नागालैण्ड विश्वविद्यालय
NAGALAND UNIVERSITY
(संसद द्वारा पारित अधिनियम 1989, क्रमांक 35 के अंतर्गत स्थापित केंद्रीय विश्वविद्यालय)
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Annexure I: Revision of course structure/syllabus for B.Tech in Computer Science & Engineering

1st semester

S.N.	Course Code	Course Name	L	T	P	Total Credits
THEORY						
1	BSH101	Physics	3	0	0	3
2	BSH102	Mathematics –I	3	1	0	4
3	BSH103	Basic Electrical Engineering	3	0	0	3
4	BSH104	Engineering Graphics and Design	1	0	0	1
5	BSH105	Technical English	2	0	0	2
6	BSH106	Environmental Science	3	0	0	3
7	BSH107	IDEA Lab Workshop	2	0	0	0
PRACTICAL						
1	BSH111	Physics Lab	0	0	2	1
2	BSH112	Engineering Graphics and Design Lab	0	0	4	2
3	BSH113	Design Thinking Lab	0	0	2	1
4	BSH114	Technical English Lab	0	0	2	1
5	BSH115	IDEA Lab Workshop	0	0	4	0
Total Credits			17	1	14	21

2nd Semester

S.N.	Course Code	Course Name	L	T	P	Total Credits
1	BSH201	Chemistry	3	0	0	3
2	BSH202	Mathematics –II	3	1	0	4
3	BSH203	Programming for Problem Solving	3	0	0	3
4	BSH204	Basic Electronics	3	0	0	3
5	BSH205	Manufacturing Practices	1	0	0	1
6	BSH206	Sports and Yoga	2	0	0	2
7	BSH207	Universal Human Values - II: Understanding Harmony and Ethical Human Conduct	2	1	0	3
PRACTICAL						

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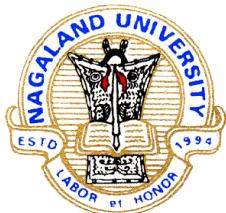| 1	BSH211	Chemistry Lab	0	0	2	1
2	BSH212	Programming for Problem Solving Lab	0	0	4	2
3	BSH213	Basic Electronics Lab	0	0	2	1
4	BSH214	Manufacturing Practices Lab	0	0	4	2
Total Credits			**17**	**2**	**12**	**23**

Remarks:

Courses for Semester 1 and 2 are updated as per AICTE 2020 model curriculum.

3rd Semester

S.N.	Course Code	Course Name	L	T	P	Total Credits
THEORY						
1	CSB301	Advanced Programming	3	0	0	3
2	CSB302	Data Structures & Algorithm	3	0	0	3
3	CSB303	Computer Graphics & Virtual Reality	3	0	0	3
4	MAT3T2	Differential Calculus	3	1	0	4
5	EC3T03	Digital Electronics & Logic Design	2	1	0	3
PRACTICAL						
1	CSB311	Advanced Programming Lab	0	0	3	1.5
2	CSB312	Data Structures & Algorithm Lab	0	0	3	1.5
3	EC3L02	Digital Electronics & Logic Design Lab	0	0	3	1.5
Total Credits			**14**	**2**	**9**	**20.5**

4th Semester

S.N.	Course Code	Course Name	L	T	P	Total Credits
THEORY						
1	CSB401	Design & Analysis of Algorithms	3	0	0	3
2	BSH401	Organizational Behaviour	3	0	0	3
3	CSB403	Formal Language & Automata Theory Automata Theory	3	0	0	3
4	CSB404	Computer Organization & Architecture	4	0	0	4
5	MAT4T2	Discrete Mathematics	3	1	0	4
PRACTICAL						

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			L	T	P	Total Credits
1	CSB411	Design & Analysis of Algorithms Lab	0	0	3	1.5
2	CSB412	Application Programming Lab-1	0	1	3	2.5
3	CSB413	Computer Organization & Architecture Lab	0	0	3	1.5
Total Credits			**16**	**2**	**9**	**22.5**

Remarks:
1. CSB301, CSB311, HSB401,CSB412 are newly introduced courses.

5th Semester

S.N.	Course Code	Course Name	L	T	P	Total Credits
THEORY						
1	CSB501	Compiler Design	3	0	0	3
2	CSB502	Operating System	3	0	0	3
3	CSB503	Database Management Systems	3	0	0	3
4	CSB504	Software Engineering	3	0	0	3
5	BSH501	Project Management & Entrepreneurship	2	0	0	2
PRACTICAL						
1	CSB511	Compiler Design Lab	0	0	3	1.5
2	CSB512	Operating System Lab	0	0	3	1.5
3	CSB513	Database Management Systems Lab	0	0	3	1.5
Total Credits			**14**	**1**	**9**	**18.5**

6th Semester

S.N.	Course Code	Course Name	L	T	P	Total Credits
1	CSB601	Computer Networks	3	0	0	3
2	CSBEXX	Elective-I	3	0	0	3
3	CSBEXX	Elective-II	3	0	0	3
4	CSBEXX	Elective-III	3	0	0	3

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5	HSB601	Introduction to Research	3	0	0	3
6	HSB602	Developing soft skills and personality	2	0	0	2
PRACTICAL						
1	CSB611	Computer Networks Lab	0	0	3	1.5
2	CSB612	Application Programming Lab-2	0	1	3	2.5
3	CSB613	Project I	0	0	6	3
Total Credits			**17**	**1**	**12**	**24**

Remarks:

1. Elective-I, HSB601, HSB602, CSB612, CSB613 are newly introduced courses.

7th Semester

S.N.	Course Code	Course Name	L	T	P	Total Credits
THEORY						
1	CSB701	Distributed System	3	0	0	3
2	CSB702	Machine Learning	3	0	0	3
3	CSBEXX	Elective-IV	3	0	0	3
4	CSBEXX	Elective-V	3	0	0	3
5	CSBOEXX	Open Elective I	3	0		3
PRACTICAL						
1	CSB711	Project-II#	0	0	12	6
2	CSB712	Machine Learning Lab	0	0	3	1.5
3	CSB713	Colloquium-I*	0	0	0	0 (No credit)
Total Credits			**15**	**0**	**15**	**22.5**

8th Semester

S.N.	Course Code	Course Name	L	T	P	Total Credits

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THEORY						
1	CSBEXX	Elective-VI	3	0	0	3
2	CSBOEXX	Open Elective-II	3	0	0	3
3	BSH801	Constitution of India	3	0	0	0 (No credit)
PRACTICAL						
1	CSB811	Project-III	0	0	12	6
Total Credits			**9**	**0**	**12**	**12**

*The student will give a presentation (Colloquium-I) on the summer/winter/industrial training (**6 – 8 weeks**) that She / He underwent during the vacation period after 5th or 6th semester. The credit(Pass or Fail) will be awarded in the 7th Semester under Colloquium-I. Presentation will be conducted in the beginning of 7th semester.

#The student will submit a synopsis for their Project at the beginning of the semester in a specified format which should be approved by the departmental committee. The student will also have to present the progress of their project through seminars and progress reports.

Total no. of Credits from 1st to 8th Semester: 164 (One Hundred Sixty four)
Remarks:
1. Open elective-II is a newly introduced course.

List of Elective						
Sl. No.	Course Code	Course Title	L	T	P	Total Credits
1	CSBE01	Digital Image Processing	3	0	0	3
2	CSBE02	Data Mining	3	0	0	3
3	CSBE03	Software Testing	3	0	0	3
4	CSBE04	Graph theory	3	0	0	3
5	CSBE05	Data Analytic with Python	3	0	0	3
6	CSBE06	Mobile Computing	3	0	0	3
7	CSBE07	Computer Vision	3	0	0	3
8	CSBE08	Linux Internal	3	0	0	3
9	CSBE09	Artificial Intelligence	3	0	0	3
10	CSBE10	Real Time Systems	3	0	0	3
11	CSBE11	Embedded Systems & Design	3	0	0	3
12	CSBE12	Operational Research	3	0	0	3
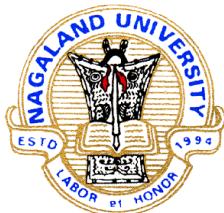
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13	CSBE13	Cloud Computing	3	0	0	3
14	CSBE14	Information Theory & Coding	3	0	0	3
15	CSBE15	Information Retrieval	3	0	0	3
16	CSBE16	Deep Learning	3	0	0	3
17	CSBE17	Cryptography & Network Security	3	0	0	3
18	CSBE18	Design & Management of Computer Network	3	0	0	3
19	CSBE19	Human Computer Interaction	3	0	0	3
20	CSBE20	Wireless Ad Hoc and Sensor Network*	3	0	0	3
21	CSBE21	GPU Architecture and Programming	3	0	0	3
22	CSBE22	Natural Language Processing	3	0	0	3
23	CSBE23	Distributed Database	3	0	0	3
24	CSBE24	Blockchain and its applications	3	0	0	3

List of Open Elective

1	CSBOE01	Introduction to Soft Computing	3	0	0	3
2	CSBOE02	Internet of Thing	3	0	0	3
3	CSBOE03	Mobile Robotics	3	0	0	3
4	CSBOE04	Cyber Law & Ethics	3	0	0	3
5	CSBOE05	Bioinformatics: Algorithms and applications	3	0	0	3
6	CSBOE06	Introduction to Cyber Security*	3	0	0	3
7	CSBOE07	Multimedia Technology	3	0	0	3
8	CSBOE08	Mobile Applications & Services	3	0	0	3

Remarks:

1. CSBE05, CSBE06, CSBE07, CSBE16, CSBE20, CSBE21, CSBE22, CSBE24, CSBOE03, CSBOE04, CSBOE05, CSBOE06 are newly introduced courses.

One course under elective or open elective per semester will be offered through MOOCs/SWAYAM/NPTEL with in-house examination.

The following practical lab will be conducted under a virtual lab.
  1. Computer Organization & Architecture Lab
  2. Software Engineering Lab

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Details of the new course contents for B.Tech in Computer Science & Engineering

Course Code	Course name	Lectures	Tutorials	Practical	Total Credits
HSB401	Organizational Behaviour	3	0	0	3

Introduction – defining organization, behavior and organizational behavior, assumptions of OB, principles of OB, levels of OB, scope of OB, OB and Human Resource Management, Applications of OB, Historical developments of OB, emerging concerns

Perception and Learning – understanding perception, Basic elements of perception, Principles of perceptual selection, Perceptual grouping, Social Perception, Self-perception and identity, attribution of causality, Perceptual biases in social perception, Implications for human resource management, defining learning, classical and operant conditioning, learning in organizations

Personality – Defining Personality, History of the concept, Key assumptions, biological and social determinants, Theories – Intrapsychic theory, social learning theory, self-theory, Trait and type theories, Related concepts (locus of control, dogmatism, authoritarianism, Machiavellianism), measuring personality.

Attitudes – Definition, Key elements of attitudes, Attitudes and related concepts (Values, opinion, belief and ideology), Characteristics of attitudes, Attitude formation, Attitude measurement, Changing attitudes, Attitudes at workplace (job satisfaction, work attitude and organizational commitment), Prejudice and discrimination at workspace.

Emotions in workplace - Definition, Types of emotions, Related concepts (mood, temperament), Stress in workplace, General Adaptation Syndrome, Managing Stress, Psychosomatic disorders and stress, emotional labor and emotional contagion.

