 2006.
2. David Bell A., *Laboratory Manual for Electronic Devices and Circuits,* Prentice Hall of India,2001.

Course Code	Course Title						Core/Elective
PC252IT	**Data Structures Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To develop skills to design and analyse simple linear and nonlinear data structures, such as stacks, queues and lists and theirapplications.
- To gain programming skills to implement sorting and searchingalgorithms.
- To Strengthen the ability to identify and apply the suitable data structures for the given real world problem
- To Gain knowledge in practical applications of datastructures

Course Outcomes

After completing this course, the student will be able to:

1. Implement various data structures using arrays, linkedlists.
2. Develop ADT necessary for solving problems based on Stacks andQueues.
3. Implement binary trees, general tree structures, advanced search trees, heaps,graphs.
4. Implement hash functions and handlecollisions.
5. Implement various kinds of sorting techniques and apply appropriate techniques for solving a given problem.

List of Programs:

1. Write a C++ program for the implementation of ArrayADT
2. Write a C++ program for the implementation of StringADT
3. Write a C++ program to implement the following usingarray
   a) StackADT b) QueueADT
4. Write a C++ program to implement the following using a single linkedlist
   a) StackADT b) QueueADT
5. Write a C++ program for evaluation of Infix to postfix conversion, evaluation of postfixexpression.
6. Write a C++ program to implement polynomial arithmetic using linkedlist.
7. Write a C++ program to perform followingoperations:
   a) Insert an element into a binary searchtree
   b) Delete an element from a binary searchtree
   c) Search for a key element in a binary searchtree
8. Write a C++ program to implement all the functions of a dictionary(ADT) usinghashing
9. Write C++ program for the implementation of tree traversals on BinaryTrees
10. Write C++ program to perform followingoperations
    a) Insertion intoB-tree b) Deletion into B-tree
11. Write C++ program to perform followingoperations
    a) Insertion intoAVLtree b) Deletion into AVLtree
12. Write C++ program for the implementation of bfs and dfs for a givenGraph
13. Write C++ program to implement Kruskal's algorithm to generate a minimum spanningtree.
14. Write C++ program to implement Prim's algorithm to generate a minimum spanningtree
15. Write C++ program to implement searchingalgorithms.
16. Write C++ program for implementing the following sortingmethods
    a) Selection sort b) Quick sort c) shell sort d) Merge sort e) Heapsort

Course Code	Course Title						Core/Elective
PC253IT	**IT Workshop Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To learn programming of python with a focus of basicstructure.
- To gain programming skills of python using function and OOPconcept.
- To gain practical knowledge of MATLAB toolkit along with operations in matrices and plotting 2D graph.

Course Outcomes

After completing this course, the student will be able to:

1. Implement basic syntax inpython.
2. Analyse and implement different kinds of OOP concept in real worldproblems.
3. Implement MATLAB operations and graphicfunctions.

List of Programming Exercises:

1. Python Variables, Executing Python from the Command Line, Editing Python Files, Python ReservedWords.
2. Comments, Strings and Numeric Data Types, Simple Input andOutput.
3. Control Flow and Syntax, Indenting, if Statement, Relational Operators, Logical Operators, Bit Wise Operators, while Loop, break and continue, for Loop, Lists, Tuples, Sets,Dictionaries.
4. Functions: Passing parameters to a Function, Variable Number of Arguments, Scope, Passing Functions to a Function, Mapping Functions in a Dictionary, Lambda, Modules, StandardModules.
5. OOP concepts: Classes, File Organization, Special Methods, Inheritance, Polymorphism, Special Characters, Character Classes, Quantifiers, Dot Character, Greedy Matches, Matching at Beginning or End, Match Objects, Compiling RegularExpressions.
6. MATLAB Menus, Toolbars, Computing with MATLAB, Script Files and the Editor/Debugger, MATLAB helpSystem.
7. MATLAB controls: Relational Logical Variables. Conditional Statements: if – else – elseif, switch2 10. Loops: for – while – break, continue. User-Defined Functions.
8. Arrays, Matrices and Matrix Operations Debugging MATLAB Programs. Working with Data Files, and Graphing Functions: XY Plots –Sub-plots.

Suggested Readings:

1. Mark Summerfield," Programming inPython
2. A Complete introduction to the Python Language", Addison-Wesley Professional,2009.
3. Martin C. Brown," PYTHON: The Complete Reference", McGraw-Hill,2001.
4. W.J. Palm III, Introduction to MATLAB 7 for Engineers, McGraw-Hill International Edition,2005.
5. Wesley J Chun," Core Python Applications Programming", Prentice Hall,2012.
6. Allen B Downey," Think Python", O'Reilly,2012.
7. Stormy Attaway, "MATLAB: A Practical Introduction to Programming and Problem Solving".3rd Edition.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Information Technology) IV – SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	MC112CE	Environmental Sciences	2	-	-	2	30	70	3	-
2	HS204ME	Operations Research	3	-	-	3	30	70	3	3
3	BS206BZ	Biology for Engineers	3	-	-	3	30	70	3	3
4	ES215EC	Signals and Systems	3	-	-	3	30	70	3	3
5	PC231IT	JAVA Programming	3	-	-	3	30	70	3	3
6	PC232IT	Database Systems	3	-	-	3	30	70	3	3
7	PC233IT	Computer Organization and Microprocessor	3	-	-	3	30	70	3	3
8	PC234IT	Data Communications	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
9	PC261IT	Microprocessor Lab	-	-	2	2	25	50	3	1
10	PC262IT	JAVA Programming Lab	-	-	2	2	25	50	3	1
11	PC263IT	Database Systems Lab	-	-	2	2	25	50	3	1
			23	**-**	**06**	**29**	**315**	**710**		**24**

Course Code	Course Title						Core/Elective
MC112CE	**Environmental Science**						**Mandatory**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

- To create awareness and impart basic knowledge about the environment and its alliedproblems.
- To know the functions ofecosystems.
- To understand importance of biologicaldiversity.
- To study different pollutions and their impact onenvironment.
- To know social and environment related issues and their preventivemeasures.

Course Outcomes

After completing this course, the student will be able to:

1. Adopt environmental ethics to attain sustainabledevelopment.
2. Develop an attitude of concern for theenvironment.
3. Conservation of natural resources and biologicaldiversity.
4. Creating awareness of Green technologies for nation'ssecurity.
5. Imparts awareness for environmental laws andregulations.

UNIT-I

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, need for public awareness.

Natural Resources: Water Resources – Use and over utilization of surface and ground water, flood, drought, conflicts over water, Dams: Benefits and Problems. Food Resources –World Food Problems, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, Forest Resources –Use and over exploitation, deforestation & its effect on tribal people. Land Resources –Land Degradation, environmental effect of mining, man induced landslides, soil erosion and desertification**.** Energy Resources –Growing energy needs, Renewable and Non-renewable energyresources.

UNIT-II

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in ecosystem, food chains, ecological pyramids, ecological succession, types of ecosystems (marine, pond, river, forest, grassland, desert)

UNIT-III

Biodiversity: Levels of Biodiversity, Bio-geographical classification of India, Value of biodiversity, Threats to biodiversity, endangered and endemic species of India, Conservation of biodiversity, global and national efforts.

UNIT-IV

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution, solid waste management.

Environment Protection Act: Air, water, forest and wildlife Acts, issues in the enforcement of environmental legislation.

UNIT-V

Social Issues and the Environment: Watershed management and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Environmental Disaster Management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology. Disaster management cycle and disaster management in India.

Field Work:

- Visit to a local area to document environmental issues- agricultural area/ pond/lake/terrestrial ecosystem
- Visit to a local polluted area- market/slum area/Industrial area/trafficarea

Suggested Readings:

1. A.K. De, *Environmental Chemistry,* Wiley EasternLtd.
2. E.P. Odum, *Fundamentals of Ecology,* W.B. Sunders Co.,USA.
3. M.N. Rao and A.K. Datta, *Waste Water Treatment,* Oxford and IBKPublications.
4. Benny Joseph, *Environmental Studies,* Tata McGraw Hill,2005.
5. V.K. Sharma, *Disaster Management,* National Centre for Disaster Management,IIPE,1999.

Course Code	Course Title						Core/Elective
HS204ME	**Operations Research**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Use variables for formulating complex mathematical models in management science, industrial engineering and transportationmodels.
- Use the basic methodology for the solution of linear programmingproblems.
- Understand the mathematical tools that are needed to solve optimization problems like Transportation models and Assignmentmodels.
- Understand the replacement models with change in money value considering with time and without time.
- Model a system as a queuing model and compute important performancemeasures

Course Outcomes

After completing this course, the student will be able to:

1. Prepare the students to have the knowledge of Linear Programming Problem inOperations
2. Research at the end students would be able to understand the concept and develop the models for differentapplications.
3. Make students understand the concept Replacement models at the end students would able to explain various features and applications of replacement models in real timescenario.
4. Prepare the students to understand theory of Game in operations research at the end students would able to explain application of Game theory in decision making for aconflict
5. Prepare the students to have the knowledge of Sequencing model at the end student would able to develop optimum model for job scheduling.
6. Prepare students to understand Queuing theory concepts and various optimization techniques at the end students would able to develop models for waiting linecases.

UNIT-I

Introduction: Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method, maximization and minimization, Degeneracy in LPP, Unbounded and, Infeasible solutions.

UNIT-II

Duality: Definition, Relationship between primal and dual solutions, Economic Interpretation, Post optimal of sensitivity analysis, Dual Simplex Method.

UNIT-III

Transportation Models: Finding an initial feasible solution - North West corner method, least cost method, Vogel's Approximation method, Finding the optimal solution, optimal solution by stepping stone and MODI methods, Special cases in Transportation problems - Unbalanced Transportation problem.

Assignment Problems: Hungarian method of Assignment problem, Maximization in Assignment problem, unbalanced problem, problems with restrictions, travelling salesman problems.

UNIT-IV

Replacement Models: Introduction, replacement of items that deteriorate ignoring change in money value, replacement of items that deteriorate considering change in money value with time, replacement of items that fail suddenly - Individual replacement policy, Group replacement policy.

Game Theory: Introduction, 2 person zero sum games, Maximin - Minimax principle, Principle of Dominance, Solution for mixed strategy problems, Graphical method for 2 x n and m x 2 games.

UNIT-V

Sequencing Models: Introduction, General assumptions, processing n jobs through 2 machines, processing 'n' jobs through m machines, Processing 2 jobs through m machines

Queuing Theory: Introduction, single channel - Poisson arrivals - exponential service times with infinite population & finite population, Multi channel - poison arrivals - Exponential service times with infinite population.

Introduction to Optimization Techniques: Single objective & Multi objective optimization Techniques like G.A, NSGA, P.Q.O & MPSOTechniques.

Suggested Readings:

1. Hamdy, A. Taha, Operations Research-An Introduction, Sixth Edition, Prentice Hall of India Pvt. Ltd.,1997.
2. S.D. Sharma, Operations Research, Kedarnath, Ramnath & Co., Meerut,2009.
3. Hrvey M. Wagner, Principles of Operations Research, Second Edition, Prentice Hall of India Ltd., 1980.
4. V.K. Kapoor, Operations Research, S. Chand Publishers, New Delhi,2004.
5. R. Paneer Selvam, Operations Research, Second Edition, PHI Learning Pvt. Ltd., New Delhi,2008.
6. Data Reconciliation by Prof. ShankerNarasimha

Course Code	Course Title						Core/Elective
BS206BZ	**Biology for Engineers**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system.

Course Outcomes

After completing this course, the student will be able to:

1. Apply biological engineering principles, procedures needed to solve real-worldproblems.
2. Understand the fundamentals of living things, their classification, cell structure and biochemical constituents.
3. Apply the concept of plant, animal and microbial systems and growth in real lifesituations.
4. Comprehend genetics and the immunesystem.
5. Know the cause, symptoms, diagnosis and treatment of commondiseases.
6. Apply basic knowledge of the applications of biological systems in relevantindustries.

UNIT-I

Introduction to Life: Characteristics of living organisms, Basic classification, cell theory, structure of prokaryotic and eukaryotic cell, Introduction to Biomolecules: definition, general classification and important functions of carbohydrates, lipids, proteins, vitamins andenzymes.

UNIT-II

Biodiversity: Plant System: basic concepts of plant growth, nutrition, photosynthesis and nitrogen fixation. Animal System: Elementary study of digestive, respiratory, circulatory, excretory systems and their functions. Microbial System: History, types of microbes, economic importance and control ofmicrobes.

UNIT-III

Genetics and Evolution: Theories of evolution and Evidences; cell division–mitosis and meiosis; evidence of laws of inheritance; variation and speciation; nucleic acids as a genetic material; central dogma; Mendel laws, gene and chromosomes.

UNIT-IV

Human Diseases: Definition, causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis. Immunity immunization, antigen – antibody immune response.

UNIT-V

Biology and its Industrial Applications: Transgenic plants and animals, stem cell and tissue engineering, bioreactors, bio pharming, recombinant vaccines, cloning, drug discovery, biological neural networks, bioremediation, biofertilizer, biocontrol, biofilters, biosensors, biopolymers, bioenergy, biomaterials, biochips, basic biomedical instrumentation.

Suggested readings:

1. A Text book of Biotechnology, R.C. Dubey, S. Chand Higher Academic Publications,2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company,2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

4. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis,2011
5. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning,2008
6. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers,2012.

Course Code	Course Title						Core/Elective
ES215EC	**Signals and Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplacetransforms.
- To understand Sampling theorem, with time and frequency domain analysis of discrete time signals with DTFS, DTFT andZ-Transform.
- To present the concepts of convolution and correlation integrals and also understand the properties in the context of signals/systems and lay down the foundation for advancedcourses.

Course Outcomes

1. Define and differentiate types of signals and systems in continuous and discretetime
2. Apply the properties of Fourier transform for continuous timesignals
3. Relate Laplace transforms to solve differential equations and to determine the response of the Continuous Time Linear Time Invariant Systems to knowninputs
4. Apply Z-transforms for discrete time signals to solve Differenceequations
5. Obtain Linear Convolution and Correlation of discrete time signals with graphicalrepresentation

UNIT-I

Some useful operations on signals: Time shifting, Time scaling, Time inversion. Signal models: Impulse function, Unit step function, Exponential function, Even and odd signals. Systems: Linear and Non-linear systems, Constant parameter and time varying parameter systems, Static and dynamic systems, Causal and Non-causal systems, Lumped Parameter and distributed parameter systems, Continuous-time and discrete-time systems, Analog and digital systems.

UNIT-II

Fourier series: Signals and Vectors, Signal Comparison: correlation, Signal representation by orthogonal signal set, Trigonometric Fourier Series, Exponential Fourier Series, LTI system response to periodic inputs.

UNIT-III

Continuous-Time Signal Analysis: Fourier Transform: Aperiodic signal representation by Fourier integral, Fourier Transform of some useful functions, Properties of Fourier Transform, Signal transmission through LTI Systems, ideal and practical filters, Signal energy. Laplace transform: Definition, some properties of Laplace transform, solution of differential equations using Laplacetransform.

