DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO. ACAD/NP/M.Tech./Syllabi/188/2013

It is hereby informed to all concerned that, on recommendation of the Faculty of Engineering and Technology, the Hon'ble Vice-Chancellor has accepted the ***"Revised Syllabi* with Cumulative Grade Point Average [CGPA] *for [1] M.Tech. [Food Processing Technology], [2] M.Tech. [Computer Science & Technology] and [3] M.Tech. [Mechanical]"*** 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/ M.TECH./
SYLLABI / 2013/14083-91
V.C.14[7] A-08.

Date:- 14-06-2013.

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Director,
Board of College and
University Development.

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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 all syllabi on University Website [www.bamu.net].**

Copy to :-

1] The Controller of Examinations,
2] The Superintendent, [Engineering Unit],
3] The Programmer [Computer Unit-1] Examinations,
4] The Programmer [Computer Unit-2] Examinations,
5] The Superintendent, [Eligibility Unit] ,
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/140613/-*

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Syllabus of

M. Tech. (Computer Science and Technology)

[Effective from Academic Year 2013 - 2014]

Dr. Babasaheb Ambedkar Marathwada University Aurangabad.

Faculty of Engineering & Technology

Rules and Regulations for M.E. & M.Tech. -2014

- **What is a credit system**

  A credit system is a systematic way of describing an educational program by attaching credits to its components. The definition of credits in higher education systems may be based on different parameters, such as student workload, learning outcomes and contact hours.

- **Advantages of the Credit System**
  - Represents a much-required shift in focus from teacher-centric to learner-centric education since the work load estimated is based on the investment of time in learning, not in teaching.
  - Helps to record course work and to document learner work load realistically since all activities are taken into account-not only the time learners spend in lectures or seminars but also the time they need for individual learning and the preparation of examinations etc.
  - Segments learning experience into calibrated units, which can be accumulated in order to gain and academic award.
  - Helps self-paced learning. Learners may undertake as many credits as they can cope with without having to repeat all the courses in a given semester if they fail in one or more courses. Alternatively, they can choose other courses and continue their studies.

- **What is Grading?**

  The word Grade derived from the Latin word gradus, meaning, step. Grading, in the educational context is a method of reporting the result of a learner's performance subsequent to his evaluation. It involves a set of alphabets which are clearly defined and designated and uniformly understood by all the stake holders. A properly introduced grading system not only provides for a comparison of the learner's performance but it

also indicate the quality of performance with respect to the amount of efforts put in and the amount of knowledge acquired at the end of the courses by the learners.

- **CURRICULUM:**

1.1 Curriculum:

Every program with specialization has a prescribed course structure which in general terms is known as Curriculum. It prescribes course to be studied in each semester; the relevant information containing course structure along with detail syllabus for each course of each program is updated periodically and is uploaded on the website.

1.2 Semesters:

The Faculty of Engineering & Technology implements a credit based curriculum and grade based evolution system for P.G. program is of four semesters. The academic courses are delivered in the first two semesters. Dissertation work is carried out by a student in the third and fourth semester. The first semester begins in the last week of July ends by the last week of November while the second semester begins in the first week of January and ends by the second week of May. Total duration for each semester is generally of 20 weeks including the period of examination, evaluation and grade declaration.

1.3 Course Credit:

Education is organized around the semester-based credit system of study. The prominent features of the credit system are a process of continuous evaluation of a student's performance/progress and flexibility to allow a student to progress at an optimum pace suited to his/her ability or convenience, subject to fulfilling minimum requirements for continuation.

A student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grades obtained by the student, grade point average is calculated. A minimum grade point average is required to be maintained for satisfactory progress and continuation in the program. Also a minimum number of earned credits and a minimum grade point average should be acquired in order to qualify for the degree. All programmes are defined by the total credit requirement and a pattern of credit distribution over courses of different categories.

1.4 Course credits assignment

Each courses, except a few special courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and laboratory contact hours in a week. This weightage is also indicative of the academic expectation that includes in-class contact and self-study outside of class hours.

Lectures and Tutorials: One lecture or tutorial hour per week per semester is assigned one credit.

Seminar/Contact Hours per week per semester is assigned one credit

Practical/Laboratory: One laboratory hour per week per semester is assigned half credit.

Example: Course: XYZ Engg: 3 credits (3-1-2)

The credits indicated for this course are computed as follows:

3 hours/week lectures = 3 credits

1 hours/week tutorial = 1 credit

2 hours/week practical = 2 x 0.5 = 1 credit

2 hours/week seminar = 2 x 0.5 = 1 credit

Dissertation seminar/Contact Hours = 1 x 1= 1 credit

(3-1-2) 3 credit course = (**3** h Lectures + **1** h Tutorial + **2** h Practical/Dissertation seminar) per week i.e. 6 Contact hours per week

1.5 Earning Credits

At the end of every course, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade, the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average.

The credit system enables continuous evaluation of a student's performance, and allows the students to progress at an optimum pace suited to individual ability and convenience, subject to fulfilling minimum requirement for continuation.

1.6 Evaluation System

1. Semester Grade Point Average (SGPA) =

   SUM (course credits in passed courses X earned grade points)

   SUM (Course credits in registered courses)

2. Cumulative Grade Point Average (CGPA) =

   SUM (course credits in passed courses X earned grade points) of all Semester

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   SUM (Course credits in registered courses) of all Semester

3. At the end of M.E & M. Tech Program, student will be placed in any one of the divisions as detailed below.(According to AICTE Handbooks 2013-2014)

   I[st] Division with distinction : CGPA ≥ 8.25 and above

   I[st] Division : CGPA ≥ 6.75 and < 8.25

   II[nd] Division : CGPA ≥ 6.75 and < 6.25

As per AICTE Handbook (2013-14), new gradation suggested as follows,

Table 1

Grade Point	Equivalent Range
6.25	55%
6.75	60%
7.25	65%
7.75	70%
8.25	75%

Conversion of CGPA to percentage marks for CGPA ≥ 5.0 can be obtained using equations.

