University of Engineering & Management, Jaipur

Syllabus for BSc Computer Science Admission Batch 2026

SEMESTER 5

S. No.	Subject Code	Subject Name	L	T	P	Total Contact Hrs	Credit Points
Theory							
1	BSCCS501	Internet Technologies	3	1	0	4	4
2	BSCCS502	Theory of Computation	3	1	0	4	4
3	BSCCS503	Digital Image Processing	3	1	0	4	4
4	BSCCS504	General Studies & Current Affairs -V	3	1	0	4	4
Practical							
5	BSCCS591	Internet Technologies Lab	0	0	2	2	2
6	BSCCS592	Theory of Computation Tutorial	0	0	2	2	2
7	BSCCS593	Digital Image Processing Lab	0	0	2	2	2
Sessional							
8	BSCCS594	Combinatorial Optimization	0	2	0	2	2
		Total	12	6	6	24	24

Subject Code: BSCCS501

Subject Name: Internet Technologies

Credit Points: 04

Course Objective

This course introduces the protocols used in Internet, its architecture, and security aspect of Internet. Student will have an insight that how a search engine works and web crawls.

Course Learning Outcomes

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

1. Describe Internet, its architecture, services and protocol.
2. Implement a simple search engine.
3. Implement a web crawler.
4. Use javascript technologies to make a website highly responsive, more efficient and user friendly.

Detailed Syllabus

Unit 1

Introduction: Network address translation, Subnet Masking, Difference between Intranet and Internet, Working of Internet, Dynamic and Static Routing, Domain Name Server, networking tools - ipconfig, ping, netstat, traceroute

Unit 2

Introduction to Internet Protocols: HTTP, HTTPS, FTP, SMTP, IMAP, POP3, VoIP

Unit 3

Web Servers: Introduction, Working, Configuring, Hosting and Managing a Web server, Proxy Servers: Introduction, Working, Type of Proxies, Setting up and managing a proxy server Client-side Technologies, Server-side Technologies and hybrid technologies

Unit 4

JavaScript, jQuery, JSON, NODE.js, BOOTSTRAP, Introduction to forums, blogging, portfolio, developing a responsive website, Combining Web Applications and Mobile Applications

Unit 5

Search Engines - components, working, optimization, Crawling, BOTS

Unit 6

Introduction to cookies and sessions, Introduction to e-commerce websites and e-carts.

References

1. Bayross, I. (2013). Web enabled commercial application development using HTML, JavaScript, DHTML and PHP. 4th edition. BPB Publication.

2. DComer. (2018). The Internet Book: Everything You need to know about Computer networking and how the internet works. 5th edition. CRC Press.
3. Duckett, J.(2014). JavaScript and JQuery: Interactive Front-End Web Development. Wiley

Additional Resources:

1. Godbole, A. S.& Kahate A (2008). Web Technologies. Tata McGrawHill
2. Greenlaw R. & Hepp E, (2007). Fundamentals of Internet and WWW. 2nd edition. Tata McGrawHill.
3. Jackson. (2008). Web Technologies. Pearson Education
4. Patel, B & Barik, L.B , Internet & Web Technology , Acme Learning Publisher
5. Reddy, S., Aggarwal, A., Sayer, M., Totty, B., & Gourley, D. (2002). HTTP: The Definitive Guide. Media: O'Reilly Media Inc.
6. Young, M. L. (2007). The Complete reference to Internet. Tata: McGraw Hill.

Subject Code: BSCCS591

Subject Name: Internet Technologies Lab

Credit Points: 02

Practical

1. Demonstrate the use of networking tools like ping, ipconfig, netstat and traceroute.
2. Configure a web-server on a personal system.
3. Demonstrate the network monitoring of the internet traffic through any predefined tool.
4. Develop an interactive website using jquery, JSON, NODE.js and BOOTSTRAP with following functionalities.
    1. Design a home page and other allied pages of the website using HTML and CSS.
    2. Create a registration form and insert the data into tables at the backend. Creating an html form with content validation using JavaScript.
    3. Handle HTML form using jQuery, store the data in JSON objects, pass them to another page and display it there using jQuery.
    4. Logging system to manage various types of accounts.
    5. Create pages with dynamic content fetching and display.
    6. Perform event handling in node.js

Subject Code: BSCCS502

Subject Name: Theory of Computation

Credit Points: 04

Course Objective

This course introduces formal models of computation, namely, finite automaton, pushdown automaton, and Turing machine; and their relationships with formal languages. Students will also learn about the limitations of computing machines.