UNIT-IV

Discrete-time signals and systems: Introduction, some useful discrete-time signal models, Sampling continuous-time sinusoids and aliasing, Useful signal operations, examples of discrete-time systems. Fourier analysis of discrete-time signals, periodic signal representation of discrete-time Fourier series, aperiodic signal representation by Fourierintegral.

UNIT-V

Discrete-time signal analysis: Z-Transform, some properties of Z-Transform, Solution to Linear difference equations using Z-Transform, System realization. Relation between Laplace transform and Z-Transform. DTFT: Definition, Properties of DTFT, comparison of continuous-time signal analysis with discrete-time signal analysis.

Suggested Readings:

1. B. P. Lathi, *Linear Systems and Signals,* Oxford University Press, 2nd Edition,2009
2. Alan V O P Penheim, A. S. Wlisky, *Signals and Systems,* 2nd Edition, PrenticeHall
3. Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, *Signals and Systems,* 4th Edition, Pearson 1998.
4. Douglas K. Linder, *Introduction to Signals and Systems,* McGraw Hill,1999
5. P. Ramakrishna Rao, *Signals and Systems,*TMH.

Course Code	Course Title						Core/Elective
PC231IT	**JAVA Programming**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To understand fundamentals of object-oriented programming in Java which includes defining classes, invoking methods, difference between applet and application programs, using classlibraries
- To create Java application programs using sound OOP practices such as interfaces, exception handling,multithreading.
- Use Collection framework, AWT and event handling to solve real worldproblems.
- Exploring Swing, and implementingServlets.

Course Outcomes

1. Achieve proficiency in object-oriented concepts and also learns to incorporate the same into the Java programminglanguage.
2. Create Java application programs using sound OOP practices e.g. Inheritance, interfaces and proper program structuring by using packages, access controlspecifiers.
3. Understand and Implement the concepts of Exception Handling injava.
4. Develop the ability to solve real-world problems through software development in high-level programming language using Large APIs of Java as well as the Java standard classlibrary.
5. Understand File, Streams, Input and Output Handling injava.
6. Create graphical user interface and Applets in java as well as apply the knowledge of Event Handling.

UNIT- I

Object Oriented Programming: Principles, Benefits of Object Oriented Programming.

Introduction to Java: Java buzzwords, bytecode. Java Programming Fundamentals: Applet and Application program using simple java program, data types, variables, arrays, operators, expressions, control statements, type conversion and casting, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, introducing access control, static, final, nested and inner classes, exploring string class, using command-linearguments.

Inheritance: Inheritance concept, types of inheritance, Member access rules, use of super and final. Polymorphism - dynamic binding, method overriding, abstract classes and methods.

UNIT - II

Interfaces: Defining an interface, implementing interfaces, extending interface.

Packages: Defining, Creating and Accessing a Package, importing packages

Exception handling: Benefits of exception handling, classification, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, built in exceptions, creating own exception sub classes

Multithreading: Java Thread Model, The Main Thread, creating a Thread, creating multiple threads, using is Alive() and join(), thread priorities, synchronization, inter thread communication,deadlock

UNIT- III

Collections: Overview of Java Collection frame work, commonly used Collection classes – Array List, Linked List, Hash Set, Tree Set, Collection Interfaces – Collection, List, Set. Accessing Collection via

iterator, working with Map. Legacy classes and interfaces – Vector, Hashtable, Stack, Dictionary, Enumeration interface.

Other Utility classes: String Tokenizer, Date, Calendar, Gregorian Calendar, Scanner

Java Input/Output: exploring java.io, Java I/O classes and interfaces, File, Stream classes, byte stream, character stream, serialization.

UNIT- IV

GUI Programming with java: The AWT class hierarchy, MVC architecture. Applet Revisited: Basics, architecture and skeleton, simple applet program.

Event Handling: Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. Handling mouse and keyboard events, Adapter classes.

Database Programming using JDBC: Introduction to JDBC, JDBC Drivers & Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.

UNIT V

Exploring Swing: JLabel, ImageIcon, JTextField, the Swing buttons, JTabbedpane, JScrollPane, JList, JComboBox.

Servlet: Life cycle, using tomcat, simple servlet, servlet API, javax.servlet package, reading servlet parameters, javax.servlet.http package, handling HTTP requests and responses

Suggested Readings:

1. Herbert Scheldt, "The Complete Reference Java, 7th Edition, Tata McGraw Hill,2006.
2. James M Slack, Programming and Problem Solving with JAVA, Thomson Learning,2002.
3. C Thomas Wu, An Introduction to Object Oriented Programming with Java 5th Edition, McGraw Hill Publishing,2010.
4. H. M. Dietel and P. J. Dietel, Java How to Program, Sixth Edition, Pearson Education /PHI.

Course Code	Course Title						Core/Elective
PC232IT	**Database Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To get familiar with fundamental concepts of database management which includes database design, database languages, and database-systemimplementation.
- To get familiar with data storage techniques andindexing.
- To impart knowledge in transaction Management, concurrency control techniques and recovery techniques.
- To master the basics of SQL and construct queries usingSQL.
- To become familiar with database storage structures and accesstechniques.

Course Outcomes

1. Developtheknowledgeoffundamentalconceptsofdatabasemanagementand Designingadatabase using ER modellingapproach.
2. Implement storage of data, indexing, andhashing.
3. Applytheknowledgeabouttransactionmanagement,concurrencycontrolandrecoveryofdatabase systems.
4. Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on thedata.
5. Apply normalization for the development of applicationsoftware.

UNIT-I

Introduction to Database: File System Organization: Sequential - Pointer - Indexed – Direct. Purpose of Database System - Database Characteristics - Users of Database System - Advantages of DBMS Approach - Schemas and Instances - Three Schema Architecture and Data Independence - The Database System Environment - Relational Algebra.

UNIT-II

Logical Database Design: Relational DBMS - Codd's Rule - Entity-Relationship model - Extended ER Normalization - Functional Dependencies - Anomaly - 1NF to 5NF - Domain Key Normal Form – Denormalization.

UNIT-III

Indexing: Types of Single Level Ordered Indexes - Multilevel Indexes - Dynamic Multilevel Indexes. **Transaction Processing and Concurrency Control**: Transaction Concepts - ACID Properties - Transaction States - Concurrency Control Problems - Serializability - Recoverability - Pessimistic and Optimistic Concurrency Control Schemes.

UNIT-IV

Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying /altering Tables and Views.

Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.

UNIT-V

Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Comparison using Null values – Logical connectivity's – AND, OR and NOT – Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL Triggers and Active Data bases.

Advanced Topics: Overview: Parallel Database - Multimedia Database - Mobile Database - Web Database - Multidimensional Database. Data Warehouse - OLTP Vs OLAP - NoSQL Database.

Suggested Readings:

1. Abraham Silberchatz, Henry F Korth and Sudarshan S, "Database System Concepts", Tata McGraw-Hill, New Delhi,2010.
2. RamezElmasri and Shamkant B Navathe, "Fundamentals of Database Systems", Addison Wesley, USA,2010.
3. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Tata McGraw-Hill, New Delhi,2008.
4. Gupta G K, "Database Management System", Tata McGraw-Hill, New Delhi,2011.
5. Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi,2009

Course Code	Course Title						Core/Elective
PC233IT	**Computer Organization and Microprocessor**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To provide in depth knowledge to the students about the design and organization of a digital computer, operation of various functional units, instruction set design and factors that influence the performance of acomputer.
- To enable the students with the understanding of basic computer architecture with instruction set and programming of 8085 inparticular.
- To learn the functionality and interfacing of various peripheraldevices.

Course Outcomes

1. To understand the architecture of modern computer, Busstructures.
2. Analyse the Different memories and evaluate the mappingtechniques.
3. Discuss the architecture, the instruction set and addressing modesof8085 processor
4. AnalyseStacks,Subroutine,Interruptsof8085,different PPI techniques, the uses of interfaces 8259, RS 232C, USART (8251), and DMAcontroller
5. Design the applications of interfacing circuits 8254/8253timer, A/D and D/A converter, Keyboard/Displaycontroller.

UNIT-I

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance, Multiprocessors and Multicomputers, Historical perspective.

Input/output Organization: Accessing I/O devices, Interrupts, Processor examples, Direct memory access, parallel interface and serial interface.

UNIT-II

The Memory System: Basic concepts, Semiconductor RAM memories, Read-Only memories, Speed, Size and Cost, Cache memories, Performance considerations, Virtual Memories, Memory management requirements, Secondary Storage.

UNIT-III

8085 Architecture: Introduction to microprocessors and microcontrollers, 8085 Processor Architecture, Internal operations, Instructions and timings. Programming the 8085 - Introduction to 8085 instructions, Addressing modes and Programming techniques with Additional instructions.

UNIT-IV

Stacks and subroutines, interfacing peripherals - Basic interfacing concepts, interfacing output displays, Interfacing input keyboards. Interrupts - 8085 Interrupts, Programmable Interrupt Controller (8259A). Direct Memory Access (DMA) - DMA Controller (Intel 8257), Interfacing 8085 with Digital to Analog and Analog to Digital converters.

UNIT-V

Programmable peripheral interface (Intel 8255A), Programmable communication interface (Intel 8251), Programmable. Interval timer (Intel 8253 and 8254), Programmable Keyboard /Display controller (Intel 8279). Serial and parallel bus standards RS 232 C, IEEE 488.

Suggested Readings:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, McGraw Hill, 2002.
2. Ramesh S Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 5/E Prentice Hall,2002.
3. Pal Chouduri, Computer Organization and Design, Prentice Hall of India,1994.
4. M. M. Mano, Computer System Architecture, 3rd Edition, PrenticeHall.

Course Code	Course Title						Core/Elective
PC234IT	**Data Communications**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Tounderstandthebasicsofdatatransmission,transmissionmedia,datacommunicationssystemand itscomponents.
- To describe various encoding and modulation schemes, various data link protocols for flow control, error detection andcorrection.
- To understand different types of multiplexing, spread spectrum techniques, Ethernet, services of WLANs and Bluetooth.

Course Outcomes

1. Demonstrate systematic understanding of Data CommunicationTechniques.
2. Apply various encodingschemes.
3. Understand multiplexingtechniques.
4. Get acquainted with the concepts of virtual circuitnetworks.
5. Understand various types of switchingtechniques.
6. Understand concepts of wirelessLANs.

UNIT-I

Introduction: Communication model and Modulation Techniques (AM, FM and PM), Data Communication networking, Protocols and Architecture, Standards.

Data Transmission: Concepts and Terminology, Analog and Digital Transmission, Transmission Impairments, Transmission media.

Data Encoding: Digital Data Digital Signals, Digital Data-Analog Signals, Analog Data- Digital Signals, Analog Data-Analog Signals.

UNIT-II

Data Communication Interface: Asynchronous and Synchronous Transmission, Line Configuration, Interfacing.

Data Link Control: Flow Control, Error Detection, Error Control, HDLC, Other Data link Control Protocols, Performance Issues**.**

UNIT-III

Multiplexing & Switching: Frequency Division Multiplexing, Wavelength Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing. Asymmetric Digital Subscriber Line, xDSL. Circuit Switching, Packet Switching & Frame Relay. ATM: Architecture, Logical Connection, ATM Cells, Transmission of ATM cells.

UNIT-IV

Ethernets: Traditional Ethernet Topologies and Transmission Media, LAN protocol architecture, MAC sub layer, CSMA/CD, Physical Layer, Bridged, Switched and Full Duplex Ethernets. Fast Ethernet: MAC sub Layer, Physical layer, Gigabit Ethernet: MAC sub Layer, Physical Layer

UNIT-V

Cellular Wireless Networks: Principles of Cellular Networks, First Generation Analog, Second Generation CDMA and Third Generation Systems.

Wireless LANs: Overview, Wireless LAN Technology, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE 802.11 Physical Layer.

Bluetooth & Zigbee: Architecture, Layers and Protocols.

Suggested Readings:

1. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, Asia-2004.
2. Behrouz A. Forouzan, "Data Communications and Networking", 4th Edition, Tata McGraw Hill, 2006.
3. Simon Haykins "Communication Systems", 2nd Edition, John Wiley &Sons
4. Drew Gislason "Zigbee Wireless Networking" Elsevier Published: August2008

Course Code	Course Title						Core/Elective
PC261IT	**Microprocessor Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

The objectives of the course are to impart knowledge of the:

- To become familiar with the architecture and Instruction set of Intel 8085microprocessor.
- To provide practical hands on experience with Assembly LanguageProgramming.
- Tofamiliarizethestudentswithinterfacingofvariousperipheraldeviceswith8085microprocessors.

Course Outcomes

After the completion of the course, the student will be able to:

1. Interpret the principles of Assembly Language Programming, instruction set in developing microprocessor basedapplications.
2. Develop Applications such as: 8-bit Addition, Multiplication, Division, array operations, swapping, negative and positivenumbers.
3. Analyse the interfaces like serial ports, digital-to-analog Converters and analog-to-digital converters etc.
4. Build interfaces of Input-output and other units like stepper motor with8085.
5. Analyse the function of traffic lightcontroller.

List of Experiments

1. Tutorials on 8085Programming.
2. Interfacing and programming of 8255. (E.g. traffic lightcontroller).
3. Interfacing and programming of8254.
4. Interfacing and programming of8279.
5. A/D and D/A converterinterface.
6. Stepper motorinterface.
7. Displayinterface

Note: Adequate number of programs covering all the instructions of 8085 instruction set should be done on the 8085 microprocessor trainer kit

Course Code	Course Title						Core/Elective
PC262IT	**JAVA Programming Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To build software development skills using java programming for real worldapplications.
- To implement frontend and backend of anapplication
- To implement classical problems using javaprogramming.

Course Outcomes

After completing this course, the student will be able to:

1. Develop Java applications using the concepts of Inheritance, interfaces, packages, access control specifiers.
2. Implement the concepts of Exception Handling in javaApplications.
3. Read and write data using different Java I/Ostreams.
4. Create graphical user interfaces and Applets by applying the knowledge of EventHandling.
5. Create robust applications using Java standard class libraries and retrieve data from a database with JDBC.
6. Ability to solve real-world problems by designing user friendly GUI with befitting backend through the APIs ofJava.