Motivation – Definition, Process of motivation, Types of motives, Motivators at workplace, Motivation theories (Process and Content theories)

Interpersonal Dynamics – Definition, Psychological Contract, Trust and trust building, Prosocial behavior, Cooperation Vs Competition, Conflict management, Levels and types of conflict at workplace, Conflict management Styles, Managing Negotiations

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Power and Leadership - Defining Power, Sources of Power, Organizational politics, Leadership, Managers Vs Leaders, Trait and Type approach to leadership, Leadership style, Leadership Grid, Contingency Theories, Contemporary issues

Team Dynamics – Groups and Teams, Types of Teams, Stages in group development, problems in team work (Free riding, social loafing, group think), Cross-cultural virtual teams.

Organizational culture – Defining culture, levels of culture, cultural dimensions, high and low context cultures, Strong and weak organizational cultures, Expressions of organizational culture, Impact of culture on individuals, Organizational cultural change

Organization Change – Change in Organizations, Nature of the chance process, Types of chance, Impact of change, Managing resistance to change, Organizational Development interventions

Organizational Structure and Design – Basic dimensions of structure, Departmentalization, Organizational life cycle, Organizations as socio-technical systems, Organizational design and its impact on employees, Organizational boundary spanning

Books and References:
1. Behaviour in Organizations by Jerald Greenberg and Robert A. Baron, PHI learning private Ltd, New Delhi (Ninth Edition).
2. Understanding Organizational Behaviour by Udai Pareek, Oxford University Press (Third Edition)ORGB by Nelson, Quick and Khandelwal , Cengage Learning New Delhi (second edition).

Course details referred from Organizational Behaviour - Course

COURSE OUTLINE :
Work is an inherent part of human behaviour. Most adults spend at least 30 percent of their life time in their work place and/or in work related activities. Like in any other context, human behaviour in the organizational and work context is a complex phenomenon. Individual behaviour at work is a result of interaction between various individual, group and organizational level factors. Understanding how individuals and groups behave at work place will not only help improve their effectiveness but also nurture the quality of work life of the individuals. This course will help students to be cognizant of these workplace

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Course Code	Course name	Lectures	Tutorials	Practical	Total Credits
HSB601	Introduction to Research	3	0	0	3

Research overview
Overview of literature survey, literature survey using web of science, literature survey using scopus, writing up, tutorial on using microsoft word with bibliographic sources, tutorial on using microsoft word with endnote entries, experimental skills

Data analysis, modeling skills, safety in laboratory

Technical presentation, technical writing

Creativity in research, ethics in research

Intellectual property, design of experiment

Course details referred from NPTEL :: General - NOC:Introduction to Research

COURSE OUTLINE :
Large numbers of students are actively considering and taking up research and associated higher studies. This course aims to introduce students to the important aspects of research. The intent of the course is to make students aware of the details associated with formal research and to help students overcome common misconceptions that may be present in their minds. By going through this course, students are likely to be able to take up research activities in a more systematic and formal manner right from the beginning.

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE24	Blockchain and its applications	3	0	0	3

PRE-REQUISITE: Computer Networks; Operating Systems; Cryptography and Network Security.

Introduction to Blockchain Technology and its Importance
Basic Crypto Primitives I – Cryptographic Hash
Basic Crypto Primitives II – Digital Signature
Evolution of the Blockchain Technology
Elements of a Blockchain
Blockchain Consensus I – Permissionless Models
Blockchain Consensus II – Permissioned Models
Smart Contract Hands On I – Ethereum Smart Contracts (Permissionless Model)
Smart Contract Hand On II – Hyperledger Fabric (Permissioned Model)
Decentralized Identity Management
Blockchain Interoperability
Blockchain Applications

Books and References:
1. Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Imran Bashir, Packt Publishing, 2020, ISBN: 9781839213199, book website: https://www.packtpub.com/product/mastering-blockchain-third-edition/9781839213199
2. Hyperledger Tutorials - https://www.hyperledger.org/use/tutorials
3. Ethereum Development Resources - https://ethereum.org/en/developers
4. Online materials and case studies

Course details source: https://nptel.ac.in/courses/106105235

COURSE OUTLINE :
In the last few years, Blockchain technology has generated massive interest among governments, enterprises,
and academics, because of its capability of providing a transparent, secured, tamper-proof solution for interconnecting different stakeholders in a trustless setup. In January 2021, the Ministry of Electronics and Information Technology (MeiTY), Government of India, published the first draft of the "National Strategy on
Blockchain" that highlights 17 potential applications that are of national interest. Against this backdrop, this subject will cover the basic design principles of Blockchain technology and its applications over different sectors. Additionally, the course also provides tutorials on setting up blockchain applications using one of the

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well-adopted permissionless blockchain platforms -Ethereum, and one permissioned blockchain platform - Hyperledger.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE16	Deep learning	3	0	0	3

Machine Learning: Fundamentals; Neural Network: Perceptrons, Back Propagation, Over-fitting, Regularization. Deep Networks: Definition, Motivation, Applications; Principal Component Analysis; Restricted Boltzmann Machine; Sparse Auto-encoder; Deep Belief Net; Hidden Markov Model. Convolution Neural Network (CNN): Basic architecture, Activation functions, Pooling, Handling vanishing gradient problem, Dropout, Greedy Layer-wise Pre-training, Weight initialization methods, Batch Normalization; Different CNN Models: Alex Net, VGG Net, Google Net, Res Net, Dense Net, MIL, Highway Network, Fractal Network, Siamese Net; Graphical Model: Bayes Net, Variational Auto-encoders. Sequence Learning: 1D CNN, Recurrent Neural Network (RNN), Gated RNN, Long short-term memory (LSTM). Generative Modeling: Generative adversarial network. Zero Shot Learning. Applications.

References:
1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016
2. Michael A. Nielsen, Neural Networks and Deep Learning , Determination Press, 2015
3. Yoshua Bengio, Learning Deep Architectures for AI, now Publishers Inc., 2009

Course details source:IIT-G

COURSE OUTLINE :
On completion of the course students will acquire the knowledge of applying Deep Learning techniques to solve various real life problems.

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBOE01	Introduction to Soft Computing	3	0	0	3

Introduction to Soft Computing, Introduction to Fuzzy logic, Fuzzy membership functions, Operations on Fuzzy sets
Fuzzy relations, Fuzzy propositions, Fuzzy implications, Fuzzy inferences
Defuzzyfication Techniques-I, Defuzzyfication Techniques-II, Fuzzy logic controller-I, Fuzzy logic controller-II
Solving optimization problems, Concept of GA, GA Operators: Encoding, GA Operators: Selection-I
GA Operators: Selection-II, GA Operators: Crossover-I, GA Operators: Crossover-II, GA Operators: Mutation
Introduction to EC-I, Introduction to EC-II, MOEA Approaches: Non-Pareto, MOEA Approaches: Pareto-I
MOEA Approaches: Pareto-II, Introduction to ANN, ANN Architecture
ANN Training-I, ANN Training-II, ANN Training-III, Applications of ANN

Books and references
1. An Introduction to Genetic Algorithm Melanic Mitchell (MIT Press)
2. Evolutionary Algorithm for Solving Multi-objective, Optimization Problems (2nd Edition), Collelo, Lament, Veldhnizer (Springer)
3. Fuzzy Logic with Engineering Applications Timothy J. Ross (Wiley)
4. Neural Networks and Learning Machines Simon Haykin (PHI)

Course details source: NPTEL

COURSE OUTLINE :
Soft computing is an emerging approach to computing which parallel the remarkable ability of the human mind to reason and learn in an environment of uncertainty and imprecision. Soft computing is based on some biological inspired methodologies such as genetics, evolution, ant's behaviors, particles swarming, human nervous systems, etc. Now, soft computing is the only solution when we don't have any mathematical modeling of problem solving (i.e., algorithm), need a solution to a complex problem in real time, easy to adapt with changed scenario and can be implemented with parallel computing. It has enormous applications in many application areas such as medical diagnosis, computer vision, hand written character recondition, pattern recognition, machine intelligence, weather forecasting, network optimization, VLSI design, etc

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE05	Data analytics with python	3	0	0	3

Introduction to data analytics and Python fundamentals
Introduction to probability
Sampling and sampling distributions
Hypothesis testing
Two sample testing and introduction to ANOVA
Two way ANOVA and linear regression
Linear regression and multiple regression
Concepts of MLE and Logistic regression
ROC and Regression Analysis Model Building
C^2 Test and introduction to cluster analysis
Clustering analysis
Classification and Regression Trees (CART)

References:
1. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
2. Swaroop, C. H. (2003). A Byte of Python. Python Tutorial.
3. Ken Black, sixth Editing. Business Statistics for Contemporary Decision Making. "John Wiley & Sons, Inc".
4. Anderson Sweeney Williams (2011). Statistics for Business and Economics. "Cengage Learning".
5. Douglas C. Montgomery, George C. Runger (2002). Applied Statistics & Probability for Engineering. "John Wiley & Sons, Inc"
6. Jay L. Devore (2011). Probability and Statistics for Engineering and the Sciences. "Cengage Learning".
7. David W. Hosmer, Stanley Lemeshow (2000). Applied logistic regression (Wiley Series in probability and statistics). "Wiley-Interscience Publication".
8. Jiawei Han and Micheline Kamber (2006). Data Mining: Concepts and Techniques. "
9. Leonard Kaufman, Peter J. Rousseeuw (1990). Finding Groups in Data: An Introduction to Cluster Analysis. "John Wiley & Sons, Inc".

Course details source: NPTEL

COURSE OUTLINE :

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We are looking forward to sharing many exciting stories and examples of analytics with all of you using python programming language. This course includes examples of analytics in a wide variety of industries, and we hope that students will learn how you can use analytics in their career and life. One of the most important aspects of this course is that you, the student, are getting hands-on experience creating analytics models; we, the course team, urge you to participate in the discussion forums and to use all the tools available to you while you are in the course!

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBOE05	Bioinformatics: Algorithms and applications	3	0	0	3

PRE-REQUISITES : Basic knowledge of Biology and any computer language would be helpful

Introduction, DNA sequence analysis, DNA Databases
Protein structure and function, protein sequence databases, sequence alignment
PAM matrix, Global and local alignment, BLAST: features and scores
Multiple sequence alignment, Conservation score, phylogenetic trees
Protein sequence analysis, hydrophobicity profiles, non-redundant datasets
Protein secondary structures, Ramachandran plot, propensity, secondary structure prediction
Protein tertiary structure, Protein Data Bank, visualization tools, structural classification
Protein structural analysis, protein structure prediction
Protein stability, energetic contributions, database, stabilizing residues
Protein folding rates, proteins interactions, binding site residues
Computer aided drug design, docking, screening, QSAR
Development of

References:
1. M. Michael Gromiha, Protein Bioinformatics: From Sequence to Function, Academic Press, 2010
2. D.E. Krane and M.L. Raymer, Fundamental concepts of bioinformatics, Pearson Education Inc. 2006

Course details source: NPTEL

COURSE OUTLINE :
Bioinformatics is an interdisciplinary field of science for analyzing and interpreting vast biological data using computational techniques. In this course, we aim to give a walkthrough of the major aspects of bioinformatics such as the development of databases, computationally derived hypothesis, algorithms, and computer-aided drug design. During the first section of the course, we will focus on DNA and protein sequence databases and analysis, secondary structures and 3D structural analysis. The second section will be devoted to applications such as prediction of protein structure, folding rates, stability upon mutation, and intermolecular interactions. Further, we will cover computer-aided drug design using docking and QSAR studies. This course is designed to nurture skills and knowledge required for aspiring students, young biologists and research scholars to develop algorithms and tools in bioinformatics.

