DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.ACAD/NP/Sci./B.Sc. & M.Sc./Syllabus/26/2013

It is hereby notified for information of all concerned that, on the recommendations of Ad-hoc Boards in Computer Science & Information Technology and Biochemistry, **the Hon'ble Vice-Chancellor has accepted the *"New Syllabi of [1] B.Sc. Artificial Intelligence and Mobile Computing, [2] M.Sc. Artificial Intelligence and Embedded Technology, [3] M.Sc. Computer Science and Networking and [4] M.Sc. Plant Breeding and Molecular Genetics First Year, Semester-I & II"* under the Faculty of Science"** on behalf of the **Academic Council Under Section-14(7) of the Maharashtra Universities Act, 1994 as appended herewith.**

This is effective from the **Academic Year 2013-2014** and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.ACAD/NP/ B.Sc. & M.Sc. /
SYLLABUS/2013/29551-60

Date:- 13-08-2013.

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Director,
Board of College and University Development.

Copy forwarded with compliments to :-

1] The Principals, affiliated concerned Colleges, Dr. Babasaheb Ambedkar Marathwada University.

2] The Director, University Network & Information Centre, UNIC, with **a request to upload the above Syllabus on University Website [www.bamu.ac.in].**

Copy to :-

1] The Controller of Examinations,
2] The Superintendent, [B.Sc. Unit],
3] The Superintendent, [Co-Ordination],
4] The Programmer [Computer Unit-1] Examinations,
5] The Programmer [Computer Unit-2] Examinations,
6] The Director, [E-Suvidha Kendra], in-front of Registrar's Quarter, Dr. Babasaheb Ambedkar Marathwada University,
7] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

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S/-130813/-*

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Syllabus of

M.Sc. (Artificial Intelligence and Embedded Technology)

With Effective from June 2013
(Academic Year 2013-2014 Onwards)

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

ORDINANCE-1

Statement showing the details of Tuition Fees and Other Fees for **M.Sc. (Artificial Intelligence and Embedded Technology) Course per Semester** on **"Non-Grant Basis"** under the Faculty of Science.

Sr. No.	Description	Fees
1	**Course**	Artificial Intelligence and Embedded Technology
2	**Admission Fees**	Rs. 100/-
3	**Tuition Fees**	Rs. 11,650/-
4	**Library Fees**	Rs. 100/-
5	**Laboratory Fees**	Rs. 4,000/-
6	**Medical Exam Fees**	Rs. 30/-
7	**Gymkhana Fees**	Rs. 50/-
8	**Sports Fees**	Rs. 50/-
9	**Student Welfare Fees**	Rs. 20/-
10	**Total**	**Rs. 16,000/-**

Admission/ Promotion:

Duration: (Four Semesters means Two Academic Years)
Intake: 20
Eligibility:
i) B.Sc. Computer Science / Information Technology / Computer Application / Bioinformatics / Informatics **OR** B.E/B. Tech. in Computer Science and Engineering/IT.**OR ii).** Any Science Graduate with at least one Optional Subject as Computer Science / Electronics / Information Technology / Computer Application, studied for at least three years, with a minimum of 50% marks (45% marks for SC/ST) in aggregate.

Scheme of Paper Setting:
1) Each theory paper is of 50 marks and is divided in 2 sections. Duration of the theory examination will be of two hours. The entire syllabus of theory paper is divided in 5 units. There will be one question on each unit with internal. The question paper should be set as follows:

i. There should be two sections, Section-A (10 marks) and Section-B (40 marks).

ii. Section-A should have 10 objective type questions/one line answer question/true-false/ fill in the blank type question with one mark each.

iii. Section-B should have seven questions of which five questions need to attempt by the students and should be from each unit of the syllabus. Each question of this part will have 8 marks and divided into two bits (a and b). Each bit carry 4 marks each. The objective of **Bit a** will be to test students regarding theoretical concepts. The questions should not be of general type, like discuss, and explain as far as possible. **Bit b** questions should be problem oriented. The questions should be designed to test students on applied nature of theoretical concepts.

iv. Question paper format will be as follows:

Q. No.	Format	Marks
	Section-A	
1.	Multiple choice / Fill in the blanks / Match the pairs / Answer in one line / Define the terms 1) 2) . . 10)	1 X 10 = 10
	Section-B	
2.	a) b)	2 X 4 = 8
3.	a) b)	2 X 4 = 8
4.	a) b)	2 X 4 = 8
5.	a) b)	2 X 4 = 8
6.	a) b)	2 X 4 = 8
7.	a) b)	2 X 4 = 8
8.	a) b)	2 X 4 = 8
	Total	**50**

2. The duration of the practical examination will be of two hours. There should be at least one external examiner for each practical examination.
3. Students are required to maintain a well documented signed with date journals for each practical. In journals, students must write the dates on which the practical has been performed.
4. The students must keep a diary for projects and seminar. In diary they must record the progress of the project and seminar and be signed by the concerned teacher/guide time to time.
5. Project Report: Two typed and duly bound copies of project report shall be submitted at least 3 weeks before commencement of the Theory/Practical examination which ever commences earlier.
6. The following shall be the Scheme of instruction and examinations of theory papers.

