



National Institute of Technology Raipur												
Computer Application												
Course of Study and Scheme of Examination							MCA 4th Semester				Branch: CA	
S. No.	Subject Code	Subject Name	Periods per Week			TA	Examination Scheme				Total Marks	Credits
			L	T	P		MSE/MTR		ESE/ESVE			
							Theory	Prac.	Theory	Prac.		
1	CA404101CA	AI & Machine Learning	3	1	0	20	30	–	50	–	100	4
2	MA404002MA	Computer Oriented Optimization	3	1	0	20	30	–	50	–	100	4
3	CA4042**CA	Elective-I	2	1	0	20	30	–	50	–	100	3
4	CA4042\$\$CA	Elective-II	2	1	0	20	30	–	50	–	100	3
5	CA4043##CA	Open Elective-I	2	1	0	20	30	–	50	–	100	3
6	CA404401CA	Computer Lab-401	0	0	4	40	–	20	–	40	100	2
7	CA404502CA	Computer Lab-402	0	0	4	40	–	20	–	40	100	2
8	CA404403HS	Language Lab-403- GD/PI	0	0	4	40	–	20	–	40	100	2
												23

\*\*, \$\$, ## are numbers to be filled from list of electives (Program and Open) prepared and maintained by the department

Program Elective-I		Program Elective-II		Open Elective-I	
Subject Code	Subject Name	Subject Code	Subject Name	Subject Code	Subject Name
CA404201CA	1. Soft Computing	CA404206CA	1. Web Technology- Advance Java	CA404301CA	1. Computer Graphics & Multimedia
CA404202CA	2. Crptography & Network Security	CA404207CA	2. Unix N/W Programming	CA404302CA	2. Advance Data Mining
CA404203CA	3. Advance Database	CA404208CA	3. Internet Technologies and Programming		
CA404204CA	4. Advance OS	CA404209CA	4. Internet of Things		
CA404205CA	5. Multimedia Techniques				



**Semester - IV**

1.	Department proposing the course	Department of Computer Applications
2.	Course Title	AI & Machine learning
3.	L-T-P Structure	3-1-0
4.	Credits / # of period	04/42
5.	Course number(Code)	
6.	Status (Core/Elective)	Core
7.	Pre-requisites(course no./title)	
8.	Frequency of offer	
9.	<b>Course Objectives:</b> <ol style="list-style-type: none"><li>1. Understanding the concepts of Artificial Intelligence.</li><li>2. Apply the Artificial Intelligence methods for solving different problems.</li><li>3. To learn methodology and tools to apply machine learning algorithms to real data and evaluate their performance.</li><li>4. To better understand the concepts of AI and Machine learning.</li></ol>	
10.	<b>Course Syllabus:</b>  <b>Unit-1</b>  Introduction to AI: Control strategies, Search strategies, Problem solving by search: state space, Problem reduction; Constraint Satisfaction problems, Game Playing, Problem solving methods - Problem graphs, Matching, Indexing and Search techniques.  <b>Unit-2</b>  Automated Reasoning: Proposition and first order logic, inference and deduction, resolution refutation, answer extraction, knowledge representation, logic programming and constrained logic programming, non-monotonic reasoning and Statistical reasoning.  <b>Unit-3</b>  Planning: state-space, plan space and partial order planning, planning algorithms; Reasoning under uncertainty: probabilistic reasoning, Probability theory, Bayes Theorem and Bayesian networks, Certainty Factor,  <b>Unit-4</b>  Machine Learning: inductive learning, decision trees, logical approaches, computational learning theory, neural networks, reinforcement, supervised and unsupervised learning; Intelligent agents, Expert System, Natural language understanding, Applications.	



11.	<b>Text Books:</b> <ol style="list-style-type: none"><li>1. Elaine Rich and Kevin Knight: Artificial Intelligence – Tata McGraw Hill.</li><li>2. Artificial Intelligence: A Modern Approach, Stuart Russell, Peter Norving, Pearson Education 2nd Edition.</li><li>3. Artificial Intelligence and Soft Computing: Behavioral and Cognitive Modeling of the Human Brain by Amit Konar, CRC Press, 2000.</li></ol>
12.	<b>Reference Books :</b> <ol style="list-style-type: none"><li>1. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan-Kaufmann.</li><li>2. Artificial Intelligence, Winston, Patrick, Henry, Pearson Education.</li><li>3. Artificial Intelligence by Gopal Krishna, Janakiraman.</li><li>4. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hall of India.</li></ol>