Course Learning Outcomes

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

1. Design a finite automaton, pushdown automaton or a Turing machine for a problem at hand.
2. Apply pumping lemma to prove that a language is non-regular/non-context-free.
3. Describe limitations of a computing machine.

Detailed Syllabus

Unit 1

Languages: Alphabets, string, language, basic operations on language, concatenation, union, Kleene star.

Unit 2

Regular Expressions and Finite Automata: Regular expressions, Deterministic finite automata (DFA).

Unit 3

Regular Languages: Non-deterministic Finite Automata (NFA), relationship between NFA and DFA, Transition Graphs (TG), properties of regular languages, the relationship between regular languages and finite automata, Kleene's Theorem.

Unit 4

Non-Regular Languages and Context Free Grammars: Pumping lemma for regular grammars, Context-Free Grammars (CFG)

Unit 5

Context-Free Languages (CFL) and PDA: Deterministic and non-deterministic Pushdown Automata (PDA), parse trees, leftmost derivation, pumping lemma for CFL, properties of CFL.

Unit 6

Turing Machines and Models of Computations: Turing machine as a model of computation, configuration of simple Turing machine, Church Turing Thesis, Universal Turing Machine, decidability, halting problem.

References

1. Cohen, D. I. A. (2011). Introduction to Computer Theory. 2nd edition. Wiley India.
2. Lewis, H.R. & Papadimitriou, H. R. (2002). Elements of the Theory of Computation. 6th edition. Prentice Hall of India (PHI)

Additional Resources

1. Goodrich, M., Tamassia, R., & Mount, D.M. (2011). Data Structures and Algorithms Analysis in C++. 2nd edition. Wiley.
2. Gopalkrishnan, G.L. (2019) Automata and Computability: A programmer's perspective. CRC Press.
3. Linz, P. (2016). An Introduction to Formal Languages and Automata.6th edition. Jones and Bartlett Learning.

Subject Code: BSCCS592

Subject Name: Theory of Computation Tutorial

Credit Points: 02

Practical

Tutorials based on theory.

Subject Code: BSCCS503

Subject Name: Digital Image Processing

Credit Points: 04

Course Objective

This course introduces students to the fundamentals of digital image processing, and various image transforms, image restoration techniques, image compression and segmentation used in digital image processing.

Course Learning Outcomes

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

1. Describe the roles of image processing systems in a variety of application.
2. Write programs to read/write and manipulate images: enhancement, segmentation and compression, spatial filtering.
3. Develop Fourier transform for image processing in frequency domain.
4. Evaluate the methodologies for image segmentation, restoration.

Detailed Syllabus

Unit 1

Introduction: Digital Image Fundamentals: Brightness, Adaptation and Discrimination, Light and Electromagnetic Spectrum, Image Sampling and Quantization, Some Basic Relationships between Pixels Types of images.

Unit 2

Spatial Domain Filtering: Some Basic Intensity Transformation Functions, Histogram Equalization, Spatial Correlation and Convolution, Smoothening Spatial Filters: Low pass filters, Order Statistics filters; Sharpening Spatial Filters: Laplacian filter

Unit 3

Filtering in Frequency Domain: The Discrete Fourier Transformation (DFT), Frequency Domain Filtering: Ideal and Butterworth Low pass and High pass filters, DCT Transform (1D, 2D)

Unit 4

Image Restoration: Image Degradation/Restoration Process, Noise models, Noise Restoration Filters.

Image Compression: Fundamentals of Image Compression, Huffman Coding, Run Length Coding, JPEG

Unit 5

Morphological Image Processing: Erosion, Dilation, Opening, Closing, Hit-or-Miss Transformation, Basic Morphological Algorithms.

Unit 6

Image Segmentation: Point, Line and Edge Detection, Thresholding, Region Based Segmentation.

References

1. Gonzalez, R. C., & Woods, R. E. (2017). Digital Image Processing. 4th edition. Pearson Education.
2. Jain, A. K. (1988). Fundamentals of Digital Image Processing. 1st edition Prentice Hall of India.

Additional Resources

1. Castleman, K. R. (1995.). Digital Image Processing. 1st edition. Pearson Education.
2. Gonzalez, R. C., Woods, R. E., & Eddins, S. (2004). Digital Image Processing using MATLAB. Pearson Education Inc.
3. Schalkoff, D. (1989). Image Processing and Computer Vision. 1st edition. John Wiley and Sons.