M.Sc. Artificial Intelligence and Embedded Technology Course Structure:

Semester I

Paper No.	Title of Paper	No. of hrs. / week	Maximum Marks	Examination hours
I	Fundamentals of Artificial Intelligence	04	50	02
II	Introduction to Embedded Systems	04	50	02
III	Basic & Digital Electronics	04	50	02
IV	Fuzzy Logic and Neural Network	04	50	02
V	Practical-I based on theory paper-I and II	08	50	02
VI	Practical-II based on theory paper-III and IV	08	50	02
	Total Marks →		**300**	

Semester II

Paper No.	Title of Paper	No. of hrs. / week	Maximum Marks	Examination hours
VII	Human Computer Interface & Knowledge based system	04	50	02
VIII	Digital Signal Processing	04	50	02
IX	Introduction to Robotics	04	50	02
X	Pattern Recognition	04	50	02
XI	Practical-III based on theory paper-VII and VIII	08	50	02
XII	Practical-IV based on theory paper-IX and X	08	50	02
	Total Marks →		**300**	

Semester-I

Paper-I: Fundamentals of Artificial Intelligence

Theory: 40 hrs.

Unit-I:

Introduction: Games, theorem proving, natural language, processing, vision & speech processing, robotics, and expert systems AI, Techniques – search, knowledge, abstraction problems solving State Space Search,

Control Strategies: Depth First Search, Breadth First Search, and Production Systems.

Problem Characteristics: Decomposition, Ignoble, Recoverable, Predictable.

Unit-II:

Use of Heuristics: Hill climbing. Best First Search A* Algorithm : Admissibility, AND/OR Graph-AO* Constraint Satisfaction : Cryptoairthmetic, Waltz Line Labeling.

Game Playing: Miming Search, Alpha-Beta Pruning.

Knowledge Representation: Predicate Logic, Well Formed Formulas, Quantifiers; Prenex Normal Form, Solemnization; unification, modus ponies; resolution refashion-various strategies.

Unit-III:

Rule Based Systems: Forward Reasoning: conflict resolution , backward reasoning: use of no backtrack structured knowledge representations : semantic net : slots , inheritance , frames-exceptions and defaults –attached predicates, conceptual dependency formalism.

Object Oriented Representations: Al Programming Languages: PROLOG, Syntax, Procedural and declarative meanings, prologue unification mechanism, anonymous variable, lists; use of fail, CUT, Not.

LISP: Basic Concepts, eval functions, functions and variables, scooping of LISP variables, iteration and recursion.

Unit-IV:

Handling Uncertanity: Probablistic Reasoning , Bays Net , Dempster Shaver Theory, use of Certainty Factors, Fuzzy Logic Nonmonotonic Reasoning, Dependency Directed Backtracking, Truth, Maintenance Systems.

Learning: Concept of Learning, Learning Automation; The Genetic Algorithm, Learning by Induction, Neural Networks, Hopfield Networks, Perceptions-Learning Algorithm, Backpropagation Network Boatsman Machine, Recurrent Networks. Planning: Components of Planning System , Plan Generation Algorithms, Forward State Propagation, Backward State Propagation , Non-Linear Planning Using Constraint Posting.

Unit-V:

Expert Systems: Need & Justification for Expert Systems- Cognitive Problems, Expert System Architecture , Rule Based Systems, Non Production System, Knowledge Acquisition, Case Studies: Mycin, R1.

References:

1. Artificial Intelligence - E. Rich & K. Knight, Tata MC-Graw Hill
2. Introduction To Al And Expert Systems –D.W . Paterson ., Paretic Hall Of India
3. Introduction To Expert Systems - Peter Jackson, Addison Wesley Pub. Company.
4. A. I. and Engineering Approach - R.J. Schalkoff. MC-Graw Hill Ed.
5. Principles of Al - N.J. Nilsson, Narrows Publishing House.