List of Experiments

1) Write a Java program to illustrate the concept of class with methodoverloading
2) Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java.util)
3) Write a Java program to illustrate the concept of Single level and Multi levelInheritance.
4) Write a Java program to demonstrate the Interfaces & AbstractClasses.
5) Write a Java program to implement the concept of exceptionhandling.
6) Write a Java program to illustrate the concept of threading using Thread Class and runnable Interface.
7) Write a Java program to illustrate the concept of Threadsynchronization.
8) Write a Java program that correctly implements producer consumer problem using the concept of inter threadcommunication.
9) Write a Java program to illustrate collection classes like Array List, LinkedList, Tree map and Hash map.
10) Write a Java program to illustrate Legacy classes like Vector, Hashtable, Dictionary & Enumeration interface
11) Write a Java program to implement iteration over Collection using Iterator interface and List Iterator interface
12) Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file inbytes.
13) Write a Java program to illustrate the concept of I/OStreams
14) Write a Java program to implement serializationconcept
15) Write a Java applet program to implement Colour and Graphicsclass
16) Write a Java applet program for handling mouse & keyevents
17) Write a Java applet program to implement Adapterclasses

18) Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display theresult.
19) Write an example for JDBC prepared statement withResultSet
20) Program to get primary key value (auto-generated keys) from inserted queries usingJDBC
21) Program to create a simpleJList
22) java Program to create a simple checkbox usingJCheckBox
23) Program to create a checkbox and ItemListener toit.
24) 1. Write Servlet application to print current date &time
    2. Html & ServletCommunication
    3. Auto refresh apage
    4. Demonstrate sessiontracking
    5. Select record fromdatabase
    6. Application for loginpage
    7. Insert record intodatabase
    8. Count the visits on webpage
    9. Insert teacher record inDatabase

Course Code	Course Title						Core/Elective
PC263IT	**Database Systems Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

The objectives of the course are to impart knowledge of:

- To practice various DDL commands inSQL
- To write simple and Complex queries inSQL
- To familiarizePL/SQL

Course Outcomes

After the completion of the course, the student will be able to:

1. Design and implement a database schema for a givenproblem
2. Develop the query statements with the help of structured querylanguage.
3. Populate and query a database using SQL andPL/SQL
4. Develop multi-user databaseapplication
5. Design GUI using forms and implement databaseconnectivity.

List of Programs

1. Creation of database (exercising the commands forcreation)
2. Simple condition query creation using SQLPlus
3. Complex condition query creation using SQLPlus
4. Usage of Triggers and StoredProcedures.
5. Creation of Forms for student Information, library information, Pay rolletc.
6. Writing PL/SQL procedures for datavalidation
7. Generation using SQLreports
8. Creating Password and Security features forapplications.
9. Usage of File locking table locking, facilities inapplications.
10. Creation of small full pledged database application spreading over to 3sessions.

Note: The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

Suggested Readings:

1. Nilesh Shah, Database System Using Oracle, PHI,2007.
2. Rick F Vander Lans, Introduction to SQL, Fourth edition, PearsonEducation,2007.
3. Benjamin Rosenzweig, Elena Silvestrova, Oracle PL/SQL by Example, Third edition, Pearson Education,2004.
4. Albert Lulushi, Oracle Forms Developer's Handbook, Pearson Education,2006.

SCHEME OF INSTRUCTION & EXAMINATION
B.E (INFORMATION TECHNOLOGY)

V Semester (2020-21)

S. No.	Course Code	Course Title	Scheme of Instruction: Periods Per week L	T	D/P	Contact per week Hrs	Scheme of Examination: Maximum Marks CIE	SEE	Duration in Hrs	Credits
Theory Course										
1.	PC 501 IT	Web Application Development	3	1	-	4	30	70	3	3
2.	PC 502 IT	Operating Systems	3	1	-	4	30	70	3	3
3.	PC 503 IT	Automata Theory	3	1	-	4	30	70	3	3
4.	PC 504 IT	Computer Networks	3	1	-	4	30	70	3	3
5.	PC 505 IT	**Software Engineering**	3	-	-	3	30	70	3	3
6.	PE-I	Professional Elective – I	3	-	-	3	30	70	3	3
Practical/Laboratory Courses										
7.	PC531 IT	Computer Networks Lab	-	-	2	2	25	50	3	1
8.	PC532 IT	Operating Systems Lab	-	-	2	2	25	50	3	1
9.	PC533 IT	Web Application Development Lab	-	-	2	2	25	50	3	1
Total			**21**	**04**	**06**	**31**	**285**	**640**	**-**	**21**

Profession Elective – I	
Course Code	Course Title
PE 511 IT	Artificial Intelligence
PE 512 IT	Computer Graphics
PE 513 IT	Image Processing

Course Code	Course Title						Core/Elective
PC 501 IT	**WEB APPLICATION DEVELOPMENT**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objective:

- To develop dynamic web applications using the concepts of HTML 5.0 and CSS
- To understand the document structure and schemas and represent data in that format
- To develop applications using JQuery and represent objects in JSON notation
- To implement applications using angular JS
- To understand the MEAN Stack and SMACK stack and develop applications using the framework

Course Outcomes:

Students will able to

- Design and develop dynamic web sites using Html 5.0, CSS, JQuery.
- Develop web content publishing applications that accesses data in XML or JSON format
- Develop single page web applications using Angular JS
- Design and develop big data applications using Mean stack and SMACK stack Frameworks.

UNIT I

HTML and CSS

Introduction: Web Application Fundamentals: protocols and web servers

HTML 5.0: Basic tags, Form elements and attributes, validation

Cascading Style Sheets CSS selectors, CSS BOX Model, CSS Positioning

UNIT II

XML: The Syntax of XML, XML Document Structure, Document Type Definitions, Name Space, XML Schemas

UNIT III

Java Script and JQuery: JQuery: Introduction to JQuery, JQuery Syntax, Selectors, HTML Manipulation, Effects and Events

JSON: JSON Introduction, Syntax, Data Types, Objects, Schema, Comparison with XML.

Java Script: Introduction to JavaScript, Selecting elements in the documents, Event handling

Unit IV

Angular JS: Preparing Development Environment, Angular modules and Controllers, Input Validation, Data Binding and Templates, Angular JS Services

Unit V

MEAN Stack, SMACK Stack : Introduction to MEAN Stack, SMACK Stack, Apache, Building Backend and Testing- Angular JS, Node JS, Express and Mongo DB

Suggested Readings:

1. Robert W. Sebesta, "Programming with World Wide Web", 8th Edition, Pearson Education, 2008.
2. John Pollak, "JQuery - A Beginners Guide", McGraw Hill Education, 2014.
3. AgusKurniawan,"AngularJS Programming by Example",PE Press, First Edition
4. Colin J Ihrig, : Full Stack JavaScript Development with MEAN, SitePoint, 2015 Edition
5. Raul Estrada,:Fast Data Processing Systems with SMACK Stack,Packt, December 2016

Course Code	Course Title						Core/Elective
PC 502 IT	**OPERATING SYSTEMS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives

- To understand the working of computer system and the basic concepts of operating system and the services provided by it.
- To understand the functions and management of different resources of the operating system (Processor, I/O, and Memory etc)
- To understand process management concepts including scheduling, synchronization, deadlocks
- To learn the mechanisms involved in memory management and I/O subsystems of an operating system.
- To understand issues of protection and security

Course Outcomes

Student will able to

- Explain the fundamental concepts and functions of operating system.
- Understand process scheduling in a multi-programming environment and implementing process scheduling algorithms.
- Write application and system calls related programs for managing processes, memory, I/O and inter-process Communication related system calls.
- Understand memory management, disk management techniques, including virtual memory and file system structure.
- Explain protection and security related issues of the computer system.

UNIT-I

Introduction: Computer System organization & Architecture, Operating System Structure &Operations, Process, Memory and Storage Managements, Protection and Security, Distributed and Special-Purpose Systems, Computing Environments.

System Structures: Operating-System Services, User Operating System Interface, System calls, Types of System Calls, System Programs, Operating-System Structure, Virtual Machines, Operating – System Generation, System Boot.

Process Concept: Overview, Process Scheduling, Operations on Processes, Interprocess communication, Examples of IPC Systems, Communication in Client/Server Systems.

Multithreaded Programming*:* Overview, Multithreading Models, Thread Libraries, Threading Issues, Operating-System Examples.

UNIT II

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multi-ProcessorScheduling, Thread Scheduling: Pthreads , Operating System Examples, Algorithm Evaluation.

Process Coordination and **Synchronization**: Background, The Critical-Section Problem, Peterson'sSolution,Synchronization, Monitors, Synchronization Examples.
Deadlocks: System Model, Deadlock characterization, Methods for Handling Deadlocks,DeadlockPrevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT III

Memory-Management Strategies: Background, Swapping, Contiguous Memory Allocation, Paging,Structure
of the Page Table, Segmentation, Example: The Intel Pentium.

Virtual Memory Management: Background, Demand paging, Copy-on-write, PageReplacement,Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory, Other Considerations,
Storage Management: File System, File Concept, Access Methods, Directory Structure, File-SystemMounting, File sharing, Protection.

UNIT IV

Implementing File Systems: File System-Structure, File-System Implementation, DirectoryImplementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery, Log-Structured File Systems, NFS.

Secondary –Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, RAID Structure, Stable-Storage Implementation, Tertiary-Storage Structure.
I/O Systems: Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystems, Transforming I/O Request to Hardware Operations, STREAMS, Performance.

UNIT V

Protection *and Security:* Goals of Protection, Principles of Protection, Domain of protection, Access Matrix, Implementation of Access Matrix, Access control, Revocation of access rights, Capability-based Systems, Language-based protection.
System Security: The security problem, program Threats, System and System Network Threats, Cryptography as a Security tool, User Authentication, Implementing Security Defences, firewalling to protect Systems and Networks, Computer Security Classification, Case Studies- Linux System.
Real-time systems: - Overview, System Characteristics, Features of Real time kernels, Implementing Real time operating Systems, Real Time CPU Scheduling, An Example: VxWorks, Linux System.

Suggested Reading

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating System principles, seventh Edition, John wiley& sons publication,2006 .
2. A.Tanenbaum-Modern Operation Systems. Third edition, Pearson Education, 2008.
3. William Stallings-Operating Systems, Fifth Edition, Pearson Education, 2005.
4. Ida M.Flynn, Understanding Operating Systems, Sixth Edition, Cengage, 2011

Course Code	Course Title						Core/Elective
PC 503IT	**AUTOMATA THEORY**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- Provides basic properties of formal languages and formal grammars, deterministic and nondeterministic finite automata, relation between types of languages and types of finite automata.
- Provides basic properties of Pushdown Automata and Turing machines and computing with Turing machines and PDA.
- Understand the challenges for Theoretical Computer Science and its contribution to other sciences

Course Outcomes

Student will able to

- Design and use deterministic, nondeterministic, and epsilon transition finite state automata and illustrate state transition on symbols of input words and establish the corresponding language of automata.
- Analyze Regular Expressions and use Laws and establish the corresponding Regular Language. Prove a given language is regular or otherwise. Use Closure and Decision Properties of Regular Language.
- Analyze ambiguity. Develop Context Free Grammars, Parse Tees and establish Context Free Language. Use Closure and Decision Properties of Regular Language.
- Design Pushdown Automata and illustrate the working. Develop deterministic Pushdown Automata and establish equivalence of language of PDA and CFG.
- Design Turing Machine and illustrate its working, implement programming techniques for Turing Machines, analyze extended and restricted Turing Machines for computational abilities, and establish the Recursively Enumerable language of Turing Machine and analyze the Undecidable problems.

UNIT I

Automata: Introduction to Finite Automata, Central Concepts of Automata Theory.
Finite Automata: An informal picture of Finite Automata, Deterministic Finite Automata, Nondeterministic Finite Automata, An Application, Finite Automata with Epsilon Transitions.

UNIT II

Regular Expression And languages: Regular Expressions, Finite Automata and Regular Expression, Applications of Regular Expressions, Algebric Laws for Regular Expression.
Properties of Regular Languages: Proving Languages not to be Regular, Closure Properties of Regular Languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.

UNIT III

Context Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications, Ambiguity in Grammars and Languages

Properties of Context Free Languages: Normal Forms for Context-Free Grammars, Pumping Lemma, Closure Properties, Decision Properties of CFL's.

UNIT IV

Pushdown Automata: Definition, Language of PDA, Equivalence of PDA's and; CFG's, Deterministic Pushdown Automata.

UNIT V

Turning Machines: Problems that Computer Cannot Solve ,The Turning Machine, Programming Techniques for Turning Machines, Extensions to the Turning Machines, Restricted Turning Machines, Turning Machine and Computers. Undecidable Problems about Turning Machines, Post's Correspondence Problem, Other Undecidable Problems.

Suggested Reading

1. John E.Hopcroft, Rajeev Motwani,Jeffery D Ulman. Introduction to Automata Theory Languages And Computation, third edition, Pearson Education, 2009.
2. John C.Martin, Introduction to Languages and the Theory of computation ,third Edition, Tata McGrawHill,2003.

Course Code	Course Title						Core/Elective
PC 504IT	**COMPUTER NETWORKS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To study the design issues in network layer and various routing algorithms
- To introduce internet routing architecture and protocols
- To learn the flow control and congestion control algorithms in Transport Layer
- To introduce the TCP/IP suite of protocols and the networked applications supported by it
- To learn basic and advanced socket system calls

Course Outcomes:

Student will be able to

- Explain the function of each layer of OSI and trace the flow of information from one
- node to another node in the network
- Understand the principles of IP addressing and internet routing
- Describe the working of various networked applications such as DNS, mail, file transfer and www
- Implement client-server socket-based networked applications

UNIT – I

Introduction: Uses of Computer Networks, Network Hardware, Network Software: Reference Models (ISO - OSI, TCP/IP). Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms

UNIT – II

Internetworking: Concatenated virtual circuits, Connectionless internetworking, Tunneling, Fragmentation. Network layer in the Internet: IP protocol, IP addresses, Internet control protocols, OSPF, BGP, Mobile IP, IPv6. The Internet Transport Protocols: UDP, Internet Transport Protocols: TCP.

UNIT – III

Network Programming**:** Socket Interface: Sockets, Socket Address, Elementary Sockets, Advanced Sockets, Socket Options, Remote Procedure Calls: Introduction, Transparency Issues and Sun RPC.

UNIT – IV

Application Layer: Domain Name System: DNS Name Space, Resource Records, Name Servers. Electronic Mail: Architecture and Services, User Agent, Message Formats, Message transfer and Final Delivery. World Wide Web: Architectural Overview, Static Web Documents, Dynamic Web Documents,HTTP, Wireless Web.

UNIT – V

Network Security: Cryptography, Symmetric Key Algorithms, Public Key Algorithms, Digital Signatures, Communication Security, Authentication Protocols, Email Security, Web Security.

Suggested Reading:

1. Andrew S. Tanenbaurn, Computer Nerworks, Fourth Edition, Pearson Education.
2. W. Richard stevens, Unix Network Programming" Prentice Hall/Pearson Education,2009.
3. James F. Kurose, Keith W, Ross, Computer Networking, Atop-Down Approach Featuring the Internet, Third Edition, Pearson Education , 2005.
4. William Stallings, Computer Networking with Internet Protocols and Technology, Pearson Education,2009

Course Code	Course Title						Core/Elective
PC 505IT	**SOFTWARE ENGINEERING**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To introduce the basic concepts of software development- processes from defining a product to shipping and maintaining that product
- To impart knowledge on various phases, methodologies and practices of software development
- To understand the importance of testing in software development and study various testing strategies and software quality metrics.