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSB412	Application programming lab-1		1	3	2.5

Python Language: Basics
Installing Python, introduction to IDE for writing Python code, variables, Basic datatypes & operators, Sequence datatypes, Input/output, Conditionals Statements, Loops

Python Language: Data structures
Manipulating lists, Manipulating strings, Getting started with tuples, Dictionaries, and Sets in Python

Arrays and Matrices
Getting started with arrays, Accessing parts of arrays, Image manipulation using Arrays, Basic Matrix Operations

Handling Large Data Files
Getting started with lists, Getting started with for, Getting started with strings, Getting started with files (txt and CSV), Parsing data, Statistics

Plotting Experimental Data
Basic Plotting, Saving plots, Multiple plots, Subplots, loading data from files, Plotting the data, Other types of plots, Plotting charts

Python Language: Advanced
Local/global Variable, oops concepts, scope of variables, Getting started with functions, Advanced features of functions, using Python modules, writing Python scripts, Modules. Image Processing

Books and references:
1. A. B. Downey, Think Python, 3e: How to Think Like a Computer Scientist, O'Reilly, 2015.
2. Z. Shaw, LEARN PYTHON 3 THE HARD WAY, Addison-Wesley, 2017.
3. Python Crash Course – A Hands-on, Project-Based Introduction to Programming (3rd Edition).

Outcome:
1- Numeric and symbolic computation
2- 2D/3D plotting
3- User interfaces
4- Parallel computing
5- Machine learning and image processing

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSB612	Application programming lab-II	0	1	3	2.5

Review of basics of Python programming: Variable, operator, control statement, data structure, file handling, function, class, object,

Building Your First Python GUI Application With Tkinter: Adding a Widget

Working With Widgets: Displaying Text and Images With Label Widgets, Displaying Clickable Buttons With Button Widgets, Getting User Input With Entry Widgets, Getting Multiline User Input With Text Widgets, Assigning Widgets to Frames With Frame Widgets, Adjusting Frame Appearance With Reliefs, Understanding Widget Naming Conventions

Controlling Layout With Geometry Managers: The .pack() Geometry Manager, The .place() Geometry Manager, The .grid() Geometry Manager

Making Your Applications Interactive: Using Events and Event Handlers, Using .bind(), Using command

Building a Temperature Converter (Example App), Building a Text Editor (Example App)

Getting started with Django: Install Django, Create a Django project, The Django project file structure, Start the Django development server, Accessing Django web page, Stop the Django development server

Creating Django Models: About Django App, Djano Model, Create a blog app, Blog app directory structure, Initialize a Django app, Create a Django Model and, Perform Database migration, Settings.py file, manage.py, migrate command, makemigrations command, 001_initial.py file

How to Use Django Admin App: Use Django admin app, Create an admin user, Django Admin interface, Login to Django Admin interface, Authentication and Authorization, Registering Blog App, Registering Blog Models, Add Blog, Add Articles, Logout from Django Admin interface, Add, Modify and Delete data using the admin app, Web Application and Web Framework

Creating Views and Design URLs: What is a view?, Create a Django view, Http Request object, HttpResponse class, django.urls modules, Create a URL routing scheme, path function, Client Server model, string formatting operation, placeholder

Creating HTML Template in Django: Create templates folder, Create a Django template, Use Django HTML template, Django templates system, Template tags, Template variables, Template filters, title filter, render function, django shortcuts module

Django Shell and Django Database Query: About Django Shell, Access Django shell, Create a Django Query, Create Blog Instance via shell, Assign value to the blog instance, Timezone module, Access blog object, Change blog name, Display blog objects, Check blog creation date, Filter with Django Queries

Creating Forms in Django: HTML Forms, Create a Django form, Django inbuilt libraries, Create views to handle form submission, CSRF - Cross Site Request Forgery Protection, GET and POST Request, Form validation, Add Blog via form input method, Display the blog list, Edit existing blog

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Using CSS and JavaScript in Django: About CSS, About JavaScript, Django Static files, Load static files, Django Static template tag, Create CSS and JavaScript files for Django, Add style to the list items, Set color to the text, Add an alert message when the page loads, Link CSS and JS to Django template

Django Authentication: Django Authentication and Authorization system, Verify user credentials, Define user actions, Create a login functionality, Create a logout functionality, Use Django's built-in login and logout functions, Login page redirection, Logout page redirection, Accessing the page as registered users, Restrict access to the pages

Books and references
1. bin Uzayr, Sufyan. *Mastering Python for Web: A Beginner's Guide*. CRC Press, 2022.
2. Melé, Antonio. *Django 5 By Example: Build powerful and reliable Python web applications from scratch*. Packt Publishing Ltd, 2024.
3. Vincent, William S. *Django for Beginners: Build websites with Python and Django*. WelcomeToCode, 2022.
4. Saurabh Chandrakar, Dr. Nilesh Bhaskarrao Bahadure, Building Modern GUIs with tkinter and Python: Building user-friendly GUI applications with ease, BPB Publications
5. Alan D. Moore , Python GUI Programming with Tkinter, 2nd edition, CRC Pr I Llc

Outcome:
1- Game development
2- Web development
3- GUI application development

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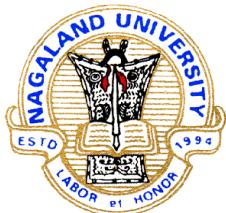
Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE22	Natural language processing	3	0	0	3

PRE-REQUISITES : Basic knowledge of probabilities for the lectures and python for programming assignment
Introduction and Basic Text Processing
Spelling Correction, Language Modeling
Advanced smoothing for language modeling, POS tagging
Models for Sequential tagging – MaxEnt, CRF
Syntax – Constituency Parsing
Dependency Parsing
Distributional Semantics
Lexical Semantics
Topic Models
Entity Linking, Information Extraction
Text Summarization, Text Classification
Sentiment Analysis and Opinion Mining

Reference:
1. Daniel Jurafsky and James H. Martin. 2020. *Speech and Language Processing.* 3rd Edition (draft)
2. Christopher D. Manning and Hinrich Schütze. 1999. *Foundations of Statistical Natural Language Processing.* MIT Press.
3. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana. 2020. *Practical Natural Language Processing.* O'Reilly.
4. Hobson Lane, Cole Howard, Hannes Hapke. 2019. *Natural Language Processing in Action.* Live Book.

Course details source: https://nptel.ac.in/courses/106105158

Course outline:
This course starts with the basics of text processing including basic pre-processing, spelling correction, language modeling, Part-of-Speech tagging, Constituency and Dependency Parsing, Lexical Semantics, distributional Semantics and topic models. Finally, the course also covers some of the most interesting applications of text mining such as entity linking, relation extraction, text summarization, text classification, sentiment analysis and opinion mining.

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE21	GPU Architecture and programming	3	0	0	3

PRE-REQUISITES : Programming and Data Structure, Digital Logic, Computer architecture

Review of Traditional Computer Architecture – Basic five stage RISC Pipeline, Cache Memory, Register File, SIMD instructions
GPU architectures - Streaming Multi Processors, Cache Hierarchy, The Graphics Pipeline
Introduction to CUDA programming
Multi-dimensional mapping of dataspace, Synchronization
Warp Scheduling, Divergence
Memory Access Coalescing
Optimization examples : optimizing Reduction Kernels
Optimization examples : Kernel Fusion, Thread and Block
OpenCL basics
OpenCL for Heterogeneous Computing
Application Design : Efficient Neural Network Training/Inferencing
Application Design : Efficient Neural Network Training/Inferencing

Reference:
1. "Computer Architecture -- A Quantitative Approach" - John L.Hennessy and David A. Patterson
2. "Programming Massively Parallel Processors" - David Kirk and Wen-mei Hwu
3. "Heterogeneous Computing with OpenCL" -- Benedict Gaster,Lee Howes, David R. Kaeli

Course detail source: https://nptel.ac.in/courses/106105220

Course outline:
The course covers basics of conventional CPU architectures, their extensions for single instruction multiple data processing (SIMD) and finally the generalization of this concept in the form of single instruction multiple thread processing (SIMT) as is done in modern GPUs. We cover GPU architecture basics in terms of functional units and then dive into the popular CUDA programming model commonly used for GPU programming. In this context, architecture specific details like memory access coalescing, shared memory usage, GPU thread scheduling etc which primarily effect program performance are also covered in detail. We next switch to a different SIMD programming language called OpenCL which can be used for programming both CPUs and GPUs in a generic manner. Throughout the course we provide different architecture-aware optimization techniques relevant to both CUDA and OpenCL. Finally, we provide the students with detail application development examples in two well-known GPU computing scenarios.

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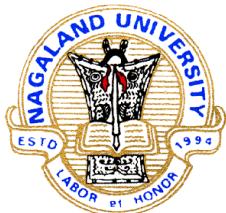**Kohima Campus, Meriema, Pin Code - 797004**
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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
HSB602	Developing soft skills and personality	2	0	0	2

PRE-REQUISITES : Programming and Data Structure, Digital Logic, Computer architecture

Introduction: A New Approach To Learning, Planning And Goal-Setting, Human Perceptions: Understanding People, Types Of Soft Skills: Self-Management Skills, Aiming For Excellence: Developing Potential And Self-Actualisation, Need Achievement And Spiritual Intelligence

Conflict Resolution Skills: Seeking Win-Win Solution, Inter-Personal Conflicts, Types Of Conflicts: Becoming A Conflict Resolution Expert, Types Of Stress: Self-Awareness About Stress, Regulating Stress: Making The Best Out Of Stress

Habits: Guiding Principles, Identifying Good And Bad Habits, Habit Cycle, Breaking Bad Habits, Using The Zeigarnik Effect For Productivity And Personal Growth, Forming Habits Of Success

Communication: Significance Of Listening, Active Listening, Barriers To Active Listening, Telephone Communication: Basic Telephone Skills, Advanced Telephone Skills, Essential Telephone Skills

Technology And Communication: Technological Personality, Mobile Personality?, E-Mail Principles, How Not To Send E-Mails!, Netiquette, E-Mail Etiquette

Communication Skills: Effective Communication, Barriers To Communication: Arising Out Of Sender/Receiver's Personality, Interpersonal Transactions, Miscommunication, Non-Verbal Communication: Pre-Thinking, Introduction And Importance, Issues And Types, Basics And Universals, Interpreting Non-Verbal Cues, Body Language: For Interviews, For Group Discussions

Presentation Skills: Overcoming Fear, Becoming A Professional, The Role Of Body Language, Using Visuals, Reading Skills: Effective Reading, Human Relations: Developing Trust And Integrity

Reference:
1. Dorch, Patricia. *What Are Soft Skills*? New York: Execu Dress Publisher, 2013.
2. Kamin, Maxine. *Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders*. Washington, DC: Pfeiffer & Company, 2013.
3. Klaus, Peggy, Jane Rohman & Molly Hamaker. *The Hard Truth about Soft Skills*. London: HarperCollins E-books, 2007.