6. Programming In Prolog - Clocks & Melissa, Narrows Publishing House.
7. Rule Based Expert S ystem - M. Sasikumar, S. Ramani, Narosa Pub. House
8. Artificial Intelligence – P.H. Winston 2nd Edition, Addison-Wesley ,1984.
9. Prolog From The Beginning - H.Konigslerg & F.De .Bruyn, MC-Graw Hill Ed.

Paper-II: Introduction to Embedded Systems

Theory: 40 hrs.

Unit-I: 8051 Microcontroller

Introduction, Comparison with Microprocessor, Evolution of Microcontroller , Microcontroller and embedded systems, Microcontroller selection criteria, Architecture and Block Diagram of 8051, Flag bits and PSW, ROM memory space allocation, RAM memory space allocation, Pin diagram of 8051,Addressing modes, Memory organization of 8051.

Unit-II: 8051 Programming in C

Bit Addresses of I/O and RAM, Data types in 8051 C, Time delay in 8051 C, I/O Programming, Logic operations, Data conversion, Accessing Code ROM Space, Data Serialization, Registers for Timer Programming, Modes of Timers, Counter Programming, Programming Timers of 8051.

Unit-III: Serial Communication and Interrupt Programming

Basics of Serial Communication, Registers of 8051 used for Serial Communication, Programming 8051 for receiving and transmitting serial data, 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming serial communication interrupt, Interrupt priority in 8051.

Unit-IV: Interfacing of 8051

LCD Interfacing, Keyboard Interfacing, ADC 0804 and 0808/09 Interfacing, DAC 0808 interfacing, Interfacing and Accessing External data memory, Stepper motor interfacing using 8255, RTC Interfacing, DC Motor control and PWM.

Unit-V: Real Time Operating Systems

Real Time Operating System Concept, Architecture of kernel, Schedule management, Task scheduler, Interrupt routines, Semaphores, Mailbox, Message queues, Pipes, Events, Timers, Memory management, RTOS services in contrast with traditional OS, Overview of commercial RTOS like Vxworks, RT Linux, µcos, QNX,

Text/ Reference Books:

1. Mazidi "The 8051 Microcontroller and Embedded Systems Using Assembly and C", PHI.
2. Rajkamal, "Embedded Systems", TMH.
3. Frank Vahid, "Embedded System Design", PHI.
4. Mazidi, "The 8051 Microcontroller and Embedded Systems", PHI.
5. Kenneth J. Ayala, " The 8051 Microcontroller", PHI

Paper-III: Basic & Digital Electronics

Unit-1

Number Systems and Arithmetic

Decimal Number System & Binary Number System , Decimal to Binary conversion(Double-dabble method only) ,Binary to Decimal Conversion 1,Binary Arithmetic : Binary addition, subtraction, multiplication & division Hexadecimal number system , Hexadecimal to binary, binary to Hexadecimal, Hexadecimal to decimal conversion Hexadecimal arithmetic: Addition, subtraction, multiplication & division Binary subtraction using 1' complement, 2's complement method

Unit-2

Boolean Algebra and Logic Gates

Postulates of Boolean Algebra, Theorems of Boolean Algebra: Complementation , commutative, AND, OR, Associative, Distributive, Absorption laws , De Morgan's theorems Reducing Boolean expressions Logic Gates : AND, OR, NOT, Ex-OR, Ex-NOR NAND as Universal building block Logic diagrams of Boolean expressions Boolean expressions for logic diagrams

Unit-3

SEMICONDUCTORS, DIODES AND DIODE CIRCUITS:

Insulators, semiconductors and metals, Mobility and conductivity, Intrinsic and extrinsic semiconductors and charge densities in semiconductors, current components in semiconductors, continuity equation. PN Junction diode – characteristic and analysis, Types of diodes – Zener diodes, Photodiodes, Light emitting diodes (LED's), Varactor diodes and tunnel diodes. Rectifiers and filter circuit: Half wave, full wave and Bridge rectifier circuits and their analysis, L, C and Pi filters, Basic regulator supply using zener diode. Working of Switched Mode Power Supply .

Unit-4

TRANSISTORS:

Construction and characteristics of bipolar junction, transistors (BJT's)-Comm. Base, Comm. emitter, Comm. Collector configuration. Transistor at low frequencies – small signal low frequency transistor model (h-parameters). Analysis of transistor amplifier circuit using h-parameters. transistor biasing and bias stabilization: - the operating point, stability factor, analysis of fixed base bias, collector to base bias, Emitter resistance bias circuit and self bias circuit. Bias compensation techniques.

Unit-5

AMPLIFIERS AND OSCILLATORS:

Classification of amplifiers, concept of feedback, general characteristics of feedback amplifiers, Single stage RC coupled amplifier.