Course Outcomes

Students will be able to:

- Define different software development processes and their usability in different problem domains.
- Explain the process of requirements collection, analyzing, and modeling requirements for effective understanding and communication with stakeholders.
- Design and Develop the architecture of real world problems towards developing a blueprint for implementation.
- Understand the concepts of software quality, testing and maintenance.
- Discuss the concepts related to Risk management and Software project Estimation

UNIT-I

Introduction to Software Engineering: A generic view of process, Software Engineering process framework, The Nature of Software, Software Engineering, Software Myths.

Process Models: A Generic Process Model, Prescriptive Process Models, Specialized Process Models, The Unified Process Personal and Team Process Models, Process Technology, Product and Process.

An Agile View of Process: Introduction to Agility and Agile Process, Agile Process Models

UNIT-II

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Building the Requirement Model, Negotiating Requirements, Validating Requirements.

Design Concepts: Design within the Context of Software Engineering, the Design Process, Design Concepts.

Architectural Design: Software Architecture, Architecture Genres, Architecture Styles, Architecture Design, Assessing Alternative Architecture Designs, Architecture Mapping Using Data Flow**.**

UNIT-III

Software Quality Assurance: Background Issues, Elements of Software Quality Assurance, SQA Tasks, Goals and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability, The ISO 9000 Quality Standards, The SQA Plan.

Risk Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan.

UNIT-IV

Software Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Validation Testing, System Testing, The Art of Debugging.

Testing Conventional Applications: Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing, Control Structure Testing, Black – Box Testing.

UNIT-V

Product Metrics: A Framework for Product Metrics, Metrics for the Requirements Model, Metrics for the Design Model, Metrics for Testing, Metrics for Maintenance.

Estimation: Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Specialized Estimation Techniques, The Make/Buy Decision.

Software Configuration Management: Software Configuration Management.

Software Process Improvement: The SPI Process, The CMMI, The people CMM, Other SPI Frameworks, SPI Return on Investment, SPI Trends.

Suggested Reading:

1. Roger S.Pressman, Software Engineering: A Practitioners Approach, Seventh Edition, McGrawHill, 2009.
2. Ali Behforoz and Frederic J.Hadson, Software Engineering Fundamentals, Oxford University Press, 1996.
3. Pankaj Jalote "An Integrated Approach to Software Engineering, Third Edition, Narosa Publishing house, 2008.

Course Code	Course Title						Core/Elective
PC 531IT	**Computer Networks Lab**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
C Progr. Unix Commands	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- To understand the use of client/server architecture in application development.
- To understand and use elementary socket system calls, advanced socket system calls and TCP and UDP based sockets
- To implement network routing algorithms, application layer protocols and encryption algorithms.

Course Outcomes:

Student will be able to

- Understand the usage of basic commands ipconig, ifconfig, netstat, ping, arp, telnet,ftp,finger,traceroute, whois of LINUX platform.
- Develop and Implement Client-Server Socket based programs using TCP,and UDP sockets
- Develop and Implement Distance Vector Routing Algorithm
- Develop and Implement RSA Public Key algorithm
- Construct simple network by using any modern Open Source Network Simulation Tool

List of Programs

1. Familiarization of Network Environment, Understanding and using network utilities: ipconig, ifconfig, netstat, ping, arp, telnet,ftp,finger,traceroute, whois.
2. Write a program to implement connection oriented and connectionless client for well known services i.e standard ports
3. Implementation of concurrent server service using connection oriented socket system calls(Service: Daytime, Time)
4. Implementation of concurrent server using connection less socket system calls. (Service: Echo server,String Concateation)
5. Implementation of Iterative server using connection oriented socket system calls.(Service:Calculate Employee Salary)
6. Implementation of Iterative server using connection less socket system calls. (Service: Student Grade)
7. Program to demonstrate the use of advanced socket sytem calls: readv(),writev() ,getsockname(),setsockname(),getpeername(),gethostbyname(), gethostbyaddr(),getnetbyname(),getnetbyaddr(),getprotobyname(), getservbyname(),getprotobynumber(),getserbyport().

8. Implementation of remote command execution using socket system calls.
9. Program to implement simple program using RPC.
10. Implementation of Distance Vector Routing Protocol.
11. Implementation of RSA public key algorithm
12. Case study on any open source network simulation tool.(simple routin g protocol implementation)
    Note: Well known services(standard ports): DAYTIME, TIME, CHARGEN, ECHO.

Suggested Reading:

1. W. Richard Stevens, "Unix Network Programming", Prentice Hall, Pearson Education,2009.
2. Douglas E.Comer,"Hands-on Networking with Internet Technologies", Pearson Education.

Course Code	Course Title						Core/Elective
PC532IT	**Operating Systems Lab**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- To practice

Course Outcomes:

Student will be able to

- Explore the LINUX low level I/O and Construct applications using process management and file management System calls.
- Demonstrate how threads can be created and simultaneously handled in LINUX POSIX environment.
- Understand possible Inter-Process Communication implementations using LINUX IPC Constructs.
- Assess the working behaviour of various synchronization approaches used in Deadlock management.
- Analyze the performance of process scheduling algorithms, page replacement Algorithms, and Disk scheduling Algorithms.

List of experiments:

1. Familiarity and usage of Linux System calls :
   a. Process management: fork(), exec(), wait(), sleep() ...,
   b. File management: open (), read (), write (), seek (), close ()...,

2. Write a program to Implement two process communication using IPC constructs.
   a)pipes b) shared memory c) message queues d)Semaphores..

3. Demonstrate the use of threads under LINUX platform using appropriate thread API

4. Write a program to Implement Producer Consumer Problem solution.

5. Write a program to Implement Dining philosopher's problem solution.

6. write a program to implement Processor Scheduling Algorithms
   a) FCFS b) SJF c) Round Robin.
7. Write a program to simulate Bankers Algorithm for Dead Lock Avoidance.

8. Write a program to implement Bankers Algorithm for Dead Lock Prevention.

9. Write a program to Implement Page replacement Algorithms:
   a) FIFO b) LRU

10. Write a program to implement disk scheduling algorithms.
    a) FCFS b) SCAN c) C-SCAN

Course Code	Course Title						Core/Elective
PC533IT	**WEB APPLICATION DEVELOPMENT LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objective:

- To develop web pages using HTML tags and perform validation using scripting
- To implement various types of styling using CSS and transform data into various forms
- To implement applications using JQuery and Angular JS
- To understand and implement the concepts of MEAN Stack and SMACK stack

Course Outcomes:

Student will able to

- Design Web pages and perform form validation using HTML 5.0 inbuilt functions.
- Apply Styles to the web content using CSS.
- Create and process web publishing content using XML and JSON.
- Use JQuery to perform client side Dynamics.
- Create single page applications (Front End) using Angular JS.
- Design Big data applications using Mean stack or SMACK stack Frameworks.

a. Implement Basic HTML Tags
b. Implement Table Tag
    i. Implement FRAMES
c. Design a form in HTML (CV/Photos/Data Storage/Publish)
    i. Validation of form Using Java Script.
d. Implement various types of CSS.
e. Display the various forms of XML document
    i. Raw XML ii. XML using CSS iii. XML using XSLT
f. Using JQuery implement the following:
    i) Selecting Elements, Getting Values, and Setting Values.
    ii) Events
g. Using angular JS implement the following
    i) Input Validation
    ii) Backend building
h. Case study on i) MEAN Stack ii) SMACK Stack

Course Code	Course Title						Core/Elective
PE 511 IT	**ARTIFICIAL INTELLIGENCE**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To understand foundations and Applications of AI
- To learn Probabilistic Reasoning and other search algorithms.
- To design Bayesian Networks and Markov model
- To learn aspects of Reinforcement Learning

Course Outcomes

Student will able to

- Identify problems that are amenable to solution using State space search algorithms
- Understand and analyze working of an AI technique using Heuristic search
- Understand and design the Bayesian Networks
- Understand and apply the concepts of Markov Decision process.
- Apply the program and apply Reinforcement Learning

Unit-I

Introduction: History of AI, Intelligent Systems, Foundations of AI, Subareas of AI, Applications. Problem Solving – State-Space Search. State space representation.

Unit-II

Search Algorithms: Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm.

Unit-III

Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

Unit-IV

Markov Decision process: MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

Unit-V

Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

Suggested Reading

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall

2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

3. Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.

4. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011
5 .NilsJ Nilsson (1998), Artificial Intelligence, A NewSynthesis. Elsevier.
6. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

Course Code	Course Title						Core/Elective
PE 512 IT	**COMPUTER GRAPHICS**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives

- Acquire knowledge about device level algorithms for displaying two dimensional output primitives for raster graphics system.
- Acquire knowledge about the basic concepts of representing 3D objects in 2D.
- To introduce computer graphics techniques transformations, clipping, curves and surfaces.

Course Outcomes

Student will able to

- Describe the steps in graphics programming pipline
- Apply affine transformations for viewing and projections
- Create realistic images of geometrical objects in 2-D and modeling implementation
- Describe the mathematical principles to represent curves and surfaces

UNIT-I

Overview of Graphics Systems-Video display devices, raster-scansystems, Random-scan system, graphics monitors and workstations, InputDevices, hard copy devices, Graphics Software. Output Primitives, Line driving, algorithms, Circle generating algorithms, ellipse generating algorithms, pixel addressing, Filled-area primitives, Fill area functions, cell array, character generation.

UNIT-II

Attributes of output primitives:Line attributes, curve attributes, color and Gray scale level, Area fill attributes, character attributes, Bundled attributes, Enquiry function. Two dimensional Geometric transformations:Basic transformations, Homogeneous coordinates, composite transformations, other transformations, transformations between coordinate systems, affine transformations, transformation functions, Raster methods for transformations.

UNIT-III

Two dimensional viewing: Viewing pipeline, viewing transformation, viewing functions, line clipping-Cohen Sutherland line clipping Liang Bar skyline clipping. Sutherland-Hodgman polygon clipping, Weller Atherton polygon clipping.

UNIT-IV

Structures and Hierarchical Modeling: Structure concepts, editing structures, Basic modeling concepts, hierarchical modeling with structures. Graphical user interfaces and Interactive input methods: The user Dialogue, logical classification of input devices, input functions and Models, Interactive picture construction techniques.

UNIT-V

Three dimensional object representations: Polygon surface, curved lines and surfaces, splinere presentations, Bezeir curves and surfaces, B-spline curves and surfaces, CSG methods: Octress, BSP Trees. Three Dimensional Transformation Three dimensional viewing: Viewing coordinates, projections, visible surface detection methods :Back- face Detections, Depth-buffer methods, depth sorting methods, Gourand shading, Phong shading.

Suggested Reading

1.HeamDonald, PaulineBakerM.,"Computer Graphics",2nd edition, PHI,1995.
2.HaningtonS.,"ComputerGraphicsAProgramming Approach",2nd edition,McGraw Hill.
3.David F. Rogers.,"Procedural ElementsforComputerGraphics",2nd edition,TataMcGraw Hill, 2001.

Course Code	Course Title						Core/Elective
PE 513 IT	**IMAGE PROCESSING**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objective:

- To gain the fundamentals of digital image processing.
- To provide mathematical foundations for digital manipulation of images; image
- acquisition; preprocessing; segmentation; Fourier domain processing; and compression.
- To be able to formulate solutions to general image processing problems

Course Outcomes

Student will able to

- Understand the fundamental concepts of a digital image processing.
- Evaluate the techniques for image enhancement and image restoration.
- Categorize various compression techniques.
- Interpret Image compression standards.
- Interpret image segmentation and representation techniques.

UNIT-I

FUNDAMENTALS Digital image, Elements of digital geometry, Components of DIP, Visual detail. Visual preliminaries- Brightness adaptation and Contrast, Acuity and contour, Texture and pattern discrimination, Shape detection and recognition, Perception of color. Image formation- Geometric Model and Photometric Model.

UNIT-II

IMAGE ENHANCEMENT Spatial Domain Methods –Binary Image, Negative of an Image, Log Transformations, Power law Transformation, contrast enhancement, Histogram equalization, Spatial Domain Filters-Smoothing filters, Sharpening filters. Frequency Domain Methods- Steps for filtering in the frequency domain, Smoothing filters, Sharpening filters.

UNIT-III

IMAGE RESTORATION A model of the image degradation, noise models, restoration in the presence of noise-spatial filtering, periodic noise reduction by frequency domain filtering, linear & position-invariant degradations, estimating the degradation function.

UNIT-IV

SEGMENTAION Points detection, line detection, edge detection methods, Histogram based image segmentation, segmentation using split and merge method, region growing method, watershed method, k-means clustering method, self-similar fractal method.

UNIT-V

REPRESENTAION, DESCRIPTION AND RECOGNITION Representation, boundary descriptors, regional descriptors, principal component analysis, relational descriptors. Recognition based on decision-theoretic and structural methods.

Suggested Reading

1 R.C Gonzalez and R.E. Woods, Digital Image Processing, 2nd Ed, Prentice Hall. 2002.

2 Anil K. Jain, Fundamentals of Image Processing, Prentice Hall, Englewood clifs, New Jersey,1989

3.G.R.Sinha and BhagavathiCharan Patel, Medical Image Processing concepts and applications,PHI,2014

4.Chanda&Majumdar, Digital image processing and analysis, Second edition PHI, 2013.

SCHEME OF INSTRUCTION & EXAMINATION
B.E (INFORMATION TECHNOLOGY)

VI SEMESTER

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs/Wk	
Theory Course										
1.	PC 601 IT Core-12	Embedded Systems	3	1	-	4	30	70	3	3
2.	PC 602 IT Core-13	Design and Analysis of Algorithms	3	1	-	4	30	70	3	3
3.	PE-II	Professional Elective -II	3	-	-	3	30	70	3	3
4.	PE -III	Professional Elective -III	3	-	-	3	30	70	3	3
5	PE -IV	Professional Elective -IV	3	-	-	3	30	70	3	3
6.	OE - 1	Open Elective -1	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
7.	PC631 IT	Embedded Systems Lab	-	-	2	2	25	50	3	1
8.	PC632 IT	Design and Analysis of Algorithms Lab	-	-	2	2	25	50	3	1
8.	PW633 IT	Mini Project-I	-	-	2	2	25	50	3	1
9.	SI 671 IT	Summer Internship*	-	-	-	-	-	-	-	-
Total			**18**	**2**	**9**	**29**	**305**	**570**		**21**

Profession Elective - II	
Course Code	**Course Title**
PE 611 IT	Data Mining
PE 612 IT	Compiler Construction
PE 613 IT	Distributed Systems
PE 614 IT	AdvancedComputer Architecture

Profession Elective – III	
Course Code	**Course Title**
PE 623 IT	Object Oriented Analysis and Design
PE 624 IT	Multimedia Technologies
PE 625 IT	Machine Learning
PE 626 IT	Data Science Using R Programming

Profession Elective - IV	
Course Code	**Course Title**
PE 627CS	Computational Intelligence
PE 628 IT	Adhoc and Sensor Networks
PE 629 CS	Natural Language Processing
PE 630 IT	Information Storage and Management

Open Elective - I	
Course Code	**Course Title**
OE 601 CE	Disaster Management
OE 602 CE	Geo Spatial Techniques
OE 601 CS	Operating Systems*
OE 602 CS	OOP using Java*
OE 601 IT	Database Systems**
OE 602 IT	Data Structures**
OE 601 EC	Principles of Embedded Systems
OE 602 EC	Digital System Design using HDL Verilog
OE 601 EE	Reliability Engineering
OE 602 EE	Basics of Power Electronics
OE 601 ME	Industrial Robotics
OE 602 ME	Material Handling
OE 601 AE	Automotive Safety & Ergonomics

Course Code	Course Title						Core/Elective
PC 601 IT	**EMBEDDED SYSTEMS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives

- To understand the architecture of 8051 microcontrollers.
- To understand the various applications of Embedded Systems using the concepts of Interfacing.
- To familiarize with smart sensors and understand various sensor applications.
- To learn the concepts of RTOS and the design process using RTOS.
- To familiarize with the design principles of SOC.