**Semester – IV**

1.	Department proposing the course	Department of Mathematics
2.	Course Title	Computer Oriented Optimization
3.	L-T-P Structure	3-1-0
4.	Credits / # of period	4/40
5.	Course number(Code)	CMA42
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	Undergraduates Mathematics
8.	Frequency of offer	Regular
9.	<b>Course Objectives:</b> To enable the students to apply the knowledge of Optimization Techniques in various fields: <ol style="list-style-type: none"> <li>1. Introduce the methods to solve the optimization problems including LPP and their applications.</li> <li>2. Introduce the methods to solve the sequencing problems, dynamic programming, and multi-objective programming.</li> <li>3. Introduce the methods to solve transportation, assignment and replacement problems.</li> <li>4. Introduce the PERT and CPM networks for scheduling, monitoring and controlling the project work.</li> </ol>	
10.	<b>Course Syllabus:</b>  <b>Unit - 1: - Introduction to Optimization</b>  Introduction to constrained and unconstrained optimization, Mathematical formulation of L.P.P., Graphical method for solving LPP with two variables, Simplex method, Application of simplex method for maximization & minimization of LPP, Artificial variable technique for finding the initial basic feasible solution, Two Phase method, The Big-M method, Degeneracy in simplex method, Duality theory in LP, Dual simplex method.  <b>Unit - 2: - Sequencing and Dynamic Programming</b>  Sequencing problem, Johnson's algorithm for processing N-jobs through two-machine problem, N-jobs through 3 machines problem, 2-jobs through N-machine by graphical method, Bellman's principle of optimality of dynamic programming, Characteristics of dynamic programming, Dynamic programming algorithm, Introduction to multi-objective optimization.  <b>Unit - 3: - Transportation, Assignment &amp; Replacement Problems</b> <b>Transportation:</b> North-West Corner Rule, Lowest Cost Entry method, Vogel's Approximation method, MODI Method. <b>Assignment problems:</b> Hungarian method. <b>Replacement:</b> Replacement of equipment/ Asset that Deteriorates Gradually, Replacement of equipment that fails suddenly, Recruitment & Promotion problem, Equipment renewal problem.	



	<p><b>Unit - 4: - Network Analysis</b></p> <p>Introduction, Network &amp; basic components, Logical sequencing, Rules of Network Construction, CPM/PERT Techniques, Critical path method (CPM), Determination of critical path (Labeling method), The Project Evaluation &amp; Review Technique (PERT), Probability Considerations in PERT, Distinction between PERT &amp; CPM, Project cost, Time-cost optimization algorithm.</p>
11.	<p><b>Text Books:-</b></p> <ol style="list-style-type: none"><li>1. Operation Research, Panneerselvam, Prentice Hall of India.</li><li>2. Operation Research: An Introduction, Hamdy, A. Taha, Prentice Hall of India.</li></ol>
12.	<p><b>Reference Books: -</b></p> <ol style="list-style-type: none"><li>1. Gillett B. E., Introduction to Operation Research- A Computer Oriented Algorithmic Approach, McGraw Hill</li><li>2. KantiSwarup, Gupta P. K., Man Mohan, Operations Research, Sultan Chand &amp; Sons.</li><li>3. Vohra N. D., Quantitative Techniques in Management, T.M.H., 1990.</li><li>4. Zojnts. S., Linear &amp; Integer Programming, Prentice Hall, 1975.</li><li>5. R. K. Gupta, Operational Research, Krishna PrakashanMandir, Meerut.</li></ol>



**Semester - IV**

1.	Department proposing the course	Department of Computer Applications
2.	Course Title	Cryptography & Network Security
3.	L-T-P Structure	2-1-0
4.	Credits / # of period	03/32
5.	Course number(Code)	
6.	Status (Core/Elective)	Elective
7.	Pre-requisites(course no./title)	Elementary Number Theory, Computer networks.
8.	Frequency of offer	Regular
9.	Course Objectives: 1. To understand basic objectives of cryptography and types of ciphers. 2. To understand the public key cryptosystem and various hard problems. 3. To study and analyze standards and certification in key exchange and signatures. 4. Explores the network and system security.	
10.	Course Syllabus: <b>Unit-1</b> <b>Introduction:</b> Security attacks, cryptographic attacks, services and mechanism, techniques. <b>Traditional symmetric key ciphers:</b> substitution ciphers, transposition ciphers, stream and block ciphers.  <b>Number theory and finite fields:</b> Euclidean algorithm, Modular arithmetic, Groups, Rings and Fields, Finite fields, Prime numbers, Fermat's and Euler's theorems, Discrete Logarithms.  <b>Unit-2</b> <b>Introduction to modern symmetric key ciphers:</b> modern block ciphers, modern stream ciphers. DES, AES, use of modern block and stream ciphers.  Asymmetric key cryptography, RSA cryptosystem, Rabin cryptosystem, El Gamal cryptosystem, Elliptic curve cryptosystem, message integrity and authentication. Cryptographic hash functions.  <b>Unit-3</b> <b>Digital signatures:</b> attacks on digital signatures, digital signature schemes, variation and applications. <b>Entity authentication:</b> passwords, challenge-response, zero-knowledge, biometrics. <b>Key management:</b> symmetric key distribution, Kerberos, symmetric key agreement, Public key distribution.  <b>Unit-4</b> <b>Network Security:</b> security at the application layer - email, PGP and S/MIME. <b>Security at the transport layer:</b> SSL architecture, SSL message formats, transport layer security. Security at the network layer: IPSec, Internet Key Exchange (IKE), ISAKMP. <b>System security:</b> description of the system. Users, trust and trusted systems, buffer overflow and malicious software, malicious programs: viruses and worms, Intrusion Detection System (IDS), Firewalls.	