Subject Code: BSCCS593

Subject Name: Digital Image Processing Lab

Credit Points: 02

Practical

1. Write program to read and display digital image using MATLAB or SCILAB
    a. Become familiar with SCILAB/MATLAB Basic command
    b. Read and display image in SCILAB/MATLAB
    c. Resize given image
    d. Convert given color image into gray-scale image
    e. Convert given color/gray-scale image into black & white image
    f. Draw image profile
    g. Separate color image in three R G & B planes
    h. Create color image using R, G and B three separate planes
    i. Flow control and LOOP in SCILAB
    j. Write given 2-D data in image file
2. To write and execute image processing programs using point processing method
    a. Obtain Negative image
    b. Obtain Flip image
    c. Thresholding
    d. Contrast stretching
3. To write and execute programs for image arithmetic operations
    a. Addition of two images
    b. Subtract one image from other image
    c. Calculate mean value of image

d. Different Brightness by changing mean value

4. To write and execute programs for image logical operations
    a. AND operation between two images
    b. OR operation between two images
    c. Calculate intersection of two images
    d. Water Marking using EX-OR operation
    e. NOT operation (Negative image)
5. To write a program for histogram calculation and equalization using
    a. Standard MATLAB function
    b. Program without using standard MATLAB functions
    c. C Program
6. To write and execute program for geometric transformation of image
    a. Translation
    b. Scaling
    c. Rotation
    d. Shrinking
    e. Zooming
7. To understand various image noise models and to write programs for
    a. image restoration
    b. Remove Salt and Pepper Noise
    c. Minimize Gaussian noise
    d. Median filter and Weiner filter

8. Write and execute programs to remove noise using spatial filters
    a. Understand 1-D and 2-D convolution process
    b. Use 3x3 Mask for low pass filter and high pass filter
9. Write and execute programs for image frequency domain filtering
    a. Apply FFT on given image
    b. Perform low pass and high pass filtering in frequency domain
    c. Apply IFFT to reconstruct image
10. Write a program in C and MATLAB/SCILAB for edge detection using different edge detection mask.
11. Write and execute program for image morphological operations erosion and dilation.
12. To write and execute program for wavelet transform on given image and perform inverse wavelet transform to reconstruct image.

Subject Code: BSCCS594

Subject Name: Combinatorial Optimization

Credit Points: 02

Course Objective

This course is designed to introduce the fundamentals of combinatorial optimization to the students in terms of both theory and applications, so as to equip them to explore the more advanced areas of convex and non-convex optimizations.

Course Learning Outcomes

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

1. Model problems using linear and integer programs.
2. Apply polyhedral analysis to develop algorithms for optimization problems.
3. Use the concept of duality for design of algorithms.

Detailed Syllabus

Unit 1

Introduction to Combinatorial Optimization Problems, Linear and Integer Programs: LP Formulation, understanding integer programs, computational complexities of IP vs LP, using LP to find optimal or approximate integral solutions, concept of integrality gap.

Unit 2

Theory of Linear Programming and Algorithmic Perspective to Simplex Method: standard vs. equational form, basic feasible solutions, convexity and convex polyhedra, correspondence between vertices and basic feasible solutions, geometry of Simplex algorithm, exception handling (unboundedness, degeneracy, infeasibility), Simplex algorithm, avoiding cycles.

Unit 3

Primal-Dual Algorithms: interpretation of dual, optimality conditions for primal and dual, weak and strong duality, complementary slackness, and primal-dual algorithm for the shortest path problem.

Unit 4

Primal-Dual Algorithms: interpretation of dual, optimality conditions for primal and dual, weak and strong duality, complementary slackness, and primal-dual algorithm for the shortest path problem.

References

1. Matousek & Gartner (2007). Understanding and Using Linear Programming. Springer.
2. Papadimitriou, C.H. & Steiglitz, K. (1998). Combinatorial Optimization: Algorithms and complexity. Dover Publications.

Additional Resources

1. Bazaraa, M.S., Jarvis, J.J., & and Sherali, H.D.(2008). Linear Programming and Network Flows. 2nd edition. Wiley.
2. Korte, B., & Vygen, J. (2006). Combinatorial Optimization. 5th edition. Springer.