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4. Petes S. J., Francis. *Soft Skills and Professional Communication*. New Delhi: Tata McGraw-Hill Education, 2011.
5. Stein, Steven J. & Howard E. Book. *The EQ Edge: Emotional Intelligence and Your Success*. Canada: Wiley & Sons, 2006.

Course details source: https://onlinecourses.nptel.ac.in/noc22_hs77/preview

Course outline:

The course aims to cause a basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfillment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills.

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSB301	Advanced Programming	3	0	0	3

PRE-REQUISITES : Familiarity with data structures, and introduction to programming.

Familiarity with the programming environment:
Understanding the build system, IDE, debugging, profiling (Eclipse TPTP / gprof / VTune etc.), and source code management

Basic principles of the Object-oriented development Process:
Introduction to Object-Oriented Paradigm: Data encapsulation, modularity, code reuse, identifying classes, attributes, methods and object

Advanced features of OOP:
Interfaces, inheritance, polymorphism, abstract classes, immutability, copying and cloning objects

Unit testing
Unit testing, developing test suite

Using language APIs
Language supported libraries for handling advanced data structures

Defensive programming
Exception handling, assertions

Modeling and Design patterns
Basic modeling techniques – e.g. Class diagram, sequence diagram, use case diagrams, etc. Introduction to design patterns: iterator, singleton, flyweight, adapter, strategy, template, prototype, factory, façade, decorator, composite, proxy, chain of responsibility, observer, state)

Suggested text books:
1. Taming Python by Programming, Jeeva Jose, Khanna Book Publishing Company, New Delhi.
2. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A.
3. Houston. Object-Oriented Analysis and Design with Applications.
4. M. Scott. Programming Language Pragmatics. 4th edition.
Suggested reference books / Online resources:
1. Jeeva Jose, Introduction to Computing and Problem Solving with Python, Khanna Book Publishing Company, New Delhi.
2. R. Sebesta. Concepts of Programming Languages. 10th edition

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3. J. Rumbaugh et al. The Unified Modeling Language Reference Manual.
4. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, and Grady Booch. Design Patterns: Elements of Reusable Object-Oriented Software.
5. P. Van Roy and S. Haridi. Concepts, Techniques, and Models of Computer - R6. https://missing.csail.mit.edu/
6. https://www.baeldung.com/junit
7. https://www.tutorialspoint.com/junit/index.htm
8. For UML tools, open source tools may be used (e.g. www.starUML.io, argouml.tigris.org/)

Course details source: AICTE model curriculum

Course outline:
1. Understanding the build system: IDE, tools for testing, debugging, profiling, and source code management.
2. Students are able to demonstrate proficiency in object-oriented programming.
3. Identify and abstract the programming task involved for a given programming problem.
4. Learning and using language libraries for building large programs.
5. Ability to apply defensive programming techniques (e.g., assertions, exceptions).

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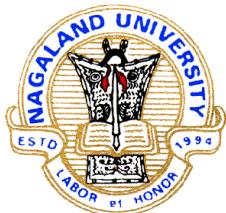
Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSB311	Advanced Programming Lab	0	0	3	1.5

PRE-REQUISITES : Familiarity with data structures, and introduction to programming.

1.

- Create GUI forms/application with different GUI components (buttons, text boxes, etc.), responding to user input by creating event handlers, productivity in creating event handlers using anonymous classes and lambda methods
- Implement simple 2-D game that uses animations (timelines, moving shapes), client-server programming (multiplayer game), object serialization/deserialization (save/reload game)

Suggested text books / Online lectures or tutorials:
   a. Oracle documentation: https://docs.oracle.com/javase/8/javase-clienttechnologies.htm
   b. P. Van Roy and S. Haridi. Concepts, Techniques, and Models of Computer Programming.

2.

- Creating and joining threads, concurrency decomposition, assigning tasks to threads, calculate parallel speedup and efficiency, debugging multithreaded programs
- Asynchronous task creation and joining, task parallelism for recursive parallelism, task dependency, controlling task granularity, Comparing performance/productivity of explicit multithreading v/s using thread pools
- Multithreaded program to push/pop items from shared queue - using monitor/Mutex locks, conditional wait and signaling, volatile keyword

Suggested text books / Online lectures or tutorials:
   a. M. Scott. Programming Language Pragmatics. 4th edition
   b. P. Pacheco. An Introduction to Parallel Programming.

Suggested reference books / Online resources:
   a. R. Sebesta. Concepts of Programming Languages. 10th edition
   b. P. Van Roy and S. Haridi. Concepts, Techniques, and Models of Computer Programming.

3.

- Set up some pre-installed programs and infrastructure to see how to run programs in the cloud. Programming in Map- Reduce/Spark to study scalability. Typical problems are from matrix multiplication, text processing, graphs , web crawling, and the like
- Redo exercises from week 2 to measure communication time

Suggested text books / Online lectures or tutorials:

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    a. Data-Intensive Text Processing with MapReduce, Jimmy Lin and Chris Dyer, Morgan & Claypool Publishers, 2010.
    b. Parallel Computer Architecture, David Culler, J. P. Singh, and A. Gupta, Elsevier, 1998.
    c. Distributed Computing: Principles, Algorithms, and Systems, A.D. Kshemkalyani, M. Singhal, Cambridge University Press, March 201

Course details source: AICTE model curriculum

Course outline:
Ability to implement basic event-driven programming.
Understanding of the fundamentals of parallel programming.
Understanding of the basics of cloud computing.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE06	Mobile Computing	3	0	0	3

PRE-REQUISITES : Java Programming, Operating Systems, Basic knowledge on socket connection

Introduction to mobile computing, installing of required software and preparing the working environment,creating your first Android Application
 Layouts, Views, Resources
Activities, Intents
Background tasks, Connecting to the Internet
Fragments, Preferences
User Interaction – input, menu items, custom views
User Experience – themes and styles, material design, adaptive layouts,accessibility,localization,debuggingthe UI
Storing Data, SQLite database
Sharing Data, content resolvers and providers, loaders to load data
Services, background work, alarms, broadcast receivers
Notification, widgets, transferring data efficiently, publishing app
Multiple form factors, sensors, Google cloud messaging, monetizing yourapp

References:
    1. Android Programming (Big Nerd Ranch Guide), by Phillips, Stewart, Hardy and Marsicano
    2. Android Programming – Pushing the limits by Hellman

Course details source: https://nptel.ac.in/courses/106106147

Course outline:
Smartphones have emerged as the ubiquitous computing platform. It is expected that by 2020, almost 70% of population will own a smartphone. Android is the most prevalent smartphones operating system with coverage of 90% of overall smartphone market. In this course, we will learn android programming to create

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applications for smartphones. We will also learn integration of mobile applications with cloud services to create mobile- cloud applications.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE07	Computer Vision	3	0	0	3
PRE-REQUISITES : Linear Algebra, Vector Calculus, Data Structures and Programming Fundamentals of Image Processing 2-D Projective Geometry and Homography and Properties of homography Camera geometry Stereo geometry Stereo Geometry Feature detection and description Feature matching and model fitting Color Processing Range image processing Clustering and classification Dimensionality Reduction and Sparse Representation Deep Neural Architecture and applications References: 1. Multiple View Geometry in Computer Vision: R. Hartley and A. Zisserman, Cambridge University Press. 2. Computer Vision: Algorithms & Applications, R. Szeleski, Springer. 3. Computer vision: A modern approach: Forsyth and Ponce, Pearson. Course details source: https://nptel.ac.in/courses/106105216 Course outline: The course will have a comprehensive coverage of theory and computation related to imaging geometry, and scene understanding. It will also provide exposure to clustering, classification and deep learning techniques applied in this area.					

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE20	Wireless Ad Hoc and Sensor Network	3	0	0	3

MANET: Introduction, Self-organizing behaviour, Co-operation, MAC, Routing, Multcast routing, Mobility model, Transport layer, Opportunistic Mobile Networks, UAV networks
Wireless Sensor Networks: Introduction, Coverage, Topology management, Mobile Sensor Networks, MAC, Congestion control, Routing, Underwater WSN, Security, Structure of sensor nodes

Course details source: https://nptel.ac.in/courses/106105160

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBOE03	Mobile Robotics	3	0	0	3

 Introduction to Mobile robot architectures, Control Paradigms, Sensors and actuators. Learning Approaches for robots. Navigation Strategies, Detecting and handling Novelty. Behavior-based robotics, AIE and their application to robots. Case studies of learning robots, Laboratory sessions will include study and implementations of the above methodologies using real robots.

Texts:
1. U. Nehmzow, Mobile Robotics - A Practical Introduction, 2nd Ed, Springer, 2003.
2. L. N. de Castro and J. Timmis, Artificial Immune Systems: A New Computational Intelligence Approach, Springer, 2002.
3. D. Dasgupta, Artificial Immune Systems and Their Applications, Springer, 1999.
4. R. C. Arkin, Behaviour Based Robotics, MIT Press, 1998.

Course details source: IIT-G

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBOE06	Introduction to Cyber Security	3	0	0	3

Introduction and basic terminology:
Cyber Security and CIA Triad, basic cyber threats to CIA, cyber-attack surfaces, recent cyber-security incidents and their high-level analysis

Basic Cryptography
Role of Cryptography in ensuring confidentiality for data at rest, data in motion, and data in process. Symmetric and Asymmetric Cryptography, their needs as complementary of each other, some basic symmetric and asymmetric algorithm outlines (RSA, DH, DES, AES) Role of cryptography in data integrity, non-repudiation Hashing and Digital Signature and some example hash function outlines (MD5, SHA-256), understanding digital signature and its role. Digital Certificate and PKI. Importance of the role of a proper Pseudo Random Number Generator

Authentication, Authorization and Privilege
Importance of strong Authentication, distinction between authorization and authorization, importance of authorization, access control, Mandatory and Discretionary Access control, role based authorization, privilege and privilege escalation

Application Security
Basic application vulnerabilities (Buffer overflow, Integer Overflow, format string vulnerability), Basic mitigations of buffer overflow – platform bases, compiler based, secure programming practice
Web Client Security, Same Origin Principle, DOM, Java Script Vulnerability, Cookies and CookieAttributes Secure, http only, Concept of session and session ID, Sessionhijacking vulnerability, http vs. https and SSL/TLS and version issue
Web Server Security – XSS, CSRF, SQL Injection, Command Injection concepts, examples of each and mitigation techniques
Vulnerabilities in DNS, Routing and IP protocols especially in IPv4 and suggested remedies with DNSSEC, S-BGP, and IPSec

Perimeter protection and Intrusion Detection
Host Intrusion Detection techniques, what are the indicators to look for and how an SIEM tool can consolidate such indicators into a management console
Network Intrusion Detection – signature based vs. behavior based, Snort

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Firewall vs. Intrusion Detection tool, Firewall rules and customization techniques

Basic Malware Analysis
Various malware classes and their characteristics
Difference between static analysis and dynamic analysis
Signature vs. behavioral detection techniques

Suggested text books / Online lectures or tutorials:
1. Ross J. Anderson, Security Engineering, Third Edition, Wiley, Nov 2020
2. Cyber Crime and its Prevention in Easy Steps, Debtoru Chatterjee, Khanna Publishing House, 2022.
3. Cyber Attacks and Counter-Measures Made Simple, Debtoru Chatterjee, Khanna Publishing House, 2022

Suggested reference books / Online resources:
1. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws 2nd Edition by D Stuttard and M Pinto
2. Cryptography and Network Security by William Stallings.
3. The Hacker Playbook: Practical Guide to Penetration Testing (vol. 1 and 2) by Peter Kim.
4. Introduction to Security of Cyber-Physical Systems, Jeeva Jose, Khanna Publishing.
5. Mastering Hacking, Harsh Bothra, Khanna Book Publishing House.