11.	<p><b>Text Books:</b></p> <ol style="list-style-type: none"><li>1. Behrouz A Forouzan and Debdeep M, Cryptography and Network Security Second Edition, Tata McGraw Hill Education Private Limited.</li><li>2. William Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall of India.</li></ol>
12.	<p><b>Reference Books :</b></p> <ol style="list-style-type: none"><li>1. Doug Stinson, Cryptography Theory and Practice, CRC Press.</li><li>2. A. Das and C. E. Veni Madhavan, Public-Key Cryptography: Theory and Practice, Pearson Education Asia.</li><li>3. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press.</li><li>4. Neal Koblitz, A course in number theory and cryptography, Springer.</li><li>5. Johannes A. Buchmann, Introduction to Cryptography, Undergraduate Text in Mathematics, Springer.</li></ol>



**Semester- IV**

1.	Department proposing the course	Department of Computer Applications
2.	Course Title	Advance OS
3.	L-T-P Structure	2-1-0
4.	Credits / # of period	03/40
5.	Course number(Code)	ECA43
6.	Status (Core/Elective)	Elective
7.	Pre-requisites(course no./title)	
8.	Frequency of offer	
9.	Course Objectives :  1. To provide knowledge about advanced concepts in OS 2. To inculcate ability to develop OS for distributed systems 3. To inculcate ability to develop modules for mobile devices	
10.	Course Syllabus:  <b>Unit 1</b>  <b>Multiprocessor Operating Systems:</b> System architectures, Structures of OS, OS design issues, Process synchronization, Process scheduling and allocation, Memory management.  <b>Unit 2</b>  <b>Distributed Operating Systems:</b> System Architectures, Design issues, Communication models, Clock synchronization, Mutual exclusion, Election algorithms, Distributed deadlock detection.  <b>Distributed scheduling:</b> Distributed shared memory, Distributed File system, Multimedia file systems, File placement, Caching.  <b>Unit 3</b>  <b>Database Operating Systems:</b> Requirements of Database OS, Transaction process model, Synchronization primitives, Concurrency control algorithms.  <b>Unit 4</b>  <b>Mobile Operating Systems:</b> ARM and Intel architectures, Power management, Mobile OS architectures, Underlying OS, Kernel structure and native level programming, Runtime issues, Approaches to power management.	





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**NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR**  
(Institute of National Importance)  
G.E. Road, Raipur – 492010 (C.G.)

Phone: (0771) 22 54 200  
Fax: (0771) 22 54 600  
Email: [director.nitr@rediffmail.com](mailto:director.nitr@rediffmail.com)  
Website: [www.nitr.ac.in](http://www.nitr.ac.in)

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11.	<b>Text Books:</b>  1. M Singhal and NG Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill Inc, 2001
12.	<b>Reference Books :</b>  1. A S Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2001 2. Source Wikipedia, Mobile Operating Systems, General Books LLC, 2010