Percentage marks = (CGPA X10) – 7.5

An example of these calculations is given below:

Typically one example for academic performance calculations of semester –I

Table 2

Course No. (1)	Course Credit (2)	Grade Awards (3)	Earned Credit (4)	Grade Points (5)	Points Secured (6)=(4) x (5)
Subject 1	4	B	4	6	24
Subject 2	4	C	4	5	20
Subject 3	4	O	4	10	40
Subject 4	4	A+	4	8	32
Subject 5	4	C	4	5	20
Lab-1	2	A+	2	9	18
Lab-2	1	A+	1	9	9
Seminar-I	1	A+	1	9	9
Total	24		24	61	172

1. Semester Grade Point Average (SGPA) = $\frac{(172)}{(24)} = 7.16$

2. Cumulative Grade Point Average (CGPA) =
   Cumulative points earned in all passed courses = 172 (past semester) + 172 (this sem.) = 344

   Cumulative earned credits = 24 (past semesters) +24 (this sem) = 48

   $\frac{\sum (172 + 172)}{\sum (24 + 24)} = 7.16$

➢ **System Evaluation Table**

Table 3

Grade	Grade Points	Marks Obtained (%)	Description Performance
		Regular Semester	
O	10	91-100	Outstanding
A++	09	86-90	Excellent
A+	08	76-85	Very Good
A	07	66-75	Good
B	06	56-65	Fair
C	05	46-55	Average
D	04	40-45	Poor
F	00	Below 40	Fail
EE			Incomplete
WW			Withdrawal
XX	--	--	Detained
ABSENT	--	--	Absent
PP	--	--	Passed (Audit Course)
NP	--	--	Not Passed (Audit Course)

➢ **Grade Awards:**

i) A ten point rating scale shall be used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master's Programme. Grade points are based on the total number of marks obtained by him/her in all the heads of examination of the course. These grade points and their equivalent range of marks are shown separately in Table-4.

Table 4: Ten point grades and grade description

Sr.No.	Equivalent Percentage	Grade Points	Grade	Grade Description
1	90.00 – 100	10	O	Outstanding
2	80.00 – 89.99	9	A++	Excellent
3	70.00 – 79.99	8	A+	Exceptional
4	60.00 – 69.99	7	A	Very Good
5	55.00 – 59.99	6	B+	Good
6	50.00 – 54.99	55	B	Fair
7	45.00 – 49.99	5	C+	Average
8	40.01 – 44.99	4.5	C	Below Average
9	40	4.00	D	Pass
10	<40	0.00	F	Fail

ii) Non appearance in any examination/assessment shall be treated as the student have secured zero mark in that subject examination/assessment.

iii) Minimum D grade (4.00 grade points) shall be the limit to clear/pass the course/subject. A student with F grade will be considered as 'failed' in the concerned course and he/she has to clear the course by reappearing in the next successive semester examinations.

iv) Every student shall be awarded Grade points out of maximum 10 points in each subject (based on 10 Point Scale). Based on the Grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and cumulative Grade card with CGPA will be given on completion of the course.

Proposed Coding System of M.E/M.Tech Subjects

Six Digit Code for a subject (PG Course)

	Digits →	1 2 3	4	5 6
Sr. No.	**Branch ↓**	**Branch code**	**Year**	**Subject**
1	Electronics	MEX	PG I year – 6	**Semester –I/III**
2	Electronics & Communication	MEC	PG II Year - 7	1-20 Theory
3	Electronics & Telecom.	MET		21-30 Practical
4	Digital Communication	MDC		31 Dissertation-I
5	Embedded System	MES		41-49 Electives
6	Structure Engineering	MSE		**Semester –II/IV**
7	Environmental Engineering	MEV		51-70 Theory
8	Water Resource Engineering	MWR		71-80 Practical
9	Computer Engineering	MCE		81 Dissertation-II
10	Computer Network	MCN		91-99 Electives
11	Software Engineering	MSW		
12	Mechanical Engineering	MME		
13	Thermal Engineering	MTE		
14	CAD/CAM	MCC		
15	Manufacturing	MMF		
16	Heat Power	MHP		
17	Design Engineering	MDE		
18	Machine Design	MMD		
19	Automation	MEA		
20	Chemical Engineering	MCH		
21	Computer & IT	MCI		
22	Production Process	MMP		
23	M.Tech Computer Science	MTC		
24	M.Tech Food Processing	MTF		
25	M.Tech Mechanical	MTM		

Note: - Kindly, Allot Same Code for same Electives/ subjects for different branches to avoid repetitions of Question papers/settings/assessments.

DEGREE OF MASTER OF ENGINEERING/TECHNOLOGY
(Course with effective from academic year: 2013-2014)

I	1	The examination for the Degree of Master of Engineering & Technology will be held in four semesters, M.E./M.Tech. Semester-I, M.E./M.Tech. Semester-II, M.E. ./M.Tech Semester-III, and M.E./M.Tech. Semester-IV in case of full time course. And for part time additional semester V & VI
II	**Rules & Eligibility**	
	1	Rule for admission to P.G. Degree course in Engineering and Technology as per rules and regulation of AICTE/DTE & Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
III	**Evaluation method**	
	1	Each theory course will be of 100 marks and be divided in to internal examination of 20 marks and semester examination of 80 marks (20+80=100 marks). Each practical course will be of 50/100 marks
	2	There shall be minimum two class tests within a semester. First based on 30% syllabus taught and second based on 30% syllabus taught. The setting of question paper and assessment will be done by the concerned teacher who has taught the syllabus. Average marks obtained out of two examinations will be considered for the preparation of final sectional marks/ grade.
	3	The Question papers in theory subjects shall be set by the Examiners appointed for the purpose by the University on the recommendations of the Board of studies of the concerned PG Course.
	4	The assessment of the Practical for any subject will be done by recognized post-graduate teacher appointed by University.
	5	To pass the examination a candidate must obtain a minimum CGPA of 6.25 (CGPA to the scale of 10).
	6	Candidate who secures CGPA $\geq$ 6.25 and CGPA < 6.75 declared to have passed examination in second class.
	7	Candidate who secures CGPA $\geq$ 6.75 and CGPA < 8.25 declared to have passed examination in first class.
	8	Candidate who secures CGPA $\geq$ 8.25 declared to have passed examination in

		first class with distinction.
IV	1	In case candidates fails to get less than D grade in one or more heads of passing examination, he will be allowed at his option, to reappear for only those heads of passing in which he has failed or got less than D grade at subsequent examinations.
	2	The grades obtained by the candidate in any head of passing at the examination will be carried forward unless the candidates reappear for the head of passing in accordance with ref. IV (1)
	3	In case the candidate passes in all heads of passing under M.E./M.Tech. Semester-I, M.E./M.Tech. Semester-II examination and obtained a minimum CGPA of 6.25 in M.E./M.Tech Semester-I, M.E./M.Tech Semester-II taken together as required under ref. II(2) above, he will not be allowed to reappear for any head of passing under M.E. Semester-I, M.E. Semester-II in accordance with ref. III(5)
	4	A candidate will not be allowed to appear for M.E. ./M.Tech Semester-III examination unless he passes in all heads of passing under M.E. ./M.Tech Semester-I, M.E./M.Tech Semester-II examination and obtains a minimum CGPA of 6.25.
	5	Whenever a candidate reappears for M.E. ./M.Tech Semester-III and M.E./M.Tech. Semester-IV examinations he will have to resubmit the dissertation with suitable modification and must also reappear for oral examination on it.
	6	A candidate registered for M.E./M.Tech Examination must clear his examination within five years from the date of registration.
V	**Attendance Requirement**	
	1	Each semester of the course shall be treated as a separate unit for calculation of the attendance
	2	A candidate shall be considered to have satisfied the attendance requirement if he/she has attended not less 75% of the class in each subject of all the semesters (Theory, Laboratory, Semester Practical training and Dissertation work) actually conducted up to the end of the semester.
	3	A Candidate, who does not satisfy the attendance required, mentioned as above, shall not be eligible to appear for the Examination of that semester and

		shall be required to repeat that semester along with regular students later.
	4	The Principal of the concerned College shall display regularly, the list of such candidates who fall short of attendance, on the Notice Boards.
	5	The list of the candidates falling short of attendance shall be sent to the University at least one week prior to the commencement of theory/practical examination, whichever is earlier.
VI	.	The following are the syllabi in the various subjects of the examination for the Degree of Master of Engineering/Technology.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Proposed Syllabus Structure of M.Tech. (Computer Science and Technology)