Oscillators – Criterion for Oscillation, type of oscillators: Hartley oscillator, Colpitt Oscillator & RC Phase shift oscillator.

Flip Flops

Introduction : RS FF ,Clocked RS FF, D FF ,Triggering, preset and clear ,JK FF , T FF , Race around condition ,Master slave FF

Counters

Introduction : Asynchronous/ ripple counter ,Modulus Counter , MOD-12 counter Synchronous counter : Synchronous serial & synch parallel counter,BCD counter Ring counter ,Johnson counter ,7 Shift Registers,Introduction, Buffer register Serial- in serial –out Serial-in parallel-out ,Parallel-in serial-out, parallel-in parallel-out.

References:

1. Millman & Halkias, Integrated Electronics, Tata McGraw -Hill, 1998.
2. Mano M.M., Digital Design, Prentice Hall of India, 2002.
3. Roth C.H., Fundamentals of Logic Design, Jaico Publishers, 2002.
4. David Kennedy, Electronic Communication Systems, Tata McGraw- Hill, 2000.
5. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw- Hill,2002
6. Rangan, Sarma and Mani, Instrumentation Devices and Systems, Tata McGraw Hill, 1997
7. Fundamentals Digital electronics by RP Jain, TMG
8. Digital electronics by Derek Molly, PHI

Paper-IV: Fuzzy Logic and Neural Network

Unit-1

Introduction

Biological Neural Networks, Characteristics of Neural Networks, Models of Neuron, Basic Learning Rules, Stability & Convergence.

Unit-2

Supervised Learning Neural Networks

Adaptive networks, Adaline and madaline, Single layer and multi layer Perceptrons Radial basis function networks, Modular neural networks

Unit-3

Feedback Neural Networks

Analysis of linear auto adaptive feed forward networks, Analysis of pattern storage Networks, Stochastic Networks & Stimulated Annealing, Boltzman machine

Unit-4

Unsupervised Learning Networks

Competitive learning, Kohonen self-organizing maps, Learning vector Quantization Principal component analysis of Hebbian Learning, Adaptive Resonance Theory

Unit-5

Applications of Neural Networks

Pattern classification, Associative memories, Optimization, Applications in Image Processing, Applications in decision making

Fuzzy Set Theory

Introduction to Fuzzy Set with Properties, Fuzzy Relations, Fuzzy Arithmetic, Fuzzy Logic, Applications and Fuzzy Control

References:

1) G. J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, Upper Saddle River, NJ, 1995
2) Neural networks and learning machines, S. S. Haykin, Prentice Hall , third edition,2008

Paper-V: Practical-I based on theory paper-I & II

Minimum 10 nos. of practical's to be performed each from paper-I and Paper-II.

Paper-VI: Practical-II based on theory paper-III & IV

Minimum 10 nos. of practical's to be performed each from paper-III and Paper-IV.

Unit-IV:

Non-parametric techniques for density estimation, Parzen-window method, K-Nearest Neighbour method, Linear discriminant function based classifiers, Perceptron, Support vector machines.

Unit-V:

Non-metric methods for pattern classification, Non-numeric data or nominal data, Decision trees, Unsupervised learning and clustering, Criterion functions for clustering, Algorithms for clustering: K-means, Hierarchical and other methods, Cluster validation, Review and interactive discussions on home tutorials, classroom tutorials and students presentation. Review of recent advances in the subject. Implementation issues in algorithms for clustering.

Text Books:

1. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
2. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

Reference Books:

1. Statistical Pattern Recognition, by K. Fukunaga, 2nd edition, Morgan Kaufmann, 1990.
2. Statistical Pattern Recognition, by A. Webb, Arnold, 1999.

Paper-XI: Practical-3 based on theory paper-VII and VIII

Minimum 10 nos. of practical to be performed each from paper-VII and Paper-VIII.

Paper-XII: Practical-4 based on theory paper-IX and X

Minimum 10 nos. of practical to be performed each from paper-IX and Paper-X.

Semester-II:

Paper-VII: Human Computer Interface & Knowledge based system

Unit 1: Foundations
The Human, The Computer, The Interaction, Paradigms

Unit 2: Design Process
Interaction design basics, HCI in the software process, Design rules, Implementation support, Evaluation techniques, Universal design, User support

Unit 3: Models and Theories
Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Dialogue notations and design, Models of the system, Modelling rich interaction

Unit 4: Outside the Box
Groupware, Ubiquitous computing and augmented realities, Hypertext, multimedia, and the world wide web.