Course details source: AICTE model curriculum

Outline:
1. Understand the importance of cyber security (data confidentiality, Integrity, and Availability) and various recent attacks on important digital systems such as banking, e-commerce systems, e-governance systems etc.
2. Understand basic cryptography concepts – symmetric vs asymmetric cryptography, Public Key Crypto Infrastructure (PKI), Symmetric Ciphers, Hashing, Digital Signatures.
3. Understand methods and tools for authentication, authorization, privilege, and their needs in securing an organization's IT system.
4. Understand the common vulnerabilities in applications, web applications, network, and the Internet Infrastructure.
5. Understand the methods and tools for Intrusion Detection (network and host intrusion detection) and perimeter security (firewall).
6. Understand basic malware functions and indicators of compromise.

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE04	Graph Theory	3	0	0	3

Unit 1: Graphs, Sub graphs, some basic properties, various example of graphs & their sub   graphs, walks, path & circuits, connected graphs, disconnected graphs and component, euler graphs, various   operation on graphs, Hamiltonian paths and circuits the traveling sales man problem.

 Unit 2: Trees and fundamental circuits, distance diameters, radius and pendent vertices, rooted and binary trees, on counting trees, spanning trees, fundamental circuits, finding all spanning trees of a graph and a weighted graph, algorithms of primes Kruskal and Dijkstra Algorithms.

  Unit 3: Cuts sets and cut vertices, some properties, all cut sets in a graph, fundamental circuits and cut sets , connectivity and separability, network flows Planer graphs, combinatorial and geometric dual: Kuratowski graphs, detection of planarity, geometric dual, Discussion on criterion of planarity, thickness and crossings.

  Unit 4: Vector space of a graph and vectors, basis vector, cut set vector, circuit vector, circuit and cut set subspaces, Matrix representation of graph – Basic concepts; Incidence matrix, Circuit matrix, Path matrix, Cut-set matrix and Adjacency matrix. Coloring, covering and partitioning of a graph, chromatic number, chromatic partitioning, chromatic polynomials, matching, covering, four color problem

 Unit 5: Discussion of Graph theoretic algorithm wherever required.

Textbooks :
1. Narsingh Deo, "Graph Theory: With Application to Engineering and Computer Science", Prentice Hall of India, 2003.
2. R.J. Wilson, "Introduction to Graph Theory", Fourth Edition, Pearson Education, 2003

Course Outcomes:
1. To learn the basic terminology and some of the theory associated with graphs.
2. To learn to model problems using graphs and to solve these problems algorithmically.
3. Modern applications of graph theory will be explored.

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSB501	Compiler Design	4	0	0	4

Unit 1: Introduction: Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, from regular expressions to finite automata, scanner generator (lex, flex).
Syntax

Unit 2: Analysis (Parser): Context-free languages and grammars, push-down automata, LL(1) gram-mars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)

Unit 3: Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree. Symbol Table: Its structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope.

Unit 4: Intermediate Code Generation: Translation of different language features, different types of intermediate forms. Code Improvement (optimization):

Unit 5: Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc. Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation

Unit 6: Advanced topics: Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages.

Textbooks:
1. Tremblay, et al., "The Theory and practice of compiler Writing", McGraw Hill, New York,1985.
2. A. Holub, "Compiler Design in C",PHI, 2004.
3. Aho, Ullman & Ravi Sethi, " Principles of Compiler Design", Pearson Education, 2002.

Reference books:
1. Andrew L. Appel, " Modern Compiler Implementation in C", Delhi, Foundation Books,2000.
2. Dick Grune et. Al., " Modern Compiler Design ", Wiley Dreamtech, 2000.

Course Outcomes:
1. For a given grammar specification develop the lexical analyser
2. For a given parser specification design top-down and bottom-up parsers
3. Develop syntax directed translation schemes
4. Develop algorithms to generate code for a target machine

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSB511	Compiler Design Lab	0	0	3	1.5

1. Write a lex Program to identify a simple and a compound statement.

2. Write a lex Program to count the number of keywords and identifiers in a sentence.

3. Imagine the syntax of a programming language construct such as *while-loop* --

while (*condition*)

begin

    statement ;

      :

end

where *while, begin, end* are keywords; *condition* can be a single comparision expression (such as *x == 20*, etc.); and *statement* is the assignment to a location the result of a single arithmatic operation (eg., *a = 10 * b*).

Write a program that verifies whether the input follows the above syntax. Use *flex* to create the lexical analyser module and write a C program that performs the required task using that lexical analyser

4. Write a lexical analyser for the C programming language using the gramar for the language given in the book "The C Programming Language", 2e, by B Kernighan and D Ritchie.

5. Write a YACC Program to check whether given string $a^n b^n$ is accepted by the grammar

6. Write a YACC program to check the validity of an arithmetic expression.

7. Write a YACC Program to identify an input for the grammar $a^n b$ (n>=10)

8. Write a C program for implementing *shift-reduce* parsing using a given grammar.

Firstly, define the data structures for representing the given CFG in BNF, the stack for the parsing, and the parse tree to be created.

9. Take a common programming language construct of an HLL, such as the for-loop construct of the C language. Use LEX and YACC to create a translator that would translate input into three-address intermediate code. The output of the translator should finally be in a file. Assume a simple structure for

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"statements" that may appear inside the construct, and make necessary assumptions for the intermediate code format.

Teacher may add more programs based on any concept taught in Compiler Design.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSB601	Computer Networks	3	0	0	3

Unit 1: Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.
Unit 2: Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA
Unit 3: Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.
Unit 4: Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.
Unit 5: Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

Textbooks:
1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw- Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Reference books:
1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

Course Outcomes:
1. Explain the functions of the different layer of the OSI Protocol.
2. Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
3. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component
4. For a given problem related TCP/IP protocol developed the network programming.

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5. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
HSB501	Project Management & Entrepreneurship	2	0	0	2

Unit 1: Project Planning: Software pricing, Plan driven development, project scheduling, Agile Planning, Estimation Technique: COCOMO model. Quality Management: Review and inspection, software measurement and matrics Concept of Quality, Control Charts, Latest Trend in Quality Management, TQM, ISO 9000 Series Maintenance Management: Différent types, Latest Trend in Maintenance Management, TPM Project Management: Definition of Project, Network Analysis, PERT and CPM Inventory Management: Concept, EOQ Model Safety in Workplace, Fire and Safety.

Unit 2: Risk Management: type of risk; Risk identification, risk analysis, risk planning and risk monitoring. People Management: Motivating people, human needs hierarchy, People Capability Maturity Model(P-CMM), Con; Motivation Theories; Leaderships, its Qualities and Styles.

Unit 3: Team Management: Selecting group member, group organization, Group Communication, Types of groups; Group Behaviour and Group role; Group Decision-Making; power and politics; Conflicts and types of conflicts; Sources of Conflict; Managing Conflict, Emotional Intelligence. Configuration management: change management, Version management, system building, release management. Process Improve management: process improvement process, process measurement, process analysis, process change, The CMMI process improvement framework.

UNIT 4: Entrepreneur, Entrepreneurship & Intrapreneurship: Definitions, importance, characteristics, Difference between entrepreneur and manager; Factors affecting entrepreneurial Growth, Qualities and Role of entrepreneurship in economic development; Concept of Intrapreneurship; McClelland Model

UNIT 5: Women and Rural Entrepreneurship: Role & Importance of women entrepreneurship, Problems of Women Entrepreneurs, women entrepreneurship in India; Rural Entrepreneurship, need and problems. Agri-Preneurship & Social Entrepreneurship: Agri-Preneurship-Meaning-Need-Opportunities-challenges, suggestions for development for agri-preneurship. Social entrepreneurship-meaning-the perspective of social entrepreneurship-Social entrepreneurship in practice.

UNIT 6: Project Formulation: Elements of project formulation; feasibility Analysis-Economic feasibility, financial feasibility, Technological Feasibility; Social Cost-benefit analysis; preparation of feasibility report. Entrepreneurial Development Agencies: Role of Government and supporting agencies/ institutions such as IDBI, District Industries Centre (DIC), Small Industries Development Organizations (SIDO), Small Institutions Service Institutions (SISI), Commercial banks EDI etc.

Text Books:
1. Ian sommerville, Software Engineering, Pearson

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2. Koontez, Odoneel: Essentials of Management, Tata McGraw Hill
3. Vasant Desai: *Dynamics of Entrepreneurship Development.*
4. David H. Holt: *Entrepreneurship: New Venture Creation*
5. Poornima M Charantimath : *Entrepreneurship Development & Small Business Enterprises,* Pearson
6. S.SKhanka: *Entrepreneurial Development*: S.Chand

Course Outcomes:
1. Manage the selection and initiation of individual projects and of portfolios of projects in the enterprise.
2. Conduct project planning activities that accurately forecast project costs, timelines, and quality. Implement processes for successful resource, communication, and risk and change management.
3. Demonstrate effective project execution and control techniques that result in successful projects.
4. Demonstrate effective organizational leadership and change skills for managing projects, project teams, and stakeholders
5. To encourage students to take up entrepreneurship as a career option and to impart skills related to it.
6. Provide knowledge about various theories related to entrepreneur and entrepreneurship.
7. Entrepreneurship programme provides knowledge and skills on how to successfully develop captivating products and services to solve challenging problems in a highly uncertain environment, often under considerable time constraints with very limited resources. You will be able to apply these skills in the context of both new ventures as well as in established companies.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE01	Digital Image Processing	3	0	0	3

Unit 1: Introduction: Digital Image representation, fundamental steps in image processing, Elements of digital image processing systems.
Unit 2 :Digital Image Fundamentals: Elements of Visual perception, A simple Model, Image Sensing and Acquisition, Image Sampling and quantization, some basic relationships between pixels.
Unit 3: Image Transformation and enhancement: Some basic Intensity Transformation functions, Histogram Processing, Smoothing and Sharpening Spatial Filters, Smoothing and Sharpening using Frequency Domain Filters.
Unit 4: Image Restoration: Degradation Model, Noise Models, Restoration in the presence of Noise – Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Inverse Filtering, Minimum Mean square error filter.
Unit 5 :Image Segmentation: Point Detection, Line Detection, Edge Detection, Thresholding, Region – Based Segmentation, Color Image Processing.

Textbooks:
1. Digital Image Processing - Rafael C Gonzalez - Addison Wesley
Reference books:
1. Digital Image Processing - Richard E Woods -'" Addison Wesley

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2. Fundamentals of Digital Image Processing - A.K Jain – PHI

Course Outcomes: After completion of course, students would be:

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.
6. Interpret image segmentation and representation techniques.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE02	Data Mining	3	0	0	3

Prerequisites: Linear Algebra and Probability, Database Management Systems

Unit 1: Introduction: Basic concepts of data mining, including motivation and definition; different types of data repositories; data mining functionalities; concept of interesting patterns; data mining tasks; current trends, major issues and ethics in data mining

Unit 2: Data: Types of data and data quality; Data Preprocessing: data cleaning, data integration and transformation, data reduction, discretization and concept hierarchy generation; Exploring Data: summary statistics, visualization, multidimensional data analysis

Unit 3: Association and Correlation Analysis: Basic concepts: frequent patterns, association rules - support and confidence; Frequent itemset generation - Apriori algorithm, FP-Growth algorithm; Rule generation, Applications of Association rules; Correlation analysis.