Semester I

Course code	Name of the Subject	Teaching scheme Hrs per week				Examination scheme- Marks					Duration of Theory Exam	Credit
		L	T	P	Total hrs	Theory	Class Test	Term Work	Viva voce	Total		
MTC 601	Advanced Computer Networking	3	1	-	4	80	20	-	-	100	3 Hrs	4
MTC 602	Research Methodology	3	1	-	4	80	20	-	-	100	3 Hrs	4
MTC 603	Advanced Algorithm	3	1	-	4	80	20	-	-	100	3 Hrs	4
MTC 604	Advanced Database Management Systems	3	1	-	4	80	20	-	-	100	3 Hrs	4
MTC 641-43	Elective- I	3	1	-	4	80	20		-	100	3 Hrs	4
MTC 621	Software development Laboratory- I	-	-	4	4	-	-	50	--	50		2
MTC 622	Software development Laboratory- II			2	2	-	-	-	50	50		1
MTC 623	Seminar - I	-	-	2	2	-	-	-	50	50		1
	Total	**15**	**05**	**08**	**28**	**400**	**100**	**50**	**100**	**650**		**24**

Semester II

Course code	Name of the Subject	Teaching scheme Hrs per week				Examination scheme- Marks					Duration of Theory Exam	Credit
		L	T	P	Total hrs	Theory	Class Test	Term Work	Viva voce	Total		
MTC 651	Advanced Operating System	3	1	-	4	80	20	-	-	100	3 Hrs	4
MTC 652	Software Reliability	3	1	-	4	80	20	-	-	100	3 Hrs	4
MTC 653	Performance Evaluation and Optimization	3	1	-	4	80	20	-	-	100	3 Hrs	4
MTC 654	Advanced Data mining & warehousing	3	1	-	4	80	20	-	-	100	3 Hrs	4
MTC 691-693	Elective - II	3	1	-	4	80	20	-	-	100	3 Hrs	4
MTC 671	Software development Laboratory- III	-	-	4	4	-	-	50	-	50		2
MTC 672	Software development Laboratory -IV			2	2				50	50		1
MTC 673	Seminar - II	-	-	2	2	-	-	-	50	50		1
	Total	**15**	**05**	**08**	**28**	**400**	**100**	**50**	**100**	**650**	**15**	**24**

Semester III

Course code	Name of the Subject	Teaching scheme Hrs per week			Examination scheme Marks				Credit
		L	CH	Total hrs	Theory	Term work	Viva voce	Total	
MTC 731	Dissertation Phase I	--	12	12	--	50	50	100	12
	Total	--	**12**	**12**	--	**50**	**50**	**100**	**12**

Semester IV

Course code	Name of the Subject	Teaching scheme Hrs per week			Examination scheme Marks				Credit
		L	CH	Total hrs	Theory	Term work	Viva voce	Total	
MTC 781	Dissertation Phase II	--	20	20	--	100	200	300	20
	Total	--	**20**	**20**	--	**100**	**200**	**300**	**20**
	Grand Total							**1700**	**80**

Elective - I
MTC 641- Real Time Systems
MTC 642- Advanced Image Processing
MTC 643- Pattern Recognition

Elective - II
MTC 691- Smart Phone Programming
MTC 692- Cloud Computing
MTC 693- Parallel Processing

L: Lecture hours per week T: Tutorial Hours per week P: Practical hours per week CT: Class Test

TH: University Theory Examination TW: Term Work CH: Contact hours

Total Credits = SEM I + SEM II + SEM III + SEM IV
= 24 + 24 + 12 + 20
= 80

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of First Year M. Tech. (Computer Science and Technology) Semester-I

Code No.: MTC601	**Title: Advanced Computer Networking**
Teaching Scheme: 04 Hrs/week	**Class Test: 20 Marks**
Theory: 03Hrs/week	**Theory Examination (Duration): 03 Hrs**
Tutorial: 1Hr/batch/week	**Theory Examination (Marks): 80**
Credits: 4	

Objectives	:	• To develop practical networking knowledge and skills in a professional environment &design, build & maintain computer networks capable of supporting local and global environment. • To learn how to resolve issues related with congestion control.
Unit-I	:	**Building a Network:** Applications, Requirements Scalable Connectivity 8, Cost-Effective Resource Sharing Support for Common Services 18, Manageability, Network Architecture Layering and Protocols, Internet Architecture ,Implementing Network Software Application Programming Interface(Sockets), Example Application, Performance Bandwidth and Latency, Delay× Bandwidth , Product, High-Speed Networks, Application, Performance Needs. **(6 Hrs)**
Unit-II	:	**Connecting to a Network:** Classes of Links, Encoding (NRZ, NRZI, Manchester, 4B/5B), Framing Byte-Oriented Protocols, Bit-Oriented Protocols (HDLC) , ,Error Detection ,Two-Dimensional Parity ,Internet Checksum Algorithm, Cyclic Redundancy Check, Reliable Transmission Stop-and-Wait ,Sliding Window. **(6 Hrs)**
Unit-III	:	**Internetworking:** Switching and Bridging Datagram, Virtual Circuit Switching, Source Routing, Bridges and, LAN Switches, Basic Internetworking (IP) What Is an Internetwork? , Service Model, Global Addresses Datagram Forwarding in IP, Subnetting and Classless Addressing, Address Translation (ARP), Virtual Networks and Tunnels, Routing Network as a Graph, Distance Vector (RIP). **(8 Hrs)**
Unit-IV	:	**Advanced Internetworking:** The Global Internet, Routing Areas, Interdomain Routing (BGP), IP Version 6(IPv6), Multicast Addresses, Multicast Routing (DVMRP, PIM, MSDP), Multiprotocol Label Switching (MPLS) Destination-Based Forwarding, Explicit Routing. **(6 Hrs)**
Unit-V	:	**End-to-End Protocols:** Simple Demultiplexer (UDP), Reliable Byte Stream (TCP) , End-to-End Issues , Segment Format, Connection Establishment and Termination, Triggering Transmission , Adaptive Retransmission , Record Boundaries TCP Extensions , Performance, Remote Procedure Call . **(8 Hrs)**
Unit-VI	:	**Congestion Control and Resource:** Allocation Issues in Resource Allocation, Network Model, Taxonomy, Evaluation Criteria, Queuing Disciplines FIFO Fair Queuing, TCP Congestion Control, Congestion- Avoidance Mechanisms. **(6 Hrs)**

Reference Books:	:	**1.** Larry L. Peterson and Bruce S. Davie, "Computer Networks A system Approach", Elsevier-Morgan Kaufmann Publications, Fifth Edition. **2.** Behrouz A. Forouzan, "Data Communication and networking", TMH, Fourth Edition **3.** E Bryan Carne, " A professional's Guide to Data Communication in a TCP/IP world, Artech House.