Course Outcomes

Students will able to

- Study and analysis of embedded systems.
- Design and develop embedded systems (hardware, software and firmware)
- Analyze, real time systems using RTOS and develop applications.
- Apply knowledge to interface various sensors and its applications in embedded systems.
- Understand principles of SOC design.

UNIT-I

Embedded Computing: Introduction, Complex Systems and Microprocessor, Embedded System Design Process, Formalisms for System Design, Design Examples.
Microprocessors and Microcontrollers: Microprocessors and Microcontrollers,
The 8051 Architecture: Introduction, 8051 Micro controller Hardware, Input/output Ports and Circuits, External Memory. Counter and Timers, Serial data Input/output, Interrupts.

UNIT-II

Programming using 8051. Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions, Applications: Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication.
Introduction to advanced architectures: ARM and SHARC, Processor and memory organization, Bus protocols: I^2C bus and CAN bus.

UNIT-III

Smart Sensors Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation.
Sensors –Applications Introduction – On-board Automobile Sensors (Automotive Sensors)– Home Appliance Sensors – Aerospace Sensors — Sensors for Manufacturing –Sensors for environmental Monitoring

UNIT-IV

Introduction to Real-Time Operating Systems: Tasks and task states, tasks and data, semaphores, and shared data; message queues, mailboxes and pipes, timer functions, events,

memory management, interrupt routines in an RTOS environment. Basic Design Using a Real-Time Operating System: Principles, semaphores and queues, hard real-time scheduling considerations, saving memory and power, An example RTOS like µ-COS (open source).

UNIT-V

Introduction to the System Approach System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

Suggested Reading

1. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, " The 8051 Micro controller and Embedded Systems using Assembly and C", Prentice Hall India, 2nd Edition
2. D. Patranabis – "Sensors and Transducers" –PHI Learning Private Limited.
3. Wayne Wolf, "Computers and Components", Elsevier, Second Edition.
4. Kenneth J.Ayala, "The8051 Microcontroller", Third Edition, , Thomson.
5. David E. Simon, "An Embedded Software Primer", Pearson Education

Course Code	Course Title						Core/Elective
PC 602IT	**DESIGN AND ANALYSIS OF ALGORITHMS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives

- To review elementary data structures, order notation and algorithm analysis.
- To learn algorithm design strategies such as Divide-and-Conquer, greedy method, dynamic programming, back tracking and branch & bound technique.
- To understand the concepts of NP-hard and NP-complete.

Course Outcomes:

Students will be able:

- Compute and analyse complexity of algorithms using asymptotic notations.
- Write algorithms to solve various computing problems and analyse their time and space complexity.
- Understand and apply different algorithm design techniques to solve real world problems and analyse their complexities.
- To describe algorithmic complexities of various well known computing problems.

UNIT-I

Introduction: Algorithm Specification, Performance analysis, Space Complexity, Time Complexity, Asymptotic Notation(O,Omega,Theta), Practical Complexities, Performance Measurement, Review of elementary data structures, Heap and Heap Sort, Hashing, Set representation, UNION, FIND.

UNIT-II

Divide- and Conquer: The general method, finding maximum minimum. Merge sort quick sort and selection.

Greedy Method: Knapsack problem, Optimal Storage on tapes, Job sequencing with deadlines, Optimal merge patterns, Minimum Spanning Trees.

UNIT-III

Dynamic Programming and Traversal Technique: Multistage graph, All Pair Shortest Path, Optimal Binary Search trees,0/1 Knapsack, Reliability Traveling Salesman Problem, Bi connected Components and Depth First Search.

UNIT-IV

Backtracking and Branch and Bounds: 8-Queens Problem, Graph Coloring Hamilton cycle, Knapsack Problem, 0/1 Knapsack Problem, Traveling salesperson problem, Lower-Bound Theory.

UNIT-V

NP-Hard and NP-Completeness: Basic concepts, cook's theorem, NP-hard graph problems and scheduling problem, NP-hard generation problems, Decision problem, Node covering problem.

Suggested Reading

1. Horowitz E. Sahani S: Fundamentals of Computer Algorithm, Second edition, University Press, 2007.
2. Anany Levitin, Introduction to the Design & Analysis, of Algorithms, Pearson Education, 2003.
3. Aho, Hopcroft, Ulman, The Design and Analysis of Computer Algorithm, Pearson Education, 2000.
4. Parag H.Dave, Himanshu B. Dave, Design and Analysis of Algorithms, Pearson Education, 2008.

Course Code	Course Title						Core/Elective
PC631 IT	**EMBEDDED SYSTEMS LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objective

- To understand basic concepts and structure of embedded systems.
- To design and develop real time applications of embedded systems

Course Outcomes

Student will able to

- Apply the basic concepts to develop an Interface for 8051 and ARM processors.
- Demonstrate the RTOS Concepts by designing real time applications.

A. Use of 8-bit and 32-bit Microcontrollers, (such as 8051 Microcontroller, ARM2148 / ARM2378, LPC 2141/42/44/46/48) Microcontroller and C compiler (Keil, Ride etc.) to:

1. Interface Input-Output and other units such as: Relays, LEDs, LCDs, Switches, Keypads, Stepper Motors, Sensors, ADCs, Timers
2. Demonstrate Communications: RS232, IIC and CAN protocols
3. Develop Control Applications such as: Temperature Controller, Elevator Controller, Traffic Controller

B. Development of Embedded Application using FPGAs, CPLDs, VHDL and Xilinx Programmable Logic Design Tools:

1. Four bit ALU
2. Pseudo Random Number Generator

C. Development and Porting of Real Time Applications on to Target machines such as Intel or other Computers using any RTOS

I. Understanding Real Time Concepts using any RTOS through Demonstration of:

1. Timing
2. Multi-Tasking
3. Semaphores
4. Message Queues
5. Round-Robin Task Scheduling
6. Preemptive Priority based Task Scheduling
7. Priority Inversion
8. Signals
9. Interrupt Service Routines

II. Application Development using any RTOS:

1. Any RTOS Booting
2. Application Development under any RTOS

Course Code	Course Title						Core/Elective
PC632 IT	**DESIGN AND ANALYSIS OF ALGORITHMS LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objective

Course Outcomes

Student will able to

- Develop and implement various searching and sorting techniques and estimate the complexities of searching and sorting algorithms.
- Solve knapsack problem using greedy method and dynamic programming.
- Develop and implement shortest path algorithms using Travelling salesman problem and All pair shortest path problem.
- Apply backtracking technique to solve N-queen problem.
- Construct graph traversals using breath first search and depth first search.

List of Experiments:

1. Implement Recursive Binary search and determine the time taken to search an element

2. ImplementLinear searchand determine the time taken to search an element.

3. Sort a given set of elements using Merge sort method and determine the time taken to sort the elements.

4. Sort a given set of elements using Quick sort method and determine the time taken to sort the elements.

5. Implement Knapsack problem using greedy method.

6. Implement 0/1 Knapsack problem using dynamic programming.

7. Implement any scheme to find the optimal solution for the Traveling Sales Person problem

8. Print all the nodes reachable from a given starting node in a digraph using BFS method.

9. Check whether a given graph is connected or not using DFS method

10. Develop a program to implement All pair shortest path.

11. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm-

12. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm-

13. Implement N Queen's problem using Back Tracking.

Course Code	Course Title						Core/Elective
PW633IT	**MINI PROJECT - I**						Project Work
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objectives

- To develop capability to analyse and solve real world problems with an emphasis on applying/integrating knowledge acquired.
- To take responsibility of the end product.

Course Outcomes

Student will able to

- Implement the system using SQL, data structures, C/C++, JAVA, Python and different software engineering models

The Students are required to take one of larger projects listed in the suggested readings or assigned by the teacher, implement and submit the report. The workbooks and project reports should be evaluated.

Course Code	Course Title						Core/Elective
PE 611 IT	**DATA MINING**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To understand data classification, data preprocessing and data mining applications.
- To understand how patterns, associations and correlations can be obtained on data.
- To understand how classification and clustering techniques can be implemented and perform its evaluation.
- To learn how complex data mining can be performed.

Course outcomes

Student will able to

- Classify types of data, perform preprocessing of data and appreciate applications of data mining.
- Analyze data for mining frequent patterns, Associations and Correlations.
- Perform the classification by using decision tree induction, Bayes classification methods etc. and evaluate the classifier.
- Select and perform clustering, outlier analysis detection methods.
- Perform Text mining, Spatial Mining, Web mining and Multimedia mining.

UNIT-I

Introduction: fundamentals of Data Mining, Kinds of Patterns can be mined, Technologies used, Applications and issues in Data Mining.Types of Data: Attribute types, Basic Statistical Descriptions of Data, Measuring data similarity and Dissimilarity.Data Pre-Processing: Need of Pre-processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation**.**

UNIT-II

Mining Frequent Patterns, Associations and Correlations: Market Basket Analysis, Association rule mining, frequent item set mining methods, mining various kinds of association rule, Constraint based frequent pattern mining.

UNIT –III

Classification: General approach to classification, Classification by Decision tree induction, Classification by back Propagation, Lazy learners, other classification methods, Prediction, Evaluating the accuracy of classifier, Increasing the accuracy of classifier.

UNIT—IV

Cluster Analysis: Basic Clustering methods, Partitioning methods, Density-based methods, Grid-based methods, and Evaluation of clustering, Outlier Analysis and detection methods.

UNIT—V

Mining Complex Data, Applications and Trends: Mining complex data: Spatial mining, Text Mining, Multimedia Mining, Web Mining, Data Mining Applications and Data Mining Trends.

Suggested Reading:

1. Han J &Kamber M, "Data Mining: Concepts and Techniques", Harcourt India, Elsevier India, Second Edition.
2. Pang-NingTan. Michael Steinback, Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2008.
3. Margaret H Dunham,S.Sridhar, "Data mining: Introductory and Advanced Topics", Pearson Education, 2008.
4. Humphires,hawkins,Dy, "Data Warehousing: Architecture and Implementation", Pearson Education, 2009.
5. Anahory, Murray, "Data Warehousing in the Real World", Pearson Education, 2008.

Course Code	Course Title						Core/Elective
PC 612IT	**COMPILER CONSTRUCTION**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objectives

- To understand various phases in Compiler Design.
- To design Parsers and generate code for target machine.
- Understand the role of a symbol table and error recovery strategies

Course Outcomes

Student will able to

- Identify and describe the various concepts underlying the components of a compiler and the translation process.
- Explain various techniques to Scan and Parse the source code.
- Analyze attribute grammars and evaluations for SDT's and use the terminology for generating intermediate code representations.
- Analyze fundamentals of storage allocation strategies towards run-time management of data.
- Explain basic code generation, code optimization techniques.

UNIT-I

Introduction: Programs related to compilers, Translation process, Major data structures, Other issues in compiler structure, Boot strapping and porting.

Lexical analysis: The role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical-Analyzer Generator Lex.

UNIT-II

Syntax Analysis: Introduction, Top-Down parsing, Bottom-Up parsing, Introduction to LR Parsing, More powerful LR parsers, Using Ambiguous Grammars, Parser Generators YACC.

UNIT-III

Syntax Directed Translation: Syntax Directed Definitions, Evaluation Orders for SDDs, Applications of Syntax Directed Translation.

Intermediate code generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow.

UNIT-IV

Symbol Table Organization: Structure of Symbol table, Symbol Table organization for Block Structured and non-Block Structured languages, Data Structures of symbol Table.

Runtime Environments: Storage Organization, Stack Allocation of Space, Access to Non local Data on the Stack, Heap Management, Introduction to Garbage Collection.

UNIT-V

Code Generation : Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Peephole Optimization, Register Allocation and Assignment.
Machine Independent Optimizations: The Principal Sources of Optimizations.

Suggested Reading

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman ,"Compilers: Principles, Techniques & Tools", Pearson Education, Second Edition, 2007.
2. Leland L Bech, "System Software: An Introduction to Systems Programming", Pearson Education, Asia.
3. Kenneth C Louden, "Compiler Construction: Principles and Practice", Cengage Learning.

Course Code	Course Title						Core/Elective
PC 613 IT	**Distributed Systems**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To learn the concept and issues of distributed systems in detail.
- To study architectures and working of distributed file systems.
- To understand the processes in distributed system and communication.
- To make students understand how names are assigned in distributed systems.
- To learn examples of distributed file systems.

Course Outcomes:

After completing this course, the student will be able to

- Describe the problems and issues associated with distributed systems.
- Understand how coordination occurs in distributed systems.
- How replicas are handled in distributed systems and consistency is maintained.
- How security is implemented in distributed systems.
- Understand design trade-offs in large-scale distributed systems

UNIT-I

Introduction: What is Distributed Systems?, Design Goals, Types of Distributed System.
Architectures: Architectural Styles, Middleware Organization, System Architectures, Example Architectures.

UNIT-II

Processes: Threads, Virtualization, Clients,Servers, Code migration.
Communication: Foundations, Remote Procedure Call, Message-Oriented Communication, Multicast Communication.

UNIT-III

Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming, and Attribute-Based Naming.
Coordination: Clock Synchronization, Logical Clocks, Mutual Exclusion, Election Algorithms, Location System, Distributed event matching, Gossip-based coordination

UNIT-IV

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, and Consistency Protocols.

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, and Recovery.
Security: Introduction to security, Secure channels, Access control, Secure naming, Security management.

UNIT-V
Distributed File Systems: Introduction, File service architecture, Case study: Sun Network File System, Case study: The Andrew File System, Enhancements and further developments.
Distributed Multimedia Systems: Introduction, Characteristics of multimedia data, Quality of service management, Resource management, Stream adaptation, Case studies: Tiger, BitTorrent and End System Multicast.
Designing Distributed Systems: GOOGLE CASE STUDY Introduction, Overall architecture and design philosophy, Underlying communication paradigms,Data storage and coordination services, Distributed computation services.