**Semester- IV**

1.	Department proposing the course	Department of Computer Applications
2.	Course Title	Web Technology - Advance Java
3.	L-T-P Structure	2-1-0
4.	Credits / # of period	03/32
5.	Course number(Code)	
6.	Status (Core/Elective)	Elective
7.	Pre-requisites(course no./title)	
8.	Frequency of offer	
9.	Course Objectives:  1. To provide students with prerequisites of Web Development. 2. To empower students with Java Web Technologies. 3. To impart basics of Network Programming using Java. 4. To introduce latest trends of Java Technologies.	
10.	Course Syllabus:  <b>Unit-1:</b>  <b>Introduction to Web:</b> Client-Server Architecture, World Wide Web, Client Side Web Technologies: HTML5, CSS3, JavaScript (JS). eXtensible Markup Language (XML), Java Script Object Notation (JSON) and, AJAX (Asynchronous JavaScript and XML).  <b>Unit-2:</b>  <b>Servlets and JSP:</b> Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Working with Servlets. Java Server Pages (JSP): Introduction, Implicit Objects, Directives, Custom Tag Libraries. Java Database Connectivity (JDBC).  <b>Unit-3:</b>  <b>Network Programming:</b> Remote Method Invocation (RMI): Defining and implementing the Remote Interface. Enterprise Java Bean: Creating a JavaBean, Types of beans.  <b>Unit-4:</b>  <b>Miscellaneous:</b> Single Page Application, Object-Relational Mapping (ORM), Introduction to MVC Framework: SpringMVC.	



11.	<p><b>Text Books:</b></p> <ol style="list-style-type: none"><li>1. Web Technologies: A Computer Science Perspective, by Jeffrey C. Jackson, Prentice Hall</li><li>2. JDBC, Servlets and JSP Black Book by Santosh Kumar K.</li></ol>
12.	<p><b>Reference Books :</b></p> <ol style="list-style-type: none"><li>1) Web Technology: A Developers Perspective by N.P.Gopalan &amp; J.Akilandeswani, PHI Publication.</li><li>2) Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, JSP, XML and Ajax, Black Book by Kogent Learning Solutions Inc.</li><li>3) Internet and Web Technologies by Raj Kamal, Tata McGraw-Hill Education.</li><li>4) Java Script:The definite Guide By Flangam ,O'Reilly.</li><li>5) Advanced Java 2 Platform HOW TO PROGRAM by H. M.Deitel, P. J. Deitel, S. E. Santry.</li><li>6) <a href="https://docs.oracle.com/javase/tutorial/">https://docs.oracle.com/javase/tutorial/</a></li><li>7) <a href="http://edutechwiki.unige.ch/en/Web_technology_and_web_design_tutorials">http://edutechwiki.unige.ch/en/Web_technology_and_web_design_tutorials</a></li></ol>



**Semester IV**

1.	Department proposing the course	Computer Applications
2.	Course Title	Advance Data Mining
3.	L-T-P Structure	2-1-0
4.	Credits / # of period	03/32
5.	Course number(Code)	
6.	Status (Core/Elective)	Elective
7.	Pre-requisites(course no./title)	
8.	Frequency of offer	
9.	Course Objectives: <ol style="list-style-type: none"><li>1. Learning in-depth about data mining techniques.</li><li>2. Understanding time series mining</li><li>3. Identifying applications of data mining: anomaly detection</li><li>4. Understanding the patterns of complex data using Machine learning algorithms</li></ol>	
10.	Course Syllabus:  <b>Unit-1</b>  Text Data Mining, Text Classification, Vector Space Model, Flat and Hierarchical Clustering, Text Summarization  <b>Unit-2</b>  Time Series Mining: Machine Learning for Time Series Data, Multivariate Time Series (MVTS) Mining, Importance of MVTS data, Sources of MVTS data, Mining MVTS data, Sign Language Data, Agro-meteorological Data  <b>Unit-3</b>  Association rules and Link analysis: Market Basket Analysis, Apriori Algorithm, FP-Growth Algorithm, Outlier Detection : Different approaches of outlier detections Practical significance of outlier detection, Outlier detection with high dimensional data.  <b>Unit-4</b>  Mining Complex data : Mining with web data, graph data, Earth Science Data, Spatial and Temporal data	



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Website: [www.nitr.ac.in](http://www.nitr.ac.in)

11.	<b>Text Books:</b> <ol style="list-style-type: none"><li>1. Data Mining Concepts and Techniques. Jiawei Han, Micheline Kamber, Jian Pei</li><li>2. Introduction to Data Mining. Tan, Kumar Seinbach, Pearson</li><li>3. Data Mining. Concepts, Models, Method and Algorithm. Mehmed Kantardzic, Wiley</li></ol>
12.	<b>Reference Books:</b> <ol style="list-style-type: none"><li>1. Forecasting Methods and Applications. Spyros Makridakis, Steven C. Wheelwright, Rob J. Hyndman. Wiley</li></ol>