Section A: Includes Unit I, II and III; Section **B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of First Year M.Tech.(Computer Science and Technology) Semester-I

Code No:MTC602
Teaching Scheme: 04Hrs/week
Theory: 03Hrs/week
Tutorial: 1Hr/batch/week
Credits: 4

Title: Research Methodology
Class Test: 20 Marks
Theory Examination (Duration): 03 Hrs
Theory Examination (Marks): 80

Objectives	:	• To learn the meaning of research. • To know how research is done. • To learn about sampling design. • To learn methods of data collection. • To learn processing and analysis of data.
Unit-I	:	**An Introduction:** Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research approaches, Significance of Research, Research methods versus Methodology, Research and Scientific method, Importance of knowing how research is done Research process, Criteria of good research, Problems Encountered by Researchers . **(6 Hrs)**
Unit-II	:	**Research Problem and Research Design:** What is research problem, selecting the problem, Necessity of defining the problem, Technique involved in defining the problem, Research Design: Meaning of research design, Need for research design, Features of a good design, Important concepts relating to research design, Different research designs, and Basic principles of experimental designs. **(7 Hrs)**
Unit-III	:	**Sampling Design:** Implication of sample design, Steps in sample design, Criteria of selecting a sampling procedure, Characteristics of a good sample design, different types of sample designs, How to select a random sample, Random sample from an infinite universe, Complex random sampling design. **(7 Hrs)**
Unit-IV	:	**Data Collection:** Collection of primary data, Observation method, Interview method, Collection of data through questionnaires, Collection of data through schedules, Difference between questionnaires and schedules, Other methods of data collection, Collection of secondary data, Selection of appropriate method for data collection, case study method. **(6 Hrs)**
Unit-V	:	**Data Analysis:** Processing Operations, Problems in processing, Elements/Types of analysis, Statistics in research, Measures of central tendency, Measures of dispersion, Measures of asymmetry, Measures of relationship, Regression analysis, Multiple correlation and regression, partial correlation, Association in case of attributes, Measures: index numbers, Time series analysis. **(7 Hrs)**

Unit-VI	:	**Testing of Hypotheses:** What is Hypothesis, Procedure for hypothesis testing, Flow diagram for hypothesis testing, Measuring the power of a hypothesis test, Test of hypotheses, Important parametric tests, Hypothesis testing of means, Hypothesis testing for differences between means, Hypothesis testing for comparing two related samples, Hypothesis testing of proportions, Hypothesis testing for differences between proportions, Limitations of tests of hypotheses, Introduction to SPSS. **(7 Hrs)**
Reference Books:	:	1. "Research Methodology- Methods and Techniques", C.R.Kothari, New Age International Publishers 2. "Methodology And Techniques Of Social Research", Wilkinson & Bhandarkar, Himalaya Pub 3. "Research Methodology", Panneerselvam, Prentice Hall 4. "Scientific Social Surveys And Research", Pauline Vyoung, Prentice-Hall

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of First Year M.Tech.(Computer Science and Technology) Semester-I

Code No:MTC603
Teaching Scheme: 04 Hrs/week
Theory: 03Hrs/week
Tutorial: 1Hr/batch/week
Credits: 4

Title: Advanced Algorithms
Class Test: 20 Marks
Theory Examination (Duration): 03 Hrs
Theory Examination (Marks): 80

Objectives	:	• To develop the necessary skills from both a theoretical perspective as well as applying their knowledge on various problem sets. • To develop the skills to design, implement and analyse algorithm to solve various problems.
Unit-I	:	**Role of Algorithms in Computing:** Algorithms: Introduction, Analysis, Design, Asymptotic Notations, Standard notations and common functions; Divide and Conquer: The maximum- sub array problem, The master method for solving recurrences; Greedy Algorithm: An activity selection problem; Dynamic programming: Rod cutting. **(08 Hrs)**
Unit-II	:	**Probabilistic Analysis And Randomized Algorithms:** The Hiring Problem, Indicator Random Variables, Randomized Algorithms, Network Flow and Matching: Flows and Cuts, maximum Flow, Maximum Bipartite Matching, Minimum-Cost Flow, Efficiency Analysis. **(06 Hrs)**
Unit-III	:	**Sorting And Order Statistics:** The sorting problem, Radix sorting, sorting by comparisons, Heap sort- an O (n log n) comparison sort, Merge sort, Quick sort- an O (n log n) expected time sort, order statistics, Expected time for order statistics. **(06 Hrs)**
Unit-IV	:	**Number Theory Algorithms:** The similarity between integers and polynomials, Integer multiplication and division, Polynomial multiplication and division, Euclid's GCD algorithm, an asymptotically fast algorithm for polynomial GCD's, The DFT and FFT, efficient FFT implementations. **(08 Hrs)**
Unit-V	:	**String And Pattern Matching Algorithms:** The naïve string matching algorithm, The Rabin-Karp Algorithm, String matching with finite automata Finite Automata and Regular expressions, Recognition of regular expression patterns, Recognition of substrings, Position trees and substring identifiers . **(06 Hrs)**
Unit-VI	:	**NP-Completeness:** The classes P and NP, Cooks theorem, NP-complete problems: 3-SAT, clique, vertex-cover problem, Hamiltonian cycle, independent set, feedback edge set. **(06 Hrs)**
Reference Books:	:	1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", MIT Press, 3rd Edition, 2009. 2. Aho, Hopcrpft, Ullman, " The Design and Analysis of Computer Algorithms",Addison Wesley.Pearson.