Suggested Readings:
1. Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems, PHI 3rd Edition, 2017.
2.George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, Distributed Systems Concepts and Design, 5th Edition, 2012.
3.A.D. Kshemkalyani, M. Singhal, Distributed Computing: Principles, Algorithms, and Systems, Cambridge University Press,2011.

Course Code	Course Title						Core/Elective
PC614 IT	**Advanced Computer Architecture**						**Elective**
Prerequisites	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Computer Architecture	3	-	-	-	30	70	03

Course Objectives:

- To learn various types of parallel computer model and Multi processors.
- To learn the model of computer architecture the architecture beyond the classical von Neumann model pipelining, vector and array processors.
- To understand different performance enhancement techniques of scalar architecture.
- To study the memory management and synchronization of multiprocessor and mutlicomputers.

Course Outcomes:

After completing this course, students will be able to:

- Understand the limitations of uni processor and appreciate the need of parallel processing.
- Explain the branch prediction and its utility and pipeline processors
- Explain the Vector processing models and its performance evaluation.
- Understand interconnection of networks and characteristics different approaches.
- Compare and contrast shared memory and distributed memory architecture.

UNIT-I:

Uni processor systems, enhancement to uni processor models, measuring performance and cost, Benchmarks, introduction to advanced computer architecture. Theory of Parallelism, Parallel Computer models, The State of Computing, Multiprocessors and Multicomputer.

UNIT-II:

Pipelining and superscalartechniques: Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design. Branch predication technique, performance evaluation, case study-sun microsystems-microprocessor.

UNIT-III:

Vector processor: Vector processing principles models, vector processor model, vector architecture and design, multi vector and SIMD computers, performance evaluation.

UNIT IV:

Array processors: Parallel array processor model, memory organization, interconnection networks, performance measures, static and dynamic topologies.

UNIT V:

Multi processors and multi computers: Multiprocessor model, shared memory and distributed memory architecture, cache coherence and synchronization mechanism, Three Generations of Multicomputer, Parallel computer model, performance model.

Suggested reading:

1. John L. Hennessy and David A. Patterson Morgan Kaufmann, Computer Architecture: A Quantitative Approach, 5 Edition, (An Imprint of Elsevier), 2011
2. Advanced Computer Architectures, S.G. Shiva, Special Indian edition CRC Press Taylor & Francis, 2018
3. Advanced Computer Architecture Second Edition, Kai Hwang, Tata Mc Graw Hill Publishers, 1999

Course Code	Course Title						Core/Elective
PE 623 IT	**OBJECT ORIENTED ANALSIS AND DESIGN**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objective:

- To introduce the basic concepts of Unified Modeling Language from defining Unified process and Core workflows
- To impart knowledge on various UML diagrams for the software development
- To understand the importance of each diagram in software development and understand rules to develop each diagram

Course Outcomes

Student will able to

- Understand the activities in the different phases of the object-oriented development life cycle.
- Model a real-world application by using a UML diagrams.
- Provide a snapshot of the detailed state of a system at a point in time using object diagram.
- Recognize when to use generalization, aggregation, and composition relationships.
- Specify different types of business rules in a class diagram.

UNIT-I

UML Introduction: Why we Model, Introducing the UML, Elements of UML

Basic Structural Modeling: Classes, Relationships, Common Mechanisms, Diagrams, Class Diagrams.

Advanced Structural Modeling: Advanced Classes, Advanced Relationships, Interfaces, Types and Roles, Packages, Instances, Object Diagrams, Components

UNIT-II

Basic Behavioral Modeling: Interactions, Use Cases, Use Case Diagrams, Interaction diagrams, Activity diagrams.

Advanced Behavioral Modeling: Events and Signals, State Machines, Processes and Threads, Time and space, State Chart Diagrams.

UNIT-III

Architectural Modeling: Artifacts, Deployment Collaborations, Patterns and Frame-works, Artifact Diagrams, Deployment Diagrams, Systems and Models

UNIT-IV

Unified Software Development Process: The Unified Process, The Four Ps, A Use-Case-Driven Process, An Architecture-Centric Processes, An Iterative and Incremental Process.

UNIT-V

Core Workflows: Requirements Capture, Capturing requirements as use cases, Analysis, Design, Implementation, Test

Suggested for Reading:

1. THE UNIFIED MODELING LANGUAGE USER GUIDE, Pearson Education- Grady Booch, James Rumbaugh, Ivar Jacobson
2. OBJECT-ORIENTED ANALYSIS AND DESIGN WITH APPLICATIONS, Pearson Education, 3rd Edition- Booch, Jacobson, Rumbaugh

Course Code	Course Title						Core/Elective
PE 624 IT	**MULTIMEDIA TECHNOLOGIES**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objective

- Acquire knowledge about the basic concepts of multimedia data formats, protocols, and Compression techniques of digital images.
- To learn JPEG and MPEG families of standards and wired and wireless networking protocols.
- To develop simple multimedia applications.

Course Outcomes

Student will able to

- Understand the technical details of common multimedia data formats, protocols, and compression techniques of digital images, video and audio content.
- Describe the technical details of JPEG and MPEG families of standards.
- Discuss the significance of "Quality of Service" in multimedia networking.
- Describe the principles and technical details of several wired and wireless networking protocols.
- Develop simple but demonstrative multimedia applications.

UNIT – I

Introduction to Multimedia: What is Multimedia, Multimedia and hypermedia, World Wide Web, Overview of Multimedia software Tools. Multimedia Authorizing and Tools, Multimedia Authoring, Some Useful Editing and Authoring Tools, VRML

UNIT – II

Graphics and Image Data Representation: Graphics/image data types, Popular File Formats, Color in image and Video and Color Science, color Models in Images, Color Models in Video

UNIT – III

Fundamental Concepts in Video and audio: Types of Video signals, Analog Video, Digital Video, Digitization of sound, Musical instrument Digital interface (MIDI), quantization and transmission of Audio

UNIT – IV

Multimedia Data Compression: Lossless Compression Algorithms, lossy Compression Algorithms, Image Compression Standards, The JPEG2000 Standard, Basic Video Compression Techniques, MPEG Video coding I— MPEG –I and 2, Basic Audio Compression techniques.

UNIT – V

Multimedia communication and Retrieval: Multimedia Network Communications and Applications, Wireless Networks, Content Based Retrieval in Digital Libraries

Suggested Reading

1. Ze-Nian Li & Mark S. Drew. Fundamentals of Multimedia.. Upper Saddle River, NJ: Pearson Education.

Course Code	Course Title						Core / Elective
PE 625 IT	**Machine Learning**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce the basic concepts of machine learning and range of problems that can be handled by machine learning
- To introduce the concepts of instance based learning and decision tree induction
- To introduce the concepts of linear separability, Perceptron and SVM
- To learn the concepts of probabilistic inference, graphical models and evolutionary learning
- To learn the concepts of ensemble learning, dimensionality reduction and clustering

Course Outcomes

After completing this course, the student will be able to

1. Explain the strengths and weaknesses of many popular machine learning approaches
2. Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques
3. Design and implement various machine learning algorithms in a range of real-world applications

UNIT-I

Introduction: Learning, Types of Machine Learning.
Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm.
Learning with Trees: Constructing Decision Trees, CART, Classification Example

UNIT-II

Linear Discriminants: The Perceptron, Linear Separability, Linear Regression
Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices, Deriving back Propagation SUPPORT Vector Machines: Optimal Separation, Kernels

UNIT-III

Some Basic Statistics: Averages, Variance and Covariance, The Gaussian, The Bias-Variance Tradeoff
Bayesian learning: Introduction, Bayes theorem. Bayes Optimal Classifier, Naive Bayes Classifier. Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm.

UNIT-IV

Evolutionary Learning: Genetic Algorithms, Genetic Operators, Genetic Programming
Ensemble learning: Boosting, Bagging
Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis

UNIT-V

Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison

Suggested Readings:

Tom M. Mitchell, Machine Learning, Mc Graw Hill, 1997
Stephen Marsland, Machine Learning - An Algorithmic Perspective, CRC Press, 2009
Margaret H Dunham, Data Mining, Pearson Edition., 2003.
Galit Shmueli, Nitin R Patel, Peter C Bruce, Data Mining for Business Intelligence, Wiley India Edition, 2007
Rajjan Shinghal, Pattern Recognition, Oxford University Press, 2006.

Course Code	Course Title						Core / Elective
PE 626 IT	**Data Science using R Programming**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To learn basics of R Programming environment: R language, R- studio and R packages
- To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting
- To learn Decision tree induction, association rule mining and text mining

Course Outcomes

After completing this course, the student will be able to

1. Use various data structures and packages in R for data visualization and summarization
2. Use linear, non-linear regression models, and classification techniques for data analysis
3. Use clustering methods including K-means and CURE algorithm

UNIT-I

Introduction to R: Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R.

Getting Started with R: Introduction, Working with Directory, Data Types in R, Few Commands for Data Exploration.

Loading and Handling Data in R: Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment in R, using as 'Operator to Change the Structure of the Data, Victors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation and Group Processing of a Variable, Simple Analysis Using R, Methods for Reading Data, Comparison of R GUI's for Data Input, Using R with Databases and Business Intelligence Systems.

UNIT-II

Exploring Data in R: Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values and Outliers, Descriptive Statistics, Spotting Problems in Data with Visualization.

UNIT-III

Linear Regression Using R: Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption.

Logistic Regression: Introduction, What Is Regression? Introduction to Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.

UNIT-IV

Decision Tree: Introduction, What Is a Decision Tree? Decision Tree Representation in R, Appropriate Problems for Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Why Prefer Short Hypotheses, Issues in Decision Tree Learning.
Time Series in R: Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.

UNIT-V
Clustering: Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K- Means Algorithm, CURE Algorithm, clustering in Non-Euclidean Space, Clustering for Streams and Parallelism.
Association Rules: Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.

Suggested Readings:

1. Nina Zumel, Practical Data Science with R, Manning Publications, 2014.
2. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly, 2017.
3. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly, 2017.
4. Roger D Peng, R Programming for Data science, Lean Publishing, 2016.
5. Rafael A Irizarry, Introduction to Data Science, Lean Publishing,2016.

Course Code	Course Title						Core / Elective
PE 627 CS	**Computational Intelligence**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

To make the student familiar with the concepts of

- To introduce the concepts of Biological and Artificial neural networks
- To understand different neural architectures with supervised learning and their learning mechanisms
- To study different neural architectures with unsupervised learning such as PCA Networks Kohenen‘s Self-Organizing Maps
- To introduce Markov decision processes, Q-Learning and TD-Learning
- To study different models of evolution and learning, neuro-fuzzy techniques, rough set theory and their applications

Course Outcomes

After completing this course, the student will be able to

1. Design single and multi-layer feed-forward neural networks
2. Implement various unsupervised learning networks
3. Design new evolutionary operators, representations and fitness functions for specific practical problems
4. Apply fuzzy logic and rough sets to handle uncertainty and vagueness in practical problems

UNIT-I

Introduction to Computational Intelligence / Soft computing: Soft versus Hard Computing, Various paradigms of computing

Foundations of Biological Neural Networks: Introduction to Neural Networks, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN (Learning, Generalization, Memory, Abstraction, Applications), McCulloch-Pitts Model, Historical Developments

Essentials of Artificial Neural Networks: Introduction, Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity (Feed forward, feedback, Single and Multi-layer), Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules (Error Correction, Hebbian, Competitive, Stochastic), Types of Application (Pattern Classification, Pattern Clustering, Pattern Association / Memory, Function Approximation, Prediction, Optimization)

UNIT-II

Neural Architectures with Supervised Learning: Single Layer Feed Forward Neural Networks(Perception), Multilayer Feed Forward Neural Networks (Back propagation

learning), Radial Basis Function Networks, Support Vector Machines, Simulated Annealing, Boltzmann Machine, Feedback (Recurrent) Networks and Dynamical Systems
Associative Memories: Matrix memories, Bidirectional Associative Memory, Hopfield Neural Network,

UNIT-III
Neural Architectures with Unsupervised Learning: Competitive learning, Principal Component Analysis Networks (PCA), Kohonen's Self-Organizing Maps, Linear Vector Quantization, Adaptive Resonance Theory (ART) Networks, Independent Component Analysis Networks (ICA)

UNIT-IV
Reinforcement Learning: Markov Decision Processes, Value Functions, Bellman Optimality Criterion, Policy and Value Iterations, Q-Learning, TD Learning

UNIT-V
Fuzzy Logic: Basic concepts, fuzzy set theory, basic operations, fuzzification, defuzzification, neurofuzzy approach, applications
Evolutionary and Genetic Algorithms: Basic concepts of evolutionary computing, genetic operators, fitness function and selection, genetic programming, other models of evolution and learning, ant colony systems, swarm intelligence, applications
Rough Set Theory: Basic concepts, indiscernability relation, lower and upper approximation, decision systems based on rough approximation, applications

Suggested Readings:
Jacek M. Zurada. Introduction to Artificial Neural Systems, Jaico Publishers, 1992.
S. Haykin. Neural Networks: A Comprehensive Foundation, Prentice Hall, 1999.
P. S. Churchland and T. J. Sejnowski. The Computational Brain. MIT Press, 1992.
A. M. Ibrahim. Introduction to Applied Fuzzy Electronics. PHI, 2004
Z. Pawlak. Rough Sets, Kluwer Academic Publishers, 1991.

Course Code	Course Title						Core / Elective
PE 628 IT	**Adhoc and Sensor Networks**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To provide students with an understanding of wireless ad-hoc and sensor networks
- To enable them to recognize the wide range of applicability of these networks
- To provide an understanding of the major design issues, including topics such as protocol mechanisms and resource constraints.

Course Outcomes

After completing this course, the student will be able to

1. Understand the needs of Wireless Adhoc and Sensor Network in current scenario of technology.
2. Describe current technology trends for the implementation and deployment of wireless adhoc/sensor networks.
3. Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc/sensor networks.
4. Explain the principles and characteristics of wireless sensor networks.

UNIT-I

Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies. Medium Access Control Protocols for Wireless Networks: Introduction, Background, Fundamentals of MAC Protocols.

UNIT-II

Adhoc Networks: Introduction and Definitions, Adhoc Network Applications, Design Challenges. Evaluating Adhoc Network Protocols -the Case for a Test bed. Routing in Mobile Adhoc Networks: Introduction, Flooding. Proactive Routing. On Demand Routing. Proactive Versus On Demand Debate. Location based Routing.

UNIT-III

Multicasting in Adhoc Networks: Introduction, Classifications of Protocols, Multicasting Protocols, Broadcasting. Protocol Comparisons, Overarching Issues. Transport layer Protocols in Adhoc Networks: Introduction, TCP and Adhoc Networks, Transport Layer for Adhoc Networks: Overview, Modified TCP, TCP-aware Cross-Layered Solutions. Adhoc Transport Protocol.