Unit 4: Clustering Algorithms and Cluster Analysis: Concept of clustering, measures of similarity, Clustering algorithms: Partitioning methods - k-means and k-medoids, CLARANS, Hierarchical methods - agglomerative and divisive clustering, BIRCH, Densitybased methods - Subspace clustering, DBSCAN; Graph-based clustering - MST clustering; Cluster evaluation; Outlier detection and analysis.

Unit 5: Classification: Binary Classification - Basic concepts, Bayes theorem and Naive Bayes classifier, Association based classification, Rule based classifiers, Nearest neighbour classifiers, Decision Trees, Random Forest; Perceptrons; Multi-category classification; Model overfitting, Evaluation of classifier performance - cross validation, ROC curves.

Unit 6: Applications: Text mining, Web data analysis, Recommender systems.

Textbooks:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining. Pearson (2005), India. ISBN 978-8131714720
2. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 3rd edition (July 2011). 744 pages. ISBN 978-0123814791

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3. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann, 3rd edition (January 2011). 664 pages. ISBN 978-0123748560.

Reference books:

1. T. Hastie, R. Tibshirani and J. H. Friedman, The Elements of Statistical Learning, Data Mining, Inference, and Prediction. Springer, 2nd Edition, 2009. 768 pages. ISBN 978-0387848570

2. C. M. Bishop, Pattern Recognition and Machine Learning. Springer, 1st edition, 2006. 738 pages. ISBN 978-0387310732

Course Outcomes: After completion of course, students would be:

1. Study of different sequential pattern algorithms
2. Study the technique to extract patterns from time series data and it application in real world.
3. Can extend the Graph mining algorithms to Web mining
4. Help in identifying the computing framework for Big Data

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE03	Software Testing	3	0	0	3

Prerequisites: Software Engineering, Data Structures & Algorithm

UNIT 1: Introduction: What is software testing and why it is so hard? Error, Fault, Failure, Incident, Test Cases, Testing Process, Limitation of Testing, No absolute proof of correctness, Overview of Graph Theory.

UNIT 2: Introduction, Need of black box testing, Black box testing Concept, Requirement Analysis, Test case design criteria, Testing Methods, requirement based testing, Positive & negative testing, Boundary value analysis, Equivalence Partitioning class, state based or graph based, cause effect graph based, error guessing, documentation testing & domain testing, design of test cases. Case studies of Black-Box testing.

UNIT 3: Introduction, Need of white box testing, Testing types, Test adequacy criteria, static testing by humans, Structure - logic coverage criteria, Cyclomatic Complexity, Basis path testing, Graph metrics, Loop Testing, Data flow testing, Mutation Testing, Design of test cases. Testing of Object oriented systems, Challenges in White box testing, Case-study of White-Box testing
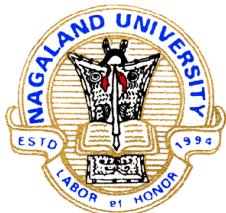
UNIT 4: Testing Activities: Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Domain Testing. **Reducing the number of test cases:** Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, slice based testing.

UNIT 5: Software quality, Quality attribute, Quality Assurance, Quality control & assurance, Methods of quality management, Cost of quality, Quality management, Quality factor, Quality management & project management, Software quality metrics-TQM, Six Sigma, ISO, SQA Model.

UNIT 6: Test organization, Structure of testing, Measurement tools, Testing metrics: Type of metric – Project, Progress, Productivity, Metric plan, Goal Question metric model, Measurement in small & large system. Other Software Testing: GUI testing, Validation testing, Regression testing, Scenario testing, Specification based testing, Adhoc testing, Sanity testing,

Textbooks:

1. William Perry, "Effective Methods for software Testing ", John Wiley & Sons, New York, 1995.
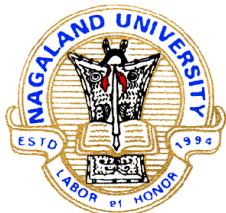
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2. Louise Tamres, " Software Testing", Pearson Education Asia, 2002.

3. Software Testing, Second Edition By: Ron Patton, Pearson Education ISBN-13: 978-0-672-32798-8

4. Software testing Principle and Practices By Ramesh Desikan, Pearson Education, ISBN 81-7758-121-X

Reference books:

1. Effective methods for software testing by William Perry , Willey Publication, ISBN 81-265-0893-0

2. Metric and Model in Software Quality Engineering , By Stephen H Kan, Pearson Education ISBN 81-297-0175-8

3. K.K Aggarwal & Yogesh Singh, " Software Engineering",2nd Ed., New Age International publishers, New Delhi

4. Boris Beizer, " Software Testing Techniques", Second Volume, Second Edition, Van Nostrand Reinhold, New York

5. Boris Beizer, " Black- Box Testing- Techniques for Functional Testing of Software and System", John wiley & Sons Inc., New York, 1995.

Course Outcomes: Upon successful completion of this course you should be able to:

1. Demonstrate knowledge of the fundamentals of software testing

2. Use fundamental techniques to implement techniques to extrapolate fundamental techniques in the framework of real world scenarios

3. Demonstrate competence in using software designed to assist in the software testing life cycle for given portions of the testing cycle

5. Methods of test generation from requirements

6.Test adequacy assessment using: control flow, data flow, and program mutations

5. The use of various test tools and Application of software testing techniques in commercial environments

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE08	Linux Internal	3	0	0	3

Prerequisites: Operating Systems

UNIT 1: Linux Utilities-File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities, sed – scripts, operation, addresses, commands, applications, awk – execution, fields and records, scripts, operation, patterns, actions, functions, using system commands in awk.

UNIT 2: Working with the Bourne again shell(bash): Introduction, shell responsibilities, pipes and input Redirection, output redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.

UNIT 3: Files: File Concept, File System Structure, Inodes, File Attributes, File types, Library functions, the standard I/O and formatted I/O in C, stream errors, kernel support for files, System calls, file descriptors, low level file access – File structure related system calls(File APIs), file and record locking, file and directory management – Directory file APIs, Symbolic links & hard links.

UNIT 4: Process – Process concept, Kernel support for process, process attributes, process control - process creation, waiting for a process, process termination, zombie process, orphan process, Process APIs. Signals– Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise , alarm, pause, abort, sleep functions.

UNIT 5: Interprocess Communication : Introduction to IPC, Pipes, FIFOs, Introduction to three types of IPC-message queues, semaphores and shared memory. Message Queues- Kernel support for messages, Unix system V APIs for messages, client/server example.

UNIT 6: Semaphores-Kernel support for semaphores, Unix system V APIs for semaphores. Shared Memory- Kernel support for shared memory, Unix system V APIs for shared memory, semaphore and shared memory example.

UNIT 7: Multithreaded Programming: Differences between threads and processes, Thread structure and uses, Threads and Lightweight Processes, POSIX Thread APIs, Creating Threads, Thread Attributes, Thread Synchronization with semaphores and with Mutexes, Example programs.

UNIT 8: Sockets: Introduction to Sockets, Socket Addresses, Socket system calls for connection oriented protocol and connectionless protocol, example-client/server programs.

Textbooks:
1. Unix System Programming using C++, T.Chan, PHI.(UNIT 3 to UNIT 8)

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2. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.
3. Beginning Linux Programming, 4th Edition, N.Matthew, R.Stones,Wrox, Wiley India Edition.

Reference books:
1. Linux System Programming, Robert Love, O'Reilly, SPD.
2. Advanced Programming in the Unix environment, 2nd Edition, W.R.Stevens, Pearson Education.
3. Unix Network Programming ,W.R.Stevens,PHI.
4. Unix for programmers and users, 3rd Edition, Graham Glass, King Ables, Pearson Education.

Course Outcomes: On completion of the course the student should be able to
1. comfortably use basic UNIX/Linux commands from the command line (from a terminal window);
2. organize and manage their files within the UNIX/Linux file system;
3. organize and manage their processes within UNIX/Linux;
4. usefully combine UNIX/Linux tools using features such as filters, pipes, redirection, and regular expressions;
5. customize their UNIX/Linux working environment;
6. be knowledgeable enough about basic UNIX/Linux shell scripting to be able to successfully read and write bash shell scripts;
7. know how to use UNIX/Linux resources to find additional information about UNIX/Linux commands

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE09	Artificial Intelligence	3	0	0	3

Prerequisites: Data Structures & Algorithm

UNIT-1: Introduction: Introduction to Artificial intelligence, Simulation of sophisticated & Intelligent Behaviour in different area, problem solving in games, natural language, automated reasoning, visual perception, heuristic algorithm versus solution guaranteed algorithms.

UNIT-2: Understanding Natural Languages: Parsing techniques, context free and transformational grammars, transition nets, augmented transition nets, Fillmore's grammars, Shanks conceptual Dependency, grammar free analyzers, sentence generation, and translation.

UNIT-3: Knowledge Representation: First order predicate calculus, Horn Clauses, Introduction to PROLOG, Semantic Nets, Partitioned Nets, Minskey Net frames Case Grammar Theory, Production Rules Knowledge Base, The Interface System, Forward & Backward Deduction.

UNIT-4: Expert System: Existing Systems (DENDRAL, MYCIN), domain exploration, Meta Knowledge, Expertise Transfer, Self Explaining System.

UNIT-5: Pattern Recognition: Introduction to pattern Recognition, Structured Description, Symbolic Description, Machine perception, Line Finding, Interception, Semantic & Model, Object Identification, Speech Recognition. Programming Language: Introduction to programming Language, LISP, PROLOG.

Reference books:
1. Char nick, " Introduction to Artificial Intellegence", Addision Welsey.
2. Rich & Knight," Artificial Intellengence" Winston, " LISP", Addision Wesley

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3. Marcellous, " Expert System Programming", PHI.
4. Elamie," Artificial Intellengence", Academic Press.
5. Lioyed, " Foundation of logic Programming", Springer Verlag.

Course Outcomes: After completion of course, students would be:
1. Knowledge of what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence.
2. Explain how Artificial Intelligence enables capabilities that are beyond conventional technology, for example, chess-playing computers, self-driving cars, robotic vacuum cleaners.
3. Implement classical Artificial Intelligence techniques, such as search algorithms, minimax algorithm, neural networks, tracking, robot localisation.
4. Ability to apply Artificial Intelligence techniques for problem solving.
5. Explain the limitations of current Artificial Intelligence techniques.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE10	Real Time Systems	3	0	0	3

Prerequisites: Programming and Data Structures, Operating Systems, Computer Architecture and Organization, Computer Network, Database Management Systems

Unit 1: Introduction. Real-Time Applications, Basic model of Real-Time systems, characteristics, safety and reliability, types of real-time tasks, timing constraints, modelling of timing constraints.
Unit 2: Real-Time Scheduling. Types of real-time tasks and their characteristics, task scheduling, clock-driven scheduling, event-driven scheduling, hybrid scheduling.
Unit 3: Handling resource sharing and dependencies among real-time tasks. Priority inversion, priority inheritance protocol, highest locker protocol, priority ceiling protocol, issues in using a resource sharing protocol, handling task dependencies.
Unit 4: Scheduling real-time tasks in multiprocessor and distributed systems. Multiprocessor task allocation, dynamic allocation of tasks, fault tolerant scheduling of tasks, clocks in distributed real-time systems, centralized and distributed clock synchronization.
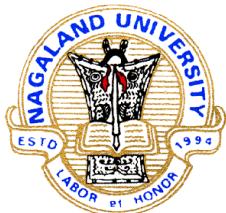**Unit 5:** Commercial real-time operating systems. Time services, features of a real-time operating system, Unix as a real-time operating system, Unix based real-time operating system, windows as a real-time operating system, POSIX, a survey of contemporary real-time operating system, bench marking real-time systems.
Unit 6: Real-time communication. Some examples, basic concepts, real-time communication in a LAN, soft and hard real-time communication in a LAN, bounded access protocols for LAN, real-time communication over packet-switched networks, QoS framework, routing, resource reservation, rate control, QoS models.
Unit 7: Real-time databases. Examples, real-time databases, characteristics of temporal data, concurrency control in real-time database, commercial real-time databases.