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of First Year M.Tech.(Computer Science and Technology) Semester-I

Code No:MTC604
Teaching Scheme: 04Hrs/week
Theory: 03Hrs/week
Tutorial: 1Hr/batch/week
Credits: 4

Title: Advanced Database Management Systems
Class Test: 20 Marks
Theory Examination (Duration): 03 Hrs
Theory Examination (Marks): 80

Objectives	:	• To cover advanced concepts of Database Management System. • To study parallel, object oriented and distributed architectures of database systems. • To understand web databases using XML. • To familiarize with mobile and multimedia database systems.
Unit-I	:	**Transaction Processing:** Transaction-Processing Monitors, Transactional Workflows, Main-Memory Databases, Real-Time Transaction Systems, Long-Duration Transactions, Transaction Management in Multi-databases. **(06hrs)**
Unit-II	:	**Parallel Databases:** Database System Architectures: Centralized and Client-Server Architectures, Server System architectures, Parallel Systems, Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism, Query Optimization, Parallelism on Multicore Processors. **(08hrs)**
Unit-III	:	**Distributed Databases:** Distributed Database Concepts: Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design- Types of Distributed Database Systems, Query Processing in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases-An Overview of 3-Tier Client-Server Architecture-Distributed Databases in Oracle, Cloud-Based Databases. **(06hrs)**
Unit-IV	:	**Object And Object Relational Databases:** Concepts for Object Databases: Overview, Object Identity, Object structure, Type Constructors, Encapsulation of Operations, Methods, Persistence, Type and Class Hierarchies, Inheritance, Complex Objects, Other Object-Oriented Concepts. Object Database Standards, Languages and Design: ODMG Model, ODL, OQL – Object Relational and Extended – Relational Systems : Overview of SQL and Its Object-Relational Features, Evolution of Data Models and Current Trends of Database Technology, Object Relational features of Oracle. **(08hrs)**
Unit-V	:	**Xml and Web Databases:** Web Database: Structured, Semi structured, and Unstructured Data, A Simple PHP Example, Overview of Basic Features of PHP, Overview of PHP Database Programming XML Databases: XML Hierarchical (Tree) Data Model, XML Documents, DTD, and XML Schema, XML Documents and Databases, XML Querying. **(06hrs)**

Unit-VI	:	**Mobile and Multimedia Databases:** Mobile Databases: Location and Handoff Management, Effect of Mobility on Data Management– datacategorization, Location Dependent Data Distribution, Mobile Transaction Models,-Concurrency Control, Transaction Commit Protocols, Mobile Database Recovery Schemes. Multimedia Databases: Types of multimedia information, multimedia database applications, multimedia object characteristics, MDDMS components, MMDBMS Architecture. **(06hrs)**
Reference Books:	:	1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Fifth Edition, PearsonEducation/Addison Wesley, 2009. ISBN : 978-81-317-1625-0. 2. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", 6thEdition, McGraw Hill, 2006. ISBN: 9780071289597. 3. Vijay Kumar, "Mobile Database Systems", John Wiley & Sons, 2006. ISBN : 13 978-0-4714-6792-2 4. Multimedia Database Management Systems by B. Prabhakaran ISBN: 8181286529, 9788181286529. 5. C.J.Date, A.Kannan and S.Swamynathan,"An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006. ISBN: 9788177585568. 6. V.S.Subramanian, "Principles of Multimedia Database Systems", Harcourt India Pvt Ltd.,2001. ISBN-13: 978-1558604667.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of First year M.Tech(Computer Science and Technology) Semester-I

Code No.:MTC641
Teaching Scheme:04 Hrs/week
Theory: 3Hrs/week
Tutorial: 1Hr/batch/week
Credits: 4

Title: (Elective-I) Real Time Systems
Class Test: 20 Marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	The contents aim to develop the knowledge of the student in the direction of Real Time Systems and solving the practical problems in the development of typical real time application.
Unit-I	:	**Introduction and Requirement analysis of real time systems** Real time systems, Types of real time systems, Basic architecture of real time systems, Task description, Characteristics of real time systems, What is requirement analysis? Difference between analysis of general purpose systems and real time systems, Estimation of execution time, Framing of task's various parameters such as release time, period of invocation, computation time and deadlines. **(7 Hrs)**
Unit-II	:	**Design issues in real time systems and Programming in real time systems** Difference between design of general purpose systems and real time systems. Use of model driven engineering in real time system design, Real time system design using Event Studio, Feature descriptive language to describe design of real time systems, Case studies of real time system design, Difference between programming of general purpose systems and real time systems. Various programming languages for real systems, Ada, Real Time Java **(7 Hrs)**
Unit-III	:	**Real time operating systems** Difference between operating system of general purpose systems(GPOS) and real time operating systems. Monolythic OS and Modular OS, Kernel, microkernel and nanokernel, RT LINUX,POSIX APIs, LynxOS, VxWorks **(6Hrs)**
Unit-IV	:	**Real time database systems** Difference between data base system of general purpose systems and real time Database systems, Architecture of real time database systems, Concurrency issues of real time database systems, Scheduling of RTDB transaction, Quality service in real time database , In memory database systems, Design issues of in memory database systems. **(6 Hrs)**
Unit-V	:	**Real Time Communication** Need for real time communication, Network topology in real time communication, Message sending techniques, Real time communication network design issues, Various real time communication protocols. **(6Hrs)**
Unit-VI	:	**Real time scheduling** What is real time scheduling? Classification of real time scheduling algorithms, various scheduling properties, Various scheduling metrics, Independent task scheduling algorithms, Aperiodic task scheduling algorithms, Precedence constraint task scheduling algorithms. **(8 Hrs)**

Reference Books:	:	1.Real-Time Systems, C.M.krishna and Kang G.Shin, McGraw Hill 2. Real Time Systems , Jane W.S.Liu ,Pearson

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of First Year M.Tech.(Computer Science and Technology) Semester-I

Code No.:MTC642
Teaching Scheme:04 Hrs/week
Theory: 3Hrs/week
Tutorial: 1Hr/batch/week
Credits: 4

Title: Elective-I (Advanced Image Processing)
Class Test: 20 Marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	• To understand the digital image processing operations and their applications. • To recognize how image compression and segmentation techniques enhance digital images. • To develop various feature extraction and object recognition skills. • To understand multiresolution image processing.
Unit-I	:	**Introduction to Digital Image Processing:** Fundamental steps in digital image processing, Sampling and quantization, Histogram equalization, Discrete Fourier Transform, Applications of DIP. **(4 Hrs)**
Unit-II	:	**Image Compression:** Fundamentals, Image compression models, Error-free compression: Huffman Coding algorithm, Lossy compression, Block transform coding, Digital Image watermarking. **(8 Hrs)**
Unit-III	:	**Image Segmentation:** Fundamentals, Detection of discontinuities, Thresholding techniques, Region oriented segmentation, segmentation using morphological watersheds: Watershed segmentation, Use of motion in segmentation. **(8 Hrs)**
Unit-IV	:	**Representation and Description:** Representation: Chain codes, Signatures, Skeletons, Feature Extraction Methods: Boundary descriptors: Simple descriptors, Shape numbers, Regional descriptors: Simple descriptors, Topological descriptor, Texture, Relational descriptors. **(8 Hrs)**
Unit-V	:	**Object Recognition:** Patterns and pattern classes, Recognition based on decision-theoretic methods: Matching, Optimum Statistical Classifiers, Neural Networks, Structural Methods: Matching Shape Numbers. **(8 Hrs)**
Unit-VI	:	**Wavelet Transform and Multi resolution Processing:** Image Pyramids, Multi resolution expansions: Series expansion, Wavelet functions, Wavelet transforms in one dimension: Discrete Wavelet transform, wavelet transforms in two dimensions. **(4 Hrs)**