### Computer Lab – 401 (AI & Machine Learning Lab Assignments)

1. Write a prolog program to find the rules for parent, child, male, female, son, daughter, brother, sister, uncle, aunt, ancestor given the facts about father and wife only.
2. Write a program to find the length of a given list.
3. Write a program to find the last element of a given list.
4. Write a program to delete the first occurrence and also all occurrences of a particular element in a given list.
5. Write a program to find union and intersection of two given sets represented as lists.
6. Write a program to read a list at a time and write a list at a time using the well defined read & write functions.
7. Write a program given the knowledge base, If x is on the top of y, y supports x. If x is above y and they are touching each other, x is on top of y. A cup is above a book. The cup is touching that book. Convert the following into wff's, clausal form; Is it possible to deduce that 'The book supports the cup'.
8. Write a program given the knowledge base, If Town x is connected to Town y by highway z and bikes are allowed on z, you can get to y from x by bike. If Town x is connected to y by z then y is also connected to x by z. If you can get to town q from p and also to town r from town q, you can get to town r from town p. Town A is connected to Town B by Road 1. Town B is connected to Town C by Road 2. Town A is connected to Town C by Road 3. Town D is connected to Town E by Road 4. Town D is connected to Town B by Road 5. Bikes are allowed on roads 3, 4, 5. Bikes are only either allowed on Road 1 or on Road 2 every day. Convert the following into wff's, clausal form and deduce that 'One can get to town B from town D'.
9. Solve the classical Water Jug problem of AI.
10. Solve the classical Monkey Banana problem of AI.
11. Solve the classical Crypt arithmetic problems such as DONALD + GERALD = ROBERT of AI.
12. Solve the classical Missionary Cannibals problem of AI.
13. Solve the classical Travelling Salesman Problem of AI.
14. Solve the classical Blocks World Problem of AI.
15. Write a program to search any goal given an input graph using AO\* algorithm.
16. Search: Uninformed search, A\* search, adversarial search, local search.
17. Planning: Markov Decision Problems, Value Iteration and Policy Iteration.
18. Probabilistic reasoning: Bayes nets, conditional independence, exact and approximate inference.
19. Supervised learning: Linear methods for classification and regression, regularization, cross-validation, decision trees, neural networks, ensemble methods.
20. Unsupervised learning: k-means clustering.



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**List of Equipments/Machine required:**

- (i) PC with Windows XP
- (ii) Visual Prolog Compiler

**Recommended Books:**

- (i) Ivan Bratko: Logic & prolog programming.
- (ii) Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd edition, Pearson, 2010.
- (iii) The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, and Jerome Friedman, 2nd edition, Springer, 2009.



**Computer Lab – 402 (Web Technology Lab Assignments)**

1. Design a static web site containing at least 5 pages using HTML and CSS.
2. Perform form-validation using javascript.
3. Create n (user defined number) number of text-inputs using javascript.
4. Create an XML document to store Books' record and access them using an HTML page.
5. Create a registration page and show the form-data on submission in another web page (using servlet/jsp).
6. Create a web page that stores student record into database (oracle/MySQL). Also create a show-student-information page that shows those records.
7. Create user registration page and login page. Also create a userhome page that should be redirected after successful login.
8. Use session to track the user across the websites.
9. Store some cookie variables on users' computer and retrieve them in next Http request.
10. Create a small single page application (SPA) using AngularJS.

**Text Books:**

1. Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book, Kogent Learning Solutions Inc.
2. JDBC, Servlets and JSP Black Book by Santosh Kumar K. Kogent Solutions Inc.

**References:**

1. Web Technology: A Developer's Perspective by Gopalan, PHI.
2. AngularJS by Green and Seshadri. O Really.





**Language Lab – 403 (GD/PI)**

1.	Department proposing the course	Humanities and Social Science
2.	Course Title	Group Discussion/Personality Development Lab
3.	L-T-P Structure	0-0-4
4.	Credits / # of period	02/02
5.	Course number(Code)	
6.	Status (Core/Elective)	Essential Program Requirement
7.	Pre-requisites (course no./title)	None
8.	Frequency of offer	Second Year (Fourth Semester)
9.	Course Objectives:  1. To enable language proficiency skills 2. To develop logical and argumentative skills 3. To use English in professional communication	
10.	Course Syllabus:  <b>UNIT I</b> Extempore ,Job Talk, Mock Interview  <b>UNIT -II</b> Group Discussion and Debate  <b>UNIT-III</b> Leadership Skills  <b>UNIT-IV</b> A Project on Communication Model	
11.	Suggested readings:  1. Group Discussion and Interview Skills-P. Patnaik-CUP 2. Campus Group Discussion with Smart Answer:Third Eye of HR Managers-Anant kr. Dass-Atlantic	