UNIT-IV

QoS Issue in Adhoc Networks: Introduction, Definition of QoS, Medium Access Layer, Q0S Routing, Inter- Layer Design Approaches. Security in Mobile Adhoc Networks: Vulnerabilities of Mobile Adhoc Networks, Potential Attacks, Attack Prevention Techniques. Intrusion Detection Techniques.

UNIT-V

Basic Wireless Sensor Technology: Introduction, Sensor Node Technology, Sensor Taxonomy. Introduction and Overview of Wireless Sensor Networks: Introduction, Overview MAC Protocols for Wireless Sensor networks. Applications of Wireless Sensor Networks: Examples of Category 1 and Category 2 WSN applications.

Suggested Readings:

Prasant Mohapatra and Srihanamurthy, "Ad Hoc Networks Technologies and Protocols", Springer, Springer International Edition, 2009.

Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks", John Wiley & Sons.

Shivaram Murthy and B. S. Manoj, "Adhoc Networks – Principles and Protocols", Pearson Education, 2012.

Course Code	Course Title						Core / Elective
PE 629 CS	**Natural Language Processing**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To represent and analyse natural language both spoken and written, using statistical and finite sta methods for modelling and classification. To use grammar for natural language processing.
- To study knowledge representation from its semantics view point with emphasis on applications. T study basic logical form language to encode ambiguity.
- To study augmented grammars and parsers for feature systems.
- To resolve and encode ambiguity using statistical methods to estimate lexical probabilities along with critical study of probabilistic context free grammars and parsing.
- To interpret semantics covering ambiguity and link syntax to semantics.

Course Outcomes

After completing this course, the student will be able to

1. Use statistical and finite state methods for modelling and classification for representation and analysis of natural languages, and use grammars for natural language processing.
2. Apply knowledge representation and semantics to machine translation and database semantic interpretation.
3. Perform top-down and bottom-up parsing, and parsing with features.
4. Estimate lexical probabilities, resolve ambiguity, and use probabilistic context-free grammar.
5. Able to encode ambiguity in logical form language and deal with word-sense and ambiguity and to link syntax to semantics.

UNIT- I

Natural Language Processing: Introduction to Natural Language Processing, the study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural Language Understanding Systems, Linguistic Background: An outline of English syntax Spoken Language input and output Technologies. Written language Input – Mathematical Methods – statistical Modelling and classification Finite State Methods.

Grammar for Natural Language Processing – Parsing – Semantic and Logic Form –

UNIT- II

Introduction to Semantics and Knowledge Representation: some applications like Machine translation, database interface Semantic Interpretation, word senses and ambiguity, Basic logical form language, Encoding ambiguity in logical from, Thematic roles, Linking syntax and semantics, Recent trends in NLP.

UNIT- III

Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top- Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.

UNIT- IV

Semantic Interpretation: word senses and ambiguity, Basic logical form language, Encoding ambiguity in logical from, Thematic roles, Linking syntax and semantics, Recent trends in NLP.

UNIT-V

Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part- of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

Suggested Readings:

James Allen, "Natural Language Understanding", Pearson Education

Christopher D Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing" MIT Press, 1999.

Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, "NLP: A Paninian Perspective", Prentice Hall, New Delhi

D. Jurafsky, J. H. Martin, "Speech and Language Processing", Pearson

Course Code	Course Title						Core / Elective
PE 630 IT	**Information Storage and Management**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce the concept of storage, emphasize the significance of storage technologies in IT infrastructure.
- To provides a comprehensive understanding of the various storage infrastructure components in data center environments.
- To learn about the architectures, features, and benefits of Intelligent Storage Systems.
- To understand various storage networking technologies such as FC-SAN, NAS, and IP-SAN; long- term archiving solution – CAS.
- To know about various business continuity solutions such as backup and replication.
- To understand information security role in storage networks and the emerging field of storage virtualization including storage resource management.

Course Outcomes

1. Evaluate storage architecture; understand logical and physical components of a storage infrastructure including storage subsystems.
2. Describe storage networking technologies such as FC-SAN, NAS, IP-SAN and data archival solution – CAS.
3. Identify different storage virtualization technologies and their benefits.
4. Understand and articulate business continuity solutions including, backup and recovery technologies, and local and remote replication solutions.
5. Identify parameters of managing and monitoring storage infrastructure and describe common storage

management activities and solutions

UNIT-I

Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, Database Management System (DBMS), Host, Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application, Disk Native Command Queuing, Introduction to Flash Drives.

UNIT-II

Data Protection: RAID, Implementation Methods, Array Components, Techniques, Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares. Intelligent Storage Systems: Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems.

UNIT-III

Fibre Channel Storage Area Networks: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Zoning, FC SAN Topologies, Virtualization in SAN. IP SAN and FCoE: iSCSI, FCIP, FCoE. Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, I/O Operation, Implementations, File-Sharing Protocols, Factors Affecting NAS Performance, FileLevel Virtualization. Object-Based and Unified Storage: Object-Based Storage Devices, Content Addressed Storage, CAS Use Cases.

UNIT-IV

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments. Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies. Remote Replication: Modes of Remote Replication, Remote Replication Technologies, Three- Site Replication.

UNIT-V

Cloud Computing: Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges. Securing the Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Storage Security Domains. Managing the Storage Infrastructure: Monitoring the Storage Infrastructure, Storage Infrastructure Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution, Information Lifecycle Management.

Suggested Readings:

EMC Corporation, Information Storage and Management, Wiley India, 2nd Edition, 2011.
Robert Spalding, Storage Networks: The Complete Reference, Tata McGraw Hill, Osborne, 2003.
Marc Farley, Building Storage Networks, Tata McGraw Hill, Osborne,2nd Edition, 2001.
Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.

Course Code	Course Title						Core/Elective
OE601CE	**DISASTER MANAGEMENT**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

Course Outcomes

Student will be able to

- Understand impact on Natural and manmade disasters.
- Classify disasters and destructions due to cyclones
- Understand disaster management applied in India

UNIT – I

Introduction to Disasters: Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks. Natural and Manmade disasters, impact of drought, review of past disasters and drought in India, its classification and characteristics. Classification of drought, causes, Impacts (including social, economic. political, environmental, health, psychosocial, etc.).

UNIT – II

Disaster: Classifications, Causes, Impacts including social, economic, political, environmental, health, psychosocial etc.

Differential Impacts - in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, climate change.

Cyclones and Floods: Tropical cyclones & Local storms, Destruction by tropical cyclones and local storms, Cumulative atmospheric hazards/ disasters, Cold waves, Heat waves, Causes of floods, Rood hazards in India.

UNIT – III

Approaches to Disaster Risk Reduction: Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural-nonstructural sources, roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRis/ULBs), states, Centre, and other stake-holders.

UNIT – IV

Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, differential impacts, impact of development projects such as darns, embankments, changes in Land-use etc. Climate Change Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT – V

Disaster Risk Management in India: Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, OM Act and Policy, other related policies, plans, programmes and legislation)

Field Work and Case Studies: The field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located.

Suggested Reading

1 Sharma V. K. (1999). Disaster Management, National Centre for Disaster Management, IIPE, Delhi.
2. Gupta Anil K, and Sreeja S. Nair. (2011). Environmental Knowledge for Disaster Risk Management,NIDM, New Delhi.
1. Nick. (1991). Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
2. Kapur, et al. (2005). Disasters in India Studies of grim reality, Rawat Publishers, Jaipur.
3. Pelling Mark, (2003). The Vulnerability of Cities: Natural Disaster and Social Resilience Earthscan publishers, London.

Course Code	Course Title						Core/Elective
OE602CE	**GEO SPATIAL TECHNIQUES**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- Description about various spatial and non-spatial data types, and data base management techniques
- Development of the concepts and professional skills in utility of geospatial techniques
- Enhancement of knowledge of geospatial techniques to field problems

Course Outcomes

Student will be able to

- Understand and apply GIS tools
- Analyse and process data to apply to the GIS tools.
- Assimilate knowledge on field problems using remote sensing

UNIT – I

Introduction: Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems. Projections and Coordinate Systems: Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map analysis.

UNIT –I I

Data Acquisition and Data Management: data types, spatial, non spatial (attribute) data, data structure and database management, data format, vector and raster data representation, object structural model filters and files data in computer, key board entry, manual digitizing, scanner, aerial photographic data, remotely sensed data, digital data, cartographic database, digital elevation data, data compression, data storage and maintenance, data quality and standards, precision, accuracy, error and data uncertainty. Data Processing: Geometric errors and corrections, types of systematic and non systematic errors, radiometric errors and corrections, internal and external errors.

UNIT –III

Data Modeling: Spatial data analysis, data retrieval query, simple analysis, recode overlay, vector data model, raster data model, digital elevation model, cost and path analysis, knowledge based system. GIS Analysis and Functions: Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non spatial data

UNIT– IV

Applications of GIS: Environmental and natural resource management, soil and water resources, agriculture, land use planning, geology and municipal applications, urban planning and project management, GIS for decision making under uncertainty, software scenario functions, standard GIS packages, introduction to Global Positioning Systems (GPS) and its applications.

UNIT– V

Introduction to Remote Sensing: General background of remote sensing technology, objectives and limitations of remote sensing, electro-magnetic radiation, characteristics, interaction with earth surface and atmosphere, remote sensing platforms and sensors, satellite characteristics, digital image processing, IRS series and high resolution satellites, software scenario functions, remote sensing applications to watershed modeling, environmental modeling, urban planning and management.

Suggested Reading

1. Burrough, P. A., and McDonnell R. A. (1998), 'Principles of Geographical Information Systems',
2. Oxford University Press, New York
3. Choudhury S., Chakrabarti, D., and Choudhury S. (2009), 'An Introduction to Geographic Information Technology', I.K. International Publishing House (P) Ltd, New Delhi
4. Kang-tsung Chang. (2006), 'Introduction to Geographical information Systems', Tata McGraw-Hill Publishing Company Ltd., Third Edition, New Delhi
5. Lilysand T.M., and Kiefer R.W. (2002), 'Remote Sensing and Image Interpretation', John Wiley and Sons, Fourth Edition, New York

Course Code	Course Title						Core/Elective
OE601EE	**RELIABILITY ENGINEERING**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To understand the concepts of different types of probability distributions.
- Importance of reliability evaluation of networks.
- To make the students understand about Reliability, availability model of Power Systems and Markov modeling of Power Plants with identical and no identical units.

Course Outcomes:

Student will be able to:

- Analyze various types of probability disseminations.
- Significance of consistency assessment of networks.
- Applicability of Markov modeling of Power Plants with matching and no similar entities.

UNIT- I

Discrete and Continuous random variables, probability density function and cumulative distribution function. Mean and Variance. Binomial, Poisson, Exponential and Weibull distributions.

UNIT - II

Failure and causes of failure. Failure rate and failure density. Reliability function and MTTF. Bath tub curve for different systems. Parametric methods for above distributions. Non - Parametric methods from field data.

UNIT- III

Reliability block diagram. Series and parallel systems. Network reduction technique, Examples. Evaluation of failure rate, MTTF and reliability, Active and Standby Redundancy, r out of n configuration. Non-series - parallel systems. Path based and cut set methods.

UNIT- IV

Availability, MTTR and MTBF, Markov models and State transition matrices. Reliability models for single component. two components, Load sharing and standby systems. Reliability and availability models of two unit parallel system with repair and standby systems with repair.

UNIT- V

Repairable Systems. maintainability. Preventive maintenance, Evaluation of reliability and J1TTF. Overhauling and replacement. Optimum maintenance policy. Markov model of a power plant with identical units and non-identical units. Capacity outage probability table. Frequency of failures and Cumulative frequency.

Suggested Reading

1. Charles E. Ebeling, Reliability and Maintainability Engineering,Mc Graw Hill Inetrnational Edition, 1997.
2. Balaguruswamy, Reliability Engineering, Tata McGraw Hill Publishing company Ltd,1984.
3. R.N.Allan. Reliability Evaluation of Engineering Systems, Pitman Publishing,1996.
4. Endrenyi. Reliability Modelling in Electric Power Systems. John Wiley & Sons,1978.

Course Code	Course Title						Core/Elective
OE601ME	**INDUSTRIAL ROBOTICS**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To familiarize the student with the anatomy of robot and their applications.
- To provide knowledge about various kinds of end effectors usage.
- To equip the students with information about various sensors used in industrial robots.
- To make the student understand the importance of spatial transformation of robots using forward and inverse kinematics.
- To specify and provide the knowledge of techniques involved in robot vision in industry.
- To equip students with latest robot languages implemented in industrial manipulators.

Course Outcomes:

Student will be

- Able to demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational workspace characteristics and Have an understanding of the functionality and limitations of robot actuators and sensors.
- Able to demonstrate an ability to apply spatial transformation to obtain forward/Inverse kinematics equation of robot manipulators using analytical/numerical/simulation tools.
- Able to apply knowledge and choose the best & economically suitable sensors/end effectors required for specific applications.
- Able to understand the importance of robot vision and apply the learnt techniques to get the required information from input images.
- Able to design and develop a industrial robot for a given purpose economically.
- Appreciate the current state and potential for robotics in new application areas.

UNIT – I

Introduction to Robotics: Basic structure of Robots. Degree of freedom of Robots. Work envelope. Classification of Robots based on Drive Technology, Work-Envelope and motion control methods. Application of Robots in Industry, Repeatability, Precision and Accuracy as applied to Robots, Specifications of robots used for various applications.

End effectors – Grippers: Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers, RCC grippers – Two fingered and three fingered grippers – Internal grippers and external grippers – Selection and design considerations.

UNIT – II

Requirements of a sensor, principles and applications of the following types of sensors – Position of sensors (Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic

position sensors) – Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters) – Proximity sensors (Inductive, Hall effect, Capacitive, Ultrasonic and Optical proximity sensors) – Touch sensors (Binary sensors, Analog sensors) – Wrist Sensors – Compliance Sensors – Slip Sensors.

UNIT- III

Kinematic Analysis of robots: Rotation matrix. Homogeneous transformation matrix, Denavit&Hartenbergrepresentation, Euler and RPY angles representation. Representation of absolute position and orientation in terms of joint parameters, Direct Kinematics of manipulators, Inverse kinematics of Robot arm for position and orientation. Redundancy in Robots. Static force analysis

UNIT-IV

Introduction to techniques used in Robot vision. Image acquisition, illumination techniques, imaging geometry, basic relationship pixels, pre-processing, segmentation & description of 3 dimensional structures, their recognition and interpretation

Types of Camera, frame grabbing , sensing and digitizing image data – Signal conversion – Image Storage – Lighting techniques – Image processing and analysis – Data reduction – Segmentation – Feature extraction – Object recognition – and various algorithms – Applications – Inspection, identification, visual serving and navigation.

UNIT-V

Robot programming languages: Characteristics of robot level languages, task level languages Teach pendant programming – Lead through programming – Robot programming languages – VAL programming – Motion commands – Sensor commands – End effecter commands – Simple programs.

RGV – AGV – Implementation of robots in industries – Various steps - Safety considerations for robot operations.Economic analysis of robots – Pay back method, EUAC method and Rate of return method.