Reference Books:	:	1. Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, Third edition, Pearson publication. 2. Digital Image Processing and Analysis, Chanda, Majumder, Second edition, PHI publication. 3. Digital Image Processing and Computer Vision, Sonka, Hlavac, Boyle, Cengage Learning publication. 4. Digital Image Processing using Matlab, Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Second edition, Mc Graw Hill publication

Section A: Includes Unit I, II and III; Section **B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus of First Year M.Tech.(Computer Science and Technology) Semester-I

Code No.:MTC643
Teaching Scheme:04 Hrs/week
Theory: 3Hrs/week
Tutorial: 1Hr/batch/week
Credits: 4

Title: Elective-I (Pattern Recognition)
Class Test: 20 Marks
Theory Examination (Marks): 80
Theory Examination (Duration): 3 Hours

Objectives	:	• To understand pattern recognition systems and design cycle • To study how Bayesian decision theory features are useful pattern recognition • To estimate maximum likelihood and Bayesian parameter • To estimate density using non-parametric techniques • To understand clustering and Hidden Markov Models
Unit-I	:	**Introduction to Pattern Recognition:** Machine perception, An example of pattern recognition, Pattern recognition systems, The design cycle, Learning and adaptation. **(4 Hrs)**
Unit-II	:	**Bayesian Decision Theory:** Introduction, Continuous features, Minimum error-rate classification, Classifiers, Discriminant functions, and Decision surfaces, Normal density, Bayes Decision theory - Discrete features, Compound Bayesian decision theory and context. **(8 Hrs)**
Unit-III	:	**Maximum Likelihood and Bayesian Parameter Estimation:** Introduction, Maximum-Likelihood Estimation: The General Principal, The Gaussian Case, Bayesian estimation: The Class Conditional Densities, The Parameter Distribution, Bayesian parameter estimation–Gaussian case. **(8 Hrs)**
Unit-IV	:	**Non-parametric Techniques for Density Estimation:** Introduction, Density Estimation, Parzen-window method: Convergence of the Mean, Classification Example, K-Nearest Neighbor method: K-Nearest Neighbor and Parzen-window Estimation, Estimation of A Posteriori Probabilities. **(8 Hrs)**
Unit-V	:	**Un-supervised Learning and Clustering:** Introduction, Mixture densities and identifiability, Maximum likelihood estimates, K-means clustering, Data description and clustering, Criteria function for clustering, Component analysis. **(8 Hrs)**
Unit-VI	:	**Discrete Hidden Markov Models:** First-Order Markov Models, First-Order Hidden Markov Models, Hidden Markov Model Computation, Evaluation, Decoding, Learning. **(4 Hrs)**
Reference Books:	:	1. Pattern Classification, Richard O. Duda, Peter E. Hart, David G. Stork, Wiley Student Edition, Second Edition, John Wiley publication. 2. Pattern Recognition and Image Analysis – Earl Gose, Richard John baugh, Steve Jost PHI 2004 3. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009 4. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Section A: Includes Unit I, II and III; Section **B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus of First Year M.Tech.(Computer Science and Technology) Semester-I

Code No.: MTC621	**Title: Software Development Laboratory - I**
Teaching Scheme: 04 Hours/week	**Term Work(Marks):50**
Practical:4 Hrs/week	
Credits: 2	**Total Examination (Marks):50**

Software Development Laboratory - I shall be based on the subjects Advanced Computer Networking and Advanced Algorithms.

The assessment of term work shall be done on the basis of the following.

- Continuous assessment.
- Performing the experiments in the laboratory.
- Oral examination conducted on the syllabus and term work mentioned above.

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Syllabus of First Year M.Tech.(Computer Science and Technology) Semester-I

Code No.: MTC622	**Title: Software Development Laboratory - II**
Teaching Scheme:02 Hours /week	**Viva voce(Marks):50**
Practical:2 Hrs per week	
Credits: 1	**Total Examination (Marks):50**

Software Development Laboratory - II shall be based on the subjects Advanced database management systems and Elective-I.

The assessment of term work shall be done on the basis of the following.

- Continuous assessment.
- Performing the experiments in the laboratory.
- Oral examination conducted on the syllabus and term work mentioned above.

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Code No.: MTC623	**Title: Seminar- I**
Teaching Scheme:02 Hours/week	**Viva voce : 50 Marks**
Credits: 1	**Total Examination (Marks):50**

The students will deliver a talk on their experience during the semester referring to at least two research papers and will deliver a seminar on topic of current interest in Information technology, Computer science, and Engineering field. The student is expected to review and study at least four research papers from IEEE transactions based on the theory subjects

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus of First Year M. Tech.(Computer Science and Technology) Semester-II

Code No.:MTC651
Teaching Scheme:04 Hrs /week
Theory: 3Hrs/week
Tutorial: 1Hr/batch/week
Credits: 4

Title: Advanced Operating System
Class Test: 20 Marks
Theory Examination (Duration): 3 Hrs
Theory Examination (Marks): 80

Objectives	:	• To get a comprehensive knowledge of the architecture of distributed systems. • To understand the deadlock and shared memory issues and their solutions in distributed environments. • To know the security issues and protection mechanisms for distributed environments. • To get a knowledge of multiprocessor operating system and database operating systems.
Unit-I	:	**Architectures of Distributed Systems:** System Architecture types - issues in distributed operating systems - communication networks – communication primitives. Theoretical Foundations - inherent limitations of a distributed system – lamp ports logical clocks – vector clocks – casual ordering of messages – global state – cuts of a distributed computation – termination detection. Distributed Mutual Exclusion – introduction – the classification of mutual exclusion and associated algorithms – a comparative performance analysis. **(6 Hrs)**
Unit-II	:	**Distributed Deadlock Detection :** Introduction - deadlock handling strategies in distributed systems – issues in deadlock detection and resolution – control organizations for distributed deadlock detection – centralized and distributed deadlock detection algorithms –hierarchical deadlock detection algorithms. Agreement protocols – introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms. Distributed resource management: introduction-architecture – mechanism for building distributed file systems – design issues – log structured file systems. **(7 Hrs)**
Unit-III	:	**Distributed shared memory:** Architecture– algorithms for implementing DSM – memory coherence and protocols – design issues. Distributed Scheduling – introduction – issues in load distributing – components of a load distributing algorithm – stability – load distributing algorithm – performance comparison – selecting a suitable load sharing algorithm – requirements for load distributing -task migration and associated issues. **(7 Hrs)**