Unit 5: Knowledge based system
Introduction to knowledge based system, Architecture and development of knowledge based system, Agent based system, Soft computing system, Knowledge based multi-agent system accessing distributed database grid: An e-learning solution, Knowledge intensive learning.

Reference:

1) Knowledge based system, Rajendra Akerkar, ISBN - 13: 9780763776473
2) Human-Computer Interaction (3rd Edition), Alan Dix (Author), Janet E. Finlay (Author), Gregory D. Abowd (Author), Russell Beale (Author)

Paper-VIII: Digital Signal Processing

Theory: 40 hrs.

Unit-I:
Introduction, Discrete-Time Signals and Systems, The Z-Transform and Its Application to the Analysis of LTI Systems

Unit-II:
Frequency Analysis of Signals and Systems, The Discrete Fourier Transform: Its Properties and Applications.

Unit-III:
Efficient Computation of the DFT: Fast Fourier Transform Algorithms, Implementation of Discrete-Time Systems.

Unit-IV:
Design of Digital Filters, Sampling and Reconstruction of Signals, Multirate Digital Signal Processing.

Unit-V:
Linear Prediction and Optimum Linear Filters, Power Spectrum Estimation.

Reference:
1. Digital Signal Processing: Principles, Algorithms and Applications, 3/E, **John G. Proakis, Dimitris K Manolakis**, Prentice Hall, ISBN-10:0133737624, ISBN-13: 9780133737622

Paper-IX: Introduction to Robotics

Unit-I: Introduction:
Automation and Robotics, Definition, Basic Structure of Robots, Classification of Robots based on co-ordinate system, Present trends and future trends in robotics, Overview of robot subsystems, Components of Robot system- Manipulator, Controller, Power conversion unit etc, Specifications of robot.

Unit-II: Dynamics & Kinematics:
Dynamic constraints, velocity & acceleration of moving frames, Robotic Mass Distribution & Inertia, Tension, Newton's equation, Euler equations, Dynamic Modeling of Robotic Manipulators. Homogeneous co-ordinate vector operations, matrix operations, co-ordinate reference frames, Homogeneous transformation and manipulator orientation relative points reference frames, forward solutions- Link co-ordinate frames, D-H matrix, Inverse or back solutions- problem of obtaining inverse solution, techniques of using direct & geometric approach.

Unit-III: End Effectors and Actuators:
Different types of grippers, vacuum & other methods of gripping, overview of actuators, Internal & External sensors, position, relocking and acceleration sensors, proximity sensors, force sensors, touch slip laser range tinder, camera.

Unit-IV: Motion Planning and Controllers:
On-off trajectory, relocking and acceleration profile, Cartesian motion of manipulator, joint interpolated control, Jacobian in terms of D-H matrix, Obstacle avoidance, Basic control system, control loops of robotic system, Fuzzy controllers.

Unit-V: Robot Vision
Machine Vision system, description, sensing, Digitizing, Image Processing and Analysis and Application of Machine Vision System, Robotic assembly sensors & Intelligent Sensors. Object recognition.

Text Books:
1. Fundamentals of Robotics: Analysis and Control – *Robert J Schilling,* PHI, NewDelhi
2. Robotic Engineering – *Klafter, Thomas, Negin,* PHI, New Delhi

Reference Books:
1. Robotics for Engineers – *Yoram Koren,* McGraw Hill, New York
2. Fundamentals of Robotics – T.C. Manjunath, Nandu Publishers, Mumbai B.E._ETC09.doc – 39.
3. Robotics and Control- R. K. Mittal, I. J. Nagrath, TMH, NewDelhi
4. MEMS and Microsystems Design and Manufacture- HSU, TMH, NewDelhi

Paper-X: Pattern Recognition

Theory: 40 hrs

Unit-I:
Basics of pattern recognition
Features, Feature Vectors and Classifiers, Supervised versus Unsupervised Pattern Recognition, Comparison of Supervised and unsupervised Pattern Recognition, Feature Vectors and Classifiers

Unit-II:
Bayesian decision theory: Classifiers, Linear Discriminant Functions and Decision Hyperplanes, erceptron, Least Squares Methods, Mean Square Estimation Revisited, Review and interactive discussions on home tutorials, classroom tutorials and students presentation. Review of recent advances in the subject. Challenges in Bayesian decision theory, Parameter estimation methods, Maximum-Likelihood estimation, Gaussian mixture models, Expectation-maximization method, Bayesian estimation.

Unit-III:
Context-dependent classification, Sequential Pattern classification, Context-dependent classification Discrete hidden Markov models, Continuous density hidden Markov models, Dimension reduction methods, Fisher discriminant analysis, Principal component analysis.