Text books:
1. Real-Time systems: Theory and Practice by Rajib Mall, Pearson.
2.Jane W. Liu, "Real-Time Systems" Pearson Education, 2001.

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3. Krishna and Shin, "Real-TIme Systems," Tata McGraw Hill. 1999.

Additional readings:
1. Alan C. Shaw, Real-Time Systems and Software, Wiley, 2001.
2. Philip Laplante, Real-TIme Systems Design and Analysis, 2nd Edition, Prentice Hall of India.

Course Outcomes:
After completion of course, students would be:
1. Characterise real time systems and describe their functions.
2. Analyse, design and implement a real-time system.
3. Apply formal methods to the analysis and design of real-time systems.
4. Apply formal methods for scheduling real-time systems.
5. Characterise and debug a real-time system.
6. Explain fundamental principles for programming of real time systems with time and resource limitations.
7. Describe the foundation for programming languages developed for real time programming.
8. Use real time system programming languages and real time operating systems for real time applications.
9. Analyse real time systems with regard to keeping time and resource restrictions.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE11	Embedded Systems & Design	3	0	0	3

Unit 1 : Introduction to Embedded System: Introducing Embedded Systems, Philosophy, Embedded Systems, Embedded Design and Development Process.

Unit 2: The Hardware Side: An Introduction, The Core Level, Representing Information, Understanding Numbers, Addresses, Instructions, Registers-A First Look, Embedded Systems-An Instruction Set View, Embedded Systems-A Register View, Register View of a Microprocessor The Hardware Side: Storage Elements and Finite-State Machines (2 hour) The concepts of State and Time, The State Diagram, Finite State Machines- A Theoretical Model.

Unit 3: Memories and the Memory Subsystem: Classifying Memory, A General Memory Interface, ROM Overview, Static RAM Overview, Dynamic RAM Overview, Chip Organization, Terminology, A Memory Interface in Detail, SRAM Design, DRAM Design, DRAM Memory Interface, The Memory Map, Memory Subsystem Architecture, Basic Concepts of Caching, Designing a Cache System, Dynamic Memory Allocation.

Unit 4 : Embedded Systems Design and Development : System Design and Development, Life-cycle Models, Problem Solving-Five Steps to Design, The Design Process, Identifying the Requirements, Formulating the Requirements Specification, The System Design Specification, System Specifications versus System Requirements, Partitioning and Decomposing a System, Functional Design, Architectural Design, Functional Model versus Architectural Model, Prototyping, Other Considerations, Archiving the Project.

Unit 5 : Real-Time Kernels and Operating Systems: Tasks and Things, Programs and Processes, The CPU is a resource, Threads – Lightweight and heavyweight, Sharing Resources, Foreground/Background Systems, The operating System, The real time operating system (RTOS), OS architecture, Tasks and Task control blocks, memory management revisited.

Unit 6 : Performance Analysis and Optimization: Performance or Efficiency Measures, Complexity Analysis, The methodology, Analyzing code, Instructions in Detail, Time, etc. – A more detailed look, Response Time, Time

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Loading, Memory Loading, Evaluating Performance, Thoughts on Performance Optimization, Performance Optimization, Tricks of the Trade, Hardware Accelerators, Caches and Performance.

Text books:

1. Embedded Systems – A contemporary Design Tool, James K. Peckol, John Weily India Pvt. Ltd, 2008.

Reference books:

1. Embedded Systems: Architecture and Programming, Raj Kamal, TMH. 2008.
2. Embedded Systems Architecture – A Comprehensive Guide for Engineers and Programmers, Tammy Noergaard, Elsevier Publication, 2005.
3. Programming for Embedded Systems, Dream tech Software Team, John Wiley India Pvt. Ltd, 2008

Course Outcomes: After completion of this course, students should be able to

1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
3. Become aware of the architecture of the ATOM processor and its programming aspects (assembly Level)
4. Become aware of interrupts, hyper threading and software optimization.
5. Design real time embedded systems using the concepts of RTOS.
6. Analyze various examples of embedded systems based on ATOM processor

| Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE13	Cloud Computing	3	0	0	3

Prerequisites: Operating Systems, Computer Networks

Unit 1: Introduction to Cloud Computing: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing

Unit 2: Cloud Computing Architecture: Requirements, Introduction Cloud computing architecture, On Demand Computing, Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise

Unit 3: Security Issues in Cloud Computing: Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

Unit 4: Security Management in the Cloud: Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS
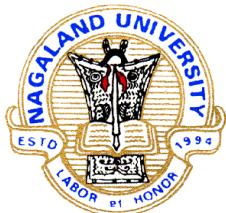
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Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

Unit 5: Audit and Compliance: Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud

Unit 6: ADVANCED TOPICS: Recent devloments in hybrid cloud and cloud security.

Text Books:

1. Anthony T.Velte, Toby J.Velte and Robert E, Cloud Computing – A Practical Approach, TMH , 2010
2. Michael Miller, Cloud Computing – Web based Applications, Pearson Publishing, 2011

Course Outcomes:
After completion of course, students would be:

1. Identify security aspects of each cloud model
2. Develop a risk-management strategy for moving to the Cloud
3. Implement a public cloud instance using a public cloud service provider
4. Apply trust-based security model to different layer

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE14	Information Theory & Coding	3	0	0	3

UNIT - 1: INFORMATION THEORY: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Markoff statistical model for information source, Entropy and information rate of mark-off source.

UNIT - 2: SOURCE CODING: Encoding of the source output, Shannon's encoding algorithm. Communication Channels, Discrete communication channels,
Continuous channels.

UNIT - 3: FUNDAMENTAL LIMITS ON PERFORMANCE: Source coding theorem, Huffman coding, Discrete memory less Channels, Mutual
Information, Channel Capacity.

UNIT - 4: Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

UNIT - 5: INTRODUCTION TO ERROR CONTROL CODING: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding.

UNIT - 6: Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation. BCH codes.

UNIT - 7: RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes.

UNIT - 8: Convolution Codes, Time domain approach. Transform domain approach

Textbooks:

1. K. Sam Shanmugam, John Wiley 'Digital and Analog Communication Systems', India Pvt. Ltd., 2008.

2. Taub & Schilling.'Principles of Communication system' .

3. John G.Proakis 'digital Communications' Tata Mc Graw Hill

4. Digital Communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

Reference books:

1. Communication Systems, Sanjay Sharma, Fifth Revised Ed June 2011

2. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007.

3. Digital Communications - Glover and Grant; Pearson Ed. 2nd Ed 2008

Course Outcomes: After completion of course, students would be:

1. The aim of this course is to introduce the principles and applications of information theory.

2. The course will study how information is measured in terms of probability and entropy.

3 The students learn coding schemes, including error correcting codes, The Fourier perspective; and extensions to wavelets, complexity, compression, and efficient coding of audio-visual information

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE15	Information Retrieval	3	0	0	3

Unit 1: Information retrieval model, Information retrieval evaluation, Searching the Web
Unit 2: Document Representation, Query languages and query operation, Meta-data search,
Unit 3: Indexing and searching, Scoring and ranking feature vectors,
Unit 4: Ontology, domain specific search, parallel and distributed information retrieval,
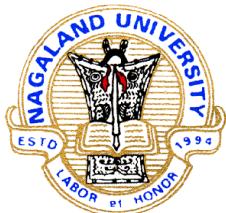**Unit 5:** Text and multimedia languages, Social networks.
Unit 6: Recent trends in Web search and Information retrieval techniques.

Reference books:

1. C. D. Manning, P. Raghavan and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008 (available at http://nlp.stanford.edu/IR-book).

2. Chakrabarti, S. (2002). Mining the web: Mining the Web: Discovering knowledge from hypertext data. Morgan-kaufman.

3. B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, AddisonWesley, 2009 (available at http://ciir.cs.umass.edu/irbook/).

4. R. Baeza-Yates, B. Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley, 2011 (2nd Edition).

Course Outcomes: After completion of course, students would be:

1. To identify basic theories and analysis tools as they apply to information retrieval.

2 To develop understanding of problems and potentials of current IR systems.

3 To learn and appreciate different retrieval algorithms and systems.

4 To apply various indexing, matching, organizing, and evaluating methods to IR problem.

5 To become aware of current experimental and theoretical IR research.

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Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE17	Cryptography & Network Security	3	0	0	3

Prerequisites: Operating Systems, Computer Networks

UNIT-1: Introduction to security attacks, services and mechanisms, Introduction to cryptography. Conventional Encryption: Conventional Encryption model, classical encryption techniques-substitution ciphers & transpositions ciphers, cryptanalysis, stereography, stream and block ciphers. Modern Block Ciphers: Block Ciphers

UNIT-2: Principles, Shannon's theory of confusion and diffusion, fiestal structure, Data Encryption Standards (DES), Strength of DES, Differential & Linear Cryptanalysis of DES, Block Cipher modes of operation, Triple DES, Confidentiality using Conventional Encryption, traffic confidentiality, key distribution, random number generation.

UNIT-3: Introduction to graph, ring and field, Prime and relative prime numbers, modular arithmetic, Fermat's & Euler's Theorem, primality testing, Euclid's Algorithm, Chinese remainder theorem, Discrete logarithms. Principles of public key cryptosystems, RSA algorithm, security of RSA, key management, Diffie- Heilman key exchange algorithm

UNIT-4: Message Authentication & Hash functions : Authentication requirements, Authentication functions, Message Authentication codes, Hash functions, Birthday attacks, Security of Hash function & MACS, MD5 message digest algorithm, Secure Hash algorithm (SHA). Digital Signatures: Digital Signatures, Authentication protocol, Digital Signature Standards (DSS), proof of digital signature algorithm.

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UNIT-5: Authentication Applications: directory authentication service, Electronic Mail security- Pretty Good Privacy (PGP), S/ MIME.IP
Security : Architecture, Authentication Header, Encapsulating security payloads, Combining security associations, Secure Electronic Transaction (SET) .
System Security : Intruders, Viruses and related threads, Firewall design principles, trusted systems.