Unit-IV	:	**Multiprocessor operating systems:** Basic multiprocessor system architectures – inter connection networks for multiprocessor systems – caching – hypercube architecture. Multiprocessor Operating System - structures of multiprocessor operating system, operating system design issues- threads- process synchronization and scheduling. **(6 Hrs)**
Unit-V	:	**Database Operating systems:** Introduction- requirements of a database operating system Concurrency control : theoretical aspects – introduction, database systems – a concurrency control model of database systems- the problem of concurrency control – serializability theory- distributed database systems, concurrency control algorithms – introduction, basic synchronization primitives, lock based algorithms- timestamp based algorithms . **(8 Hrs)**
Unit-VI		**Failure Recovery and Fault Tolerance:** Failure Recovery and Fault tolerance: introduction– basic concepts – classification of failures – backward and forward error recovery, backward error recovery- recovery in concurrent systems – consistent set of check points – synchronous and asynchronous check pointing and recovery – check-pointing for distributed database systems- recovery in replicated distributed databases **(6 Hrs)**
Reference Books	:	1. Mukesh Singhal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", TMH, 2001 2. Andrew S.Tanenbaum, "Modern operating system", PHI, 2003 3. Pradeep K.Sinha, "Distributed operating system-Concepts and design", PHI, 2003. 4. Andrew S.Tanenbaum, "Distributed operating system", Pearson education, 2003

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of F. Y. M. Tech.(Computer Science and Technology) Semester-II

Code No.:MTC652
Teaching Scheme:04 Hrs/week
Theory: 3 Hrs/week
Tutorial: 1 Hr/batch/week
Credits: 4

Title: Software Reliability
Class Test: 20 Marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	• To manage and improve the reliability of the software. • To check the efficiency of development activities. • To estimate the software reliability at the end of validation activities and in Operation. • To compare the various software reliability models
Unit-I	:	**Introduction to Software Reliability:** Basic Concepts, Failure and Faults, Environment, Availability, Modeling, Uses. **(6 Hrs)**
Unit-II	:	**Software Reliability Modeling:** Concepts, General Model Characteristic, Historical Development of models, Model Classification scheme, Markovian models, General concepts, General Poisson, Type Models, Binomial, Type Models, Poisson, Type models, Fault reduction factor for Poisson, Type models. **(7Hrs)**
Unit-III	:	**Comparison of Software Reliability Models** Comparison Criteria, Failure Data, Comparison of Predictive Validity of Model Groups Recommended Models, Comparison of Time Domains, Calendar Time Modeling, Limiting Resource Concept, Resource Usage model, Resource Utilization, Calendar Time Estimation and confidence Intervals, Reliability Growth Model, Model Evaluation. **(7 Hrs)**
Unit-IV	:	**Measurements Theory** Fundamentals of Measurement, Measurements in Software Engineering, Scope of Software metrics, Measurements theory, Goal based Framework, Software Measurement Validation, Measurement of Quality, Quality Management Models. **(8Hrs)**
Unit-V	:	**Reliability Assessment** Ability to Test Entire System, Software Reliability Improvement Techniques Measurement of Internet Product Attributes, Orthogonal Classification **(6 Hrs)**

Unit-VI		**Reliability Evaluation of Architectural analysis** Path based models, state based models, additives, Model Driven Engineering-UML 2.0- Extension for reliability evaluation. **(6 Hrs)**
Reference Books	:	1. John D. Musa, Anthony Iannino, Kazuhira Okumoto, "Software Reliability – Measurement, Prediction, Application, Series in Software Engineering and Technology", McGraw Hill, 1987. 2. John D. Musa, "Software Reliability Engineering", Computing McGraw Hill, 1999. 3. Michael R. Lyu ,Handbook of Software Reliability Engineering , McGraw-Hill 4. Hoang Pham, "System software reliability", Springer series in Reliability Engineering.

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of First Year M.Tech.(Computer Science and Technology) Semester-II

Code No:MTC653
Teaching Scheme: 04 Hrs/week
Theory: 03Hrs/week
Tutorial: 1Hr/batch/week
Credits: 4

Title: Performance Evaluation and Optimization
Class Test: 20 Marks
Theory Examination (Duration): 03 Hrs
Theory Examination (Marks): 80

Objectives	:	• To know the fundamental techniques in performance evaluation of computer systems. • To understand computer system as well as various analysis techniques such as statistics, probability theory, experimental design, simulation and queuing theory.
Unit-I	:	**An Overview Of Performance Evaluation** The art of performance evaluation, common mistakes in performance evaluation, a systematic approach to performance evaluation, selecting an evaluation technique, selecting performance metrics, commonly used performance metrics, utility classification of performance metrics, setting performance requirements. **(6 Hrs)**
Unit-II	:	**Measurement Techniques and Tools** Types of workloads: addition instruction, instruction mixes, kernels, the art of workload selection: services exercised, level of detail, representativeness, timeliness, other considerations in workload selection, workload characterization techniques: Averaging, Specifying dispersion, Single-parameter histograms, Multiparameter histograms, Principal-component analysis, Markov models, Clustering. Monitors: monitor terminology, monitor classification, software monitors, hardware monitors, software versus hardware monitors, firmware and hybrid monitors and distributed system monitors. **(7 Hrs)**
Unit-III	:	**Probability Theory and Statistics** Summarizing Measured Data: Basic probability and statistics concepts, summarizing data by a single number, selecting among the mean, median, and mode, common misuses of means, geometric mean, harmonic mean, mean of a ratio, summarizing variability, selecting the index of dispersion, determining distribution of data. Comparing systems using sample data: Sample versus population, Confidence interval for the mean, Testing for a zero mean. Experimental design and analysis: terminology, common mistakes in experimentation, types of experimental designs. **(7 Hrs)**
Unit-IV	:	**Simple Linear Regression Models** Definition of a good model, estimation of model parameters, allocation of variation, standard deviation of errors, confidence intervals for regression parameters, confidence intervals for predictions, visual tests for verifying the regression assumptions. **(6 Hrs)**