Suggested Readings

1. Groover M P, "Industrial Robotics", McGraw Hill Publications, 1999.
2. Fu. K.S., GonZalez R.C., Lee C.S.G. "Robotics, Control-sensing vision and Intelligence", McGraw Hill,Int. Ed., 1987.
3. Spong and Vidyasagar, "Robot Dynamics & Control", John Wiley and Sons, Ed.,1990
4. Mittal and Nagrath, "Industrial Robotics", Tata McGraw Hill Publications, 2004.
5 Saha&Subirkumarsaha, ‘robotics’, tmh, india

Course Code	Course Title						Core/Elective
OE602ME	**MATERIAL HANDLING**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To know about the working principle of various material handling equipments
- To understand the Material handling relates to the loading, unloading and movement of all types of materials
- To understand the estimation of storage space and maintenance of material handling equipments

Course Outcomes:

Student will be able to

- Understand various conveying systems that available in industry
- Understand various bulk solids handling systems and their design features
- Understand and various modern material handling systems and their integration.
- Calculate number of MH systems required, storage space, cost and maintenance.

UNIT – I

Mechanical Handling Systems: Belt Conveyors and Desing, Bucket Elevators, Package conveyors, Chain and Flight Conveyors, Screw Conveyors, Vibratory Conveyors, Cranes and Hoists.

UNIT – II

Pneumatic and Hydraulic Conveying Systems: Modes of Conveying and High pressure conveying systems, Low Velocity Conveying System. Components of Pneumatic Conveying Systems: General Requirements, Fans and Blowers, Boots-Type Blowers, Sliding-Vane Rotary Compressors, Screw Compressors, Reciprocating Compressors, Vacuum Pumps.

UNIT- III

Bulk Solids Handling: Particle and Bulk Properties. Adhesion, Cohesion and Moisture Content. Gravity Flowof Bulk Solids: Static and Dynamic Pressure Distribution in Bulk Solids. Modes of Flow: Mass Flow, Funnel Flow and Expanded Flow from Hoppers, Bins and Silos.

UNIT- IV

Modern Material Handling Systems: Constructional features of (i) AGV (ii) Automated storage and retrieval systems. Sensors used in AGVs and ASRS.Bar code systems and RFID systems: Fundamentals and their integration with computer-based information systems.

UNIT-V

Total MH Throughput: Calculation for no. of MH systems; storage space estimation based on no of aisles. Maintenance of MH equipment, spare parts management, cost of materials handling, cost per unit load computations.

Suggested Readings

1. Dr. Mahesh Varma, "Construction Equipment and its Planning & Application", Metropolitan Book
2. Co.(P) Ltd., New Delhi, India 1997.
3. James M. Apple, "Material Handling Systems Design", The Ronald Press Company, New York, USA, 1972.
4. Woodcock CR. and Mason J.S., "Bulk Solids Handling: An Introduction to Practice Technology", Leonard Hill USA, Chapman and Hall, New York.
5. M P Grooveretal, "Industrial Robotics", Me Graw Hill, 1999.

Course Code	Course Title						Core/Elective
OE602EC	**DIGITAL SYSTEMS DESIGN using VERILOG HDL**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To familiarize with various modeling styles: structural, dataflow and behavioral of Verilog HDL.
- To develop combinational and sequential circuits using various modeling styles of Verilog HDL.
- To design and develop Verilog HDL models of data path and control units of Central Processing Unit (CPU).
- To learn Synthesis and FPGA design flow.
- To design and develop real time applications: Booth's multiplier, Divider, hardwired control for basic CPU and FIR filter.

Course Outcomes

Student will be able to

- Able to implement and distinguish different Verilog HDL modeling styles.
- Able to construct and analyze Verilog HDL models of combinational and sequential circuits.
- Able to design and develop Verilog HDL modeling and test bench for digital systems for the given specifications.
- Able to outline FPGA design flow and timing analysis.

UNIT – I

Structural modeling: Overview of Digital Design with Verilog HDL, Basic concepts, modules and ports, gate-level modeling, hazards and design examples

UNIT – II

Dataflow and Switch level modeling: dataflow modeling, operands and operators. Switch Level Modeling: CMOS switches and bidirectional switches and design examples

UNIT – III

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, multi-way branching, Loops, Sequential and Parallel blocks, Generate blocks. Combinational, sequential logic modules and design examples.

UNIT –IV

Synthesis and Verification: Tasks and Functions: Differences between Tasks and Functions. Verilog HDL synthesis, Application Specific IC (ASIC) and Field Programmable Gate Array (FPGA) design flow. Verification: Timing analysis and Test bench design. Design examples.

UNIT – V

Real time implementations: Fixed-Point Arithmetic modules: Addition, Multiplication, Division, Arithmetic and Logic Unit (ALU), Timer, Universal Asynchronous Receiver and Transmitter (UART), DSP modules: FIR and IIR filters, CPU design: Data path and control units.

Suggested Readings

1. Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis," 2nd Edition, Pearson Education, 2006.
2. Ming-Bo Lin, Digital System Designs and Practices: Using Verilog HDL and FPGA," Wiley India Edition, 2008.
3. J. Bhasker, "A Verilog HDL Primer," 2nd Edition, BS Publications, 2001.

Course Code	Course Title						Core/Elective
OE601CS	**OPERATING SYSTEMS**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To understand CPU, Memory, File and Device management
- To learn about concurrency control, protection and security
- To gain knowledge of Linux and Windows NT internals

Course Outcomes

Student will be able to

- Explain the components and functions of operating systems
- Analyze various Scheduling algorithms
- Apply the principles of concurrency
- Compare and contrast various memory management schemes
- Perform administrative tasks on Linux Windows Systems

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Threads, Inter process communication. CPU scheduling algorithms, Process synchronization, Critical section problem, Semaphores, Monitors.

UNIT-II: Memory management, Swapping, Contiguous allocation, Paging, Static and Dynamic partitions, Demand paging, Page replacement algorithms, Thrashing, Segmentation, Segmentation with paging. File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation.

UNIT-III

Deadlocks: Necessary conditions, Resource allocation graph, Methods for handling deadlocks, Prevention, Avoidance, Detection and Recovery. Protection: Goals, Domain of protection, Access matrix. Security: Authentication, Threat monitoring, Encryption.

UNIT-IV Device Management: Disk scheduling methods, Disk management, Device drivers and interfaces, CPU- Device interactions, I/O optimization.

UNIT-V: Case Studies:

The Linux System–Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process communication

Windows NT – General Architecture, The NT kernel, The NT executive

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Suggested Reading

1. Abraham Silberschatz, Peter B Galvin, Operating System Concepts, Addison Wesley, 2006
2. William Stallings, Operating Systems-Internals and Design Principles, 5th edition, PHI, 2005
3. Andrew S Tanenbaum, Modern Operating Systems, 4th edition, Pearson, 2016

Course Code	Course Title						Core/Elective
OE602CS	**OOP Using JAVA**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To introduce fundamental object oriented concepts of Java programming Language - such as classes, inheritance, packages and interfaces
- To introduce concepts of exception handling and multi-threading
- To use various classes and interfaces in java collection framework and utility classes
- To understand the concepts of GUI programming using AWT controls
- To introduce Java I/O streams and serialization

Course Outcomes

Student will be able to

- Develop java applications using OO concepts and packages
- Write multi threaded programs with synchronization
- Implement real world applications using java collection frame work and I/O classes
- Write Event driven GUI programs using AWT/Swing

UNIT – I

Object Oriented System Development: understanding object oriented development, understanding object oriented concepts, benefits of object oriented development.

Java Programming Fundamentals: Introduction, overview of Java, data types, variables and arrays, operators, control statements.

UNIT – II

Java Programming OO concepts: classes, methods, inheritance, packages and interfaces.Exceptional Handling, Multithreaded Programming

UNIT – III

I/O Basics, Reading Console Input and Output, Reading and Writing Files, Print Writer Class, String Handling

Exploring Java.Lang, Collections Overview, Collection Interfaces, Collection Classes, Iterators, Random Access Interface, Maps, Comparators, Arrays, Legacy Classes and Interfaces, String Tokenizer

UNIT – IV

Introducing AWT working With Graphics: AWT Classes, Working with Graphics

.Event Handling: Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces

AWT Controls: Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, CheckboxGroup, Choice Controls, Using Lists, Managing Scroll Bars, Using TextField, Using TextArea, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, FileDialog,Handling events by Extending AWT Components, Exploring the controls, Menus and Layout Managers.

UNIT – V

Java I/O Classes and Interfaces, Files, Stream and Byte Classes, Character Streams, Serialization.

Suggested Readings

1. Herbert Schildt, The Complete Reference JAVA, Tata McGraw Hill, 7thEdition, 2005
2. James M Slack, Programming and Problem Solving with JAVA, Thomson learning, 2002
3. C.Thomas Wu, An Introduction to Object-Oriented Programming with Java, Tata McGraw Hill, 5thEdition, 2005.

Course Code	Course Title						Core/Elective
OE601LA	**INTELLECTUAL PROPERTY RIGHTS**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To create awareness on Engineering Ethics providing basic knowledge about ethics, moral issues & moral dilemmas and professional ideals.
- To understanding, define and differentiate different types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.
- To expose to the Legal management of IP and understanding of real life practice of Intellectual Property Management.

Course Outcomes:

Student will able be

- Able to identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
- Able to recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
- Able to identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights and duties in products and technology development.

UNIT –I

Introduction: Meaning of Intellectual Property- Nature of I.P- Protection of I.P. Rights-kinds of Intellectual Property Rights –International Conventions of Intellectual Property Rights-patent Traty 1970, GATT 1994, TRIPS & TRIMS – International Organization for Protection of IPR – WTO, WIPRO, UNESCO.

UNIT –II

Patents: Meaning of Patent- Commercial Significance – Obtaining of Patent – patentable Subject – matter – rights and obligations of Patentee – specification – Registration of patents – Compulsory licensing and licenses of rights – Revocation.

UNIT –III

Industrial Designs : Definitions of Designs – Registration of Designs – Rights and Duties of Proprietor of Design – Piracy of Registered Designs.

UNIT –IV

Trade Marks : Meaning of trademark – purpose of protecting trademarks Registered trade mark – procedure – passing off – Assignment and licensing of trade marks – Infringement of trademarks.

UNIT – V

Nature, scope of copyright – Subject matter of copy right – Right conferred by copyrightPublication – Broad – casting, telecasting – computer programme – Database right – Assignment – Transmission of copyright – Infringement of copy right.

Suggested Reading

1.Cornish W.R, "Intellectual Property Patents", Copyright, Trademarks and Allied Rights, Sweet & Maxwell 1993.
2. P. Narayanan, "Intellectual Property Law", Eastern law House 2nd Edn. 1997.
3. Robin Jacob & Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copyrights and designs", Sweet and Maxwell, 4th Edn.,1993.

Course Code	Course Title						Core/Elective
OE601IT	**DATABASE SYSTEMS (open Elective)**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce E-R Model and Normalization
- To learn formal and commercial query languages of RDBMS
- To understand the process of database application development
- To study different database architectures
- To introduce security issues in databases

Course Outcomes:

Student will be able to:

- Understand the mathematical foundations of Database design
- Model a set of requirements using the Entity Relationship (E-R)Model , transform an E-R model into a relational model ,and refine the relational model using theory of Normalization
- Understand the process of developing database application using SQL
- Understand the security mechanisms in RDBMS

UNIT I

Design: Conceptual design (E-R modeling), the relational model, normalization

UNIT II

Queries: algebra and logic (relational algebra and calculus), relational query languages and queries (namely SQL),select, project, join, union, intersection, except, recursion, aggregation, data manipulation

UNIT III

Applications: application development, database application interfaces (e.g., JDBC), internet applications, proper database application paradigms, transactions, transaction management, concurrency control, crash recovery

UNIT IV

Distributed DB, Architecture, Query processing and Optimization in Distributed DB, Introduction to NoSQL Databases , Graph databases, Columnar Databases

UNIT V

Introduction to Database Security Issues, Security mechanism, Database Users and Schemas, Privileges

Suggested Books

1. Jim Melton and Alan R. Simon.SQL 1999: Understanding Relational Language Components.First Edition, 1999.Morgan Kaufmann Publishers.

2. Don Chamberlin.Using the New DB2: IBM's Object-Relational Database System.First Edition, 1996.Morgan Kaufmann Publishers.
3. Database System Concepts Sixth Edition, by Abraham Silberschatz , Henry F Korth, S Sudarshan,Mc Graw-Hill Education
4. Fundamentals of Database Systems , Elmasri, Navathe, Sixth Edition , Addison-Wesley

Course Code	Course Title						Core/Elective
	Introduction to Data Structures						**Open Elective**
Prerequisites	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PPS	3	-	-	-	30	70	03

Course Objectives:

- To develop basic understanding of time and space complexity of an algorithm
- To understand need of data structures for efficient storage and easy access of data.
- To introduce basic linear data structures and operations on them.
- To introduce non-linear data structures and their representations.
- To understand various sorting and searching techniques and their efficiency.

Course Outcomes:

After completing this course, students will be able to:

- Emphasize on need of data structure in writing efficient algorithms.
- Distinguish between linear and non-linear data structures and their applications in real world problems.
- Explain representation of different data structures in computer systems.
- Explain different operations on data structures and write algorithms for them.
- Explain different sorting techniques and write algorithms for them.

Unit – I:

Algorithms: Definition, Algorithm Specifications, Performance Analysis of an Algorithm – Time and Space Complexity, Asymptotic Notations.

Introduction to Data Structures – Definition, Basic Concepts, Implementation of Data Structures.

Arrays: Definition, Terminology, One-Dimensional Arrays, Memory Allocation and Basic Operations on arrays.

Unit – II:

Stacks: Introduction, Definition, Representation of a Stack, Operations on a Stack, Applications of a Stack: Recursion, and Evaluation of an Arithmetic Expression.

Queues: Introduction, Definition, Representation of a Queue, Various Queue Structures: Circular Queue, Deque.

Unit – III:

Linked Lists: Definition, Single Linked List – Representation and basic Operations, Circular Linked List, Double Linked List, Implementing Stack and Queue using Linked List.

Unit – IV:

Trees – Basic Terminologies, Definition, Representation of Binary Trees, Operations on Binary Trees, Binary Search Trees.

Graphs: Introduction, Terminology, Representation of Graphs, Graph Traversal Techniques, Minimum Spanning Cost Trees.

Unit – V:

Searching and Sorting: Linear Search, Binary Search, and its complexity analysis, Sorting Algorithms: Selection Sort, Bubble Sort, Insertion Sort, and Merge Sort – and their complexity analyses.

Suggested Readings:

1. Classic Data Structures, Debasis Samanta, SecondEdition, PHI, 2006.
2. Fundamentals of Data structures in C, Second Edition, E. Horowitz, S. Sahni and Susan, Anderson-Freed, Universities Press, 2007.