Textbooks:
1. William Stallings," Cryptography and Network Security:
2. Principles and Practice" Prentice Hall,New Jersey.
3. Johannes A. Buchmann," Introduction to cryptography", Springer Verlag. Bruce Schiener, " Applird Cryptography

Course Outcomes: After completion of course, students would be able to:
1. Describe network security services and mechanisms.
2. Symmetrical and Asymmetrical cryptography.
3. Data integrity, Authentication, Digital Signatures.
4. Various network security applications, IPSec, Firewall, IDS, Web security, Email security, and Malicious software etc.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE18	Design & Management of Computer Network	3	0	0	3

Prerequisites: Computer Networks

Unit 1: Fundamentals. Communication networks, network elements, networking principles, switched networks and shared media networks, datagrams and virtual circuits, multiplexing, switching, error and flow control, congestion control, layered architecture, QoS.
Unit 2: Requirements and flow analysis. Requirement analysis, requirement specification and map, requirement analysis process - developing the requirements specification, flows, identifying and developing flows, flow models, prioritization and specification.
Unit 3: Network architecture. Architecture and design – component architectures, reference architecture, architecture models, system and network architecture, addressing and routing architecture – addressing and routing fundamentals, network management architecture, performance mechanisms, security and privacy architecture – planning security and privacy mechanisms.
Unit 4: Network design. Design concepts, design process, network layout, design traceability, design metrics, logical network design – topology design, switching and routing protocols, physical network design – selecting technologies and devices for campus and enterprise networks, optimizing network design.

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Unit 5: Network management. Monitoring and Control – Network management systems – abstract syntax notation – CMIP – SNMP communication model – SNMP MIB group – functional model – major changes in SNMPv2 and SNMPv3 – remote monitoring – RMON SMI and MIB

Reference books:

1. James D. McCabe and Morgan Kaufmann, "Network Analysis, Architecture, and Design", 3rd Edition, 2007.

2. Larry L. Peterson and Bruce S. Davie "Computer Networks: A Systems Approach", Elsevier, 2007.

3. Priscilla Oppenheimer, "Top-down Network Design: A Systems Analysis Approach to Enterprise Network Design", 3rd Edition, Cisco Press

4. Heinz-Gerd Hegering, Sebastian Abeck, and Bernhard Neumair "Integrated Management of Networked Systems: Concepts, Architectures, and Their Operational Application" Morgan Kaufmann Series in Networking, 1999.

5. Steven T.Karris, "Network Design and Management", 2nd Edition, Orchard Publications, 2009.

6. Teresa C. Mann-Rubinson and Kornel Terplan, "Network Design, Management and Technical Perspective", , CRC Press, 1999.

7. Gilbert Held, "Ethernet Networks-Design, Implementation, Operation and Management", 4th Edition, John Wiley and sons.

8. James Kurose and Keith Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 1999.

9. William Stallings, 'High Speed Networks: Performance and Quality of Service', 2nd Edition, Pearson Education, 2002.

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

1. A comprehensive knowledge of applicable methods and techniques and their limitations.
2. A deep knowledge and understanding of the principles of their specialties.
3. The ability to critically analyze the network.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE19	Human Computer Interaction	3	0	0	3

Unit 1: Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity-Paradigms.

Unit 2: Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules– principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

Unit 3: Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

Unit 4: Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

Unit 5: Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Unit 6: Recent Trends: Speech Recognition and Translation, Multimodal System

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Reference books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
2. Brian Fling, "Mobile Design and Development", First Edition , O☐Reilly Media Inc., 2009 (UNIT – IV)
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O☐Reilly, 2009.(UNIT-V)

Course Outcomes: After completion of course, students would be able to:

1. Understand the structure of models and theries of human computer interaction and vision.\
2. Design an interactive web interface on the basis of models studied.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBE23	Distributed Databases	3	0	0	3

Pre-Requisites: Distributed Systems

Unit 1: Introduction: Distributed Data processing, Distributed database system (DDBMS), Promises of DDBMSs, Complicating factors and Problem areas in DDBMSs, Overview Of Relational DBMS Relational Database concepts, Normalization, Integrity rules, Relational Data Languages, Relational DBMS.

Unit 2: Distributed DBMS Architecture: DBMS Standardization, Architectural models for Distributed DBMS, Distributed DBMS Architecture. Distributed Database Design: Alternative design Strategies, Distribution design issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data security, Semantic Integrity Control.

Unit 3: Overview of Query Processing: Query processing problem, Objectives of Query Processing, Complexity of Relational Algebra operations, characterization of Query processors, Layers of Query Processing. Introduction to Transaction Management: Definition of Transaction, Properties of transaction, types of transaction. Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanisms, locking bases concurrency control algorithms.

Unit 4: Parallel Database Systems: Database servers, Parallel architecture, Parallel DBMS techniques, Parallel execution problems, Parallel execution for hierarchical architecture.

Unit 5: Distributed Object Database Management systems: Fundamental Object concepts and Object models, Object distribution design. Architectural issues, Object management, Distributed object storage, Object query processing.

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Transaction management. Database Interoperability: Database Integration, Query processing.
Unit 6: Recent approaches, models and current trends in improving the performance of Distributed Database.

References:
1. Principles of Distributed Database Systems, Second Edition, M. Tamer Ozsu Patrick Valduriez
2. Distributed Databases principles and systems, Stefano Ceri, Giuseppe Pelagatti, Tata McGraw Hill.

Course Outcomes: After completion of course, students would be:
1. Able to understand relational database management systems, normalization to make efficient retrieval from database and query.
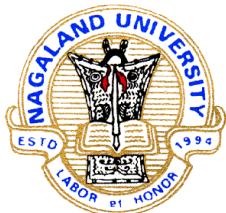
Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBOE02	Internet-of-Things	3	0	0	3

Prerequisites: Operating Systems, Computer Networks

Unit 1: Introduction and Applications:smart transportation, smart cities, smart living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security
Unit 2: IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraintshardware, Data representation and visualization, Interaction and remote control.
Unit 3: Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation- Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

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Unit 4: Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases

Unit 5: IOT Physical Devices & Endpoints: What is an IOT Device, Exemplary Device Board, Linux on Raspberry , Interface and Programming & IOT Device

Unit 6: Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT

References:
1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing
3. Mandler, B., Barja, J., Mitre Campista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publishing

Course Outcomes: On completion of the course the student should be able to
1. Understand the vision of IoT from a global context.
2. Determine the Market perspective of IoT.
3. Use of Devices, Gateways and Data Management in IoT.
4. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints. Building state of the art architecture in IoT.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBOE04	Cyber Law & Ethics	3	0	0	3

Cyber laws and rights in today's digital age; IT Act, Intellectual Property Issues connected with use and management of Digital Data The similar Acts of other countries Information Warfare: Nature of information warfare, including computer crime and information terrorism; Threats to information resources, including military and economic espionage, communications eavesdropping, computer break-ins, denial-of-service, destruction and modification of data, distortion and fabrication of information, forgery, control and disruption of information How, electronic bombs, and sops and perception management. Countermeasures, including authentication, encryption, auditing, monitoring, intrusion election, and firewalls, and the limitations of those countermeasures. Cyberspace law and law enforcement,

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information warfare and the military, and intelligence in the information age. Information warfare policy and ethical Issues.

References:

1.Hon C Graff, Cryptography and E-Commerce - A Wiley Tech Brief, Wiley Computer Publisher, 2001

2.Michael Cross, Norris L Johnson, Tony Piltzecker, Security, Shroff Publishers and Distributors Ltd.

http://cse.nitk.ac.in/course/cyber-law-and-ethics

Course Outcomes: On completion of the course the student should be able to
1. Describe laws governing cyberspace and analyze the role of Internet Governance in framing policies for Internet security
2. Discuss different types of cybercrimes and analyze legal frameworks of different countries to deal with these cybercrimes.
3. Explain the importance of jurisdictional boundaries and identify the measures to overcome cross jurisdictional cyber crimes.
4. Illustrate the importance of ethics in the legal profession and determine the appropriate ethical and legal behaviour according to legal frameworks
5. Identify intellectual property right issues in the cyberspace and design strategies to protect your intellectual property.
6. Assess the legal issues with e-commerce
7. Recognize the importance of digital evidence in prosecution and compare laws of different countries

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBOE07	Multimedia Technology	3	0	0	3

Prerequisites: Computer Graphics & Virtual Reality
Unit 1: Introductory Concepts: Multimedia-Definitions, CD-ROM and the Multimedia Highway, Uses of Multimedia, Introduction to making multimedia- The Stages of project, the requirements to make good multimedia, Multimedia skills and training, Training opportunities in Multimedia. Motivation for multimedia usage, Frequency domain analysis, Application Domain & ODA etc.

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Unit 2: Multimedia-Hardware and Software: Multimedia Hardware- Macintosh and Windows production Platforms, Hardware peripherals – Connections, Memory and storage devices, Media software- Basic tools, making instant multimedia, Multimedia software and Authoring tools, Production Standards.

Unit 3: Multimedia- making it work- multimedia building blocks- Text, Sound, Images, Animation and Video, Digitization of Audio and Video objects, Data Compression: Different Compression algorithms concern to text, audio, video and images etc., Working Exposure on Tools like Dream Weaver, 3D Effects, Flash etc.

Unit 4: Multimedia and Internet: History, Internet working, Connections, Internet Services, The world Wide Web, Tools for the WWW- web Servers, Web Browsers, Web Page makers and editors, Plug-Ins and Delivery Vehicles, HTML , VRLM, Designing for the WWW-Working on the web , Multimedia Applications- Media Communication, Media Consumption, Media Entertainment, Media games.

Unit 5: Multimedia-looking towards future: Digital Communication and New Media, Interactive Television, Digital Broadcasting, Digital Radio, Multimedia Conferencing,Assembling and delivering a project-planning and costing, Designing and Producing, content and talent, Delivering , CD-ROM technology.

Textbooks:
1. Steve Heath,"Multimedia & Communication Systems",Focal Press,UK,1999.
2. TAy Vaughan,"Multimedia Making it Work", TMH,1999.
3. K. Andleigh And K. Thakkar,"Multimedia System Design",PHI, PTR,2000.

Reference books:
1. Keyes,"Multimedia Handbook",TMH,2000.
2. Ralf Steinmetz and Klara Naharstedt,"Multimedia: Computing, Communication & Applications",Pearson,2001.
3. Steve Rimmer,"Advanced Multimedia Programming", MHI,2000.

Course Outcomes: After completion of course, students would be:
1. To identify a range of concepts, techniques and tools for creating and editing the interactive multimedia applications.
2. To identify the current and future issues related to multimedia technology.
3. To identify both theoretical and practical aspects in designing multimedia systems surrounding the emergence of multimedia technologies using contemporary hardware and software technologies.

Course Code	Course name	Lectures	Tutorials	Practicals	Total Credits
CSBOE08	Mobile Applications & Services	3	0	0	3

Pre-Requisites: Wireless Communication and Mobile Computing

Unit 1: Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User
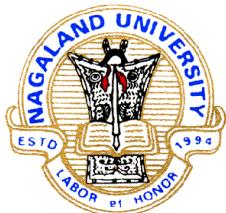
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Unit 2: More on Uis: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis, . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider

Unit 3: Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics

Unit 4: Putting It All Together : Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia

Unit 5: Platforms and Additional Issues : Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking , Active Transactions, More on Security, Hacking Android

Unit 6: Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT

Reference books:

1. Wei-Meng Lee, Beginning Android™ 4 Application Development, 2012 by John Wiley & Sons

Course Outcomes: On completion of the course the student should be able to

1   Identify the target platform and users and be able to define and sketch a mobile application

2.   Understand the fundamentals, frameworks, and development lifecycle of mobile application platforms including iOS, Android, and PhoneGap

3.   Design and develop a mobile application prototype in one of the platform (challenge project)