Unit-V	:	**Simulation** Introduction to simulation, common mistakes in simulation, other causes of simulation analysis failure, terminology, selecting a language for simulation, types of simulations, event-set algorithms. Analysis of simulation results: Model verification techniques, Model validation techniques. Commonly used distributions: Bernoulli distribution, Beta distribution, Binomial distribution, Chi-square distribution, Erlang distribution, Exponential distribution, F distribution, Gamma distribution, Geometric distribution, Lognormal distribution, Negative binomial distribution, Normal distribution, Pareto distribution, Pascal distribution, Poisson distribution, Student's t Distribution, Uniform distribution (continuous), Uniform distribution (discrete), Weibull distribution n, Relationships among distributions. **(7Hrs)**
Unit-VI	:	**Decision Theory and Queuing Theory** Steps in Decision Theory Approach, Decision-Making Environments, Decision-Making under conditions of certainty, Decision –Making under conditions of uncertainty, Decision-Making under conditions of risk, Maximum likelihood criteria. Queing Theory: Queing Notation, Rules for all queues, Little's Law, Types of stochastic processes, M/M/1 queue, M/M/m queue, M/M/m/B queue with finite buffers. **(7 Hrs)**
Reference Books:	:	1."The Art of Computer System Performance Analysis", Raj Jain, Wiley India publication 2. "Operation Research", Prem kumar Gupta, D.S. Hira, S. Chand publications 3. "Quantitative system performance -Computer system analysis with queuing network models", Edward D. Lazawska, John zahorjan, G. Scott Graham, Kenneth C.Sevcik, Prentice Hall publication 4. "Measuring Computer Performance - A Practitioner's Guide", D.J. Lilja, Cambridge University Press

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of First Year M.Tech.(Computer Science and Technology) Semester-II

Code No:MTC654 | **Title: Advanced Data Mining and Warehousing**
Teaching Scheme: 04 Hrs/week | **Class Test: 20 Marks**
Theory: 03Hrs/week | **Theory Examination (Duration): 03 Hrs**
Tutorial: 1Hr/batch/week | **Theory Examination (Marks): 80**
Credits: 4

Objectives	:	1. The explore different techniques of data mining 2. To apply data mining in real world application 3. To introduce Big Data Tools and applications.
Unit-I	:	Mining Frequent Patterns, Associations: Basic Concepts, Efficient and Scalable Frequent Itemset Mining methods (Apriori Algoithm, improving efficiency of Apriori, Mining frequent Itemsets without Candidate generation, using vertical data formats, closed frequent itemsets). Mining various kinds of association rules, from association analysis to Correlation analysis, constraint-based association mining. **(6Hrs)**
Unit-II	:	Types of data in cluster analysis, classical Partitioning methods: k-Means and k-Medoids, Hierarchical clustering, outliers. **(7 Hrs)**
Unit-III	:	Graph Mining, Social Network Analysis, and Web Mining: Types of Web mining, information retrieval and web search, Temporal Mining, Sequence mining, Spatial Mining. **(7 Hrs)**
Unit-IV	:	Introduction and history of Big Data, Getting Up to Speed with Big Data, Comparison of hadoop with other systems, Apache hadoop, Need for large data Processing, Hadoop Mapreduce, Hadoop Streaming **(6 Hrs)**
Unit-V	:	Big Data Tools, Techniques, and Strategies : Designing Great Data Products , What It Takes to Build Great Machine Learning Products, Data Issues **(7 Hrs)**
Unit-VI	:	The Application of Big Data, What to Watch for in Big Data, The Application of Big Data: Product and Processes, Hadoop Distributed file system **(7 Hrs)**
Reference Books:	:	1. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers 2. Margaret H. Dunham. Data Mining: Introductory and Advanced Topics, Pearson Education 3. Web Data Mining- Exploring Hyperlinks, Contents, Usage Data by Bing Liu,Springer 4. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses by Michael Minelli, Michele Chambers, AmbigaDhiraj Frank Ohlhorst, "Big data Analytics"Wiely Publication. 5. Big Data Now: 2012 Edition by O'Reilly Media, Inc. Big Data Now:Current Perspectives from O'Reilly Radar, O'Reilly Media,Inc.

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of First Year M. Tech.(Computer Science and Technology) Semester-II

Code No.:MTC691
Teaching Scheme:04 Hrs/week
Theory: 3Hrs/week
Tutorial: 1Hr/batch/week
Credits: 4

Title: Elective-II (Smart Phone Programming)
Class Test: 20 Marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	• To get advanced knowledge of smart phone programming • An architectural overview of WP7 • Comparisons with iOS and Android • How to build your applications • Methods for testing applications • Using the Windows Phone Emulator • How to publish your applications • Understanding WP7 UI principles • Building a UI • Customizing a UI
Unit-I	:	**Introduction** An Overview Of Windows Phone 7, Application Framework, Comparisons With Android And IPHONE, Targeting Windows Phone 7, The Hardware Chassis, Sensors And Services.**(05 Hrs)**
Unit-II	:	**The Development Environment** Creating WP7 Applications with Visual Studio, Differences between Wp7 and Android Development, Testing WP7 Applications in the Windows Phone Emulator, Testing WP7 Applications on the Actual Windows Phone Device. Basic application project structure, Comparing Application Project Structure for Android and IOS, Application execution model and life cycles, Comparing Application Model and Life Cycles in Android and IOS, Creating the WP7 Life Cycles Application. **(08 hrs)**
Unit-III	:	**User Interfaces** UI design principles, comparing the WP7 display to ANDROID AND IOS, building the WP7 UI, Defining WP7 UI Programmatically, Pages and Navigation Among Pages, Sharing Data among Pages, Using Controls, Overview of Pivot and Panorama Control, Example of Using Pivot and Panorama Control, Handling UI Events, Other UI Considerations, UI customization **(07 Hrs)**

Unit-IV	:	**Application Data Storage** Application storage on mobile devices, local files and databases, isolated storage, saving data to the cloud, data storage design considerations **(06 hrs)**
Unit-V	:	**Web Services And Push Notifications And Leveraging Location And Maps** A primer of web services, consuming web services on wp7, wp7 push notifications, mobile advertising basics. Location frameworks roundup, getting current location, using maps, combining the location service and bing map **(06 hrs)**
Unit-VI	:	**Multimedia** Multimedia overview, WP7 Multimedia, IOS multimedia, Android Multimedia, playing audio on WP7, Playing Sounds Using Sound Effect, Sound, Picture, and Graphics Integration, playing video on WP7, Playing Video Using Media Element, accessing the microphone on WP7. **(08 Hrs)**
Reference Books:	:	1.Charles PetZold, "Programming Windows phone 7", MICROSOFT publication,2010 2.Zhinan Zhou, Robert Zhu, Pei Zheng, "Windows phone 7 programming for android and IOS developers", John Wiley & Sons, Inc. 3.Sams Teach Yourself Android Application Development in 24 Hours By Darcey by pearson 4.Android for Programmers: An App-Driven Approach ,Deitel / Deitel / Deitel / Morgano by Pearson

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V & VI

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus of First Year M. Tech.(Computer Science and Technology) Semester-II

Code No.:MTC692
Teaching Scheme:04 Hrs/week
Theory: 3Hrs/week
Tutorial: 1Hr/batch/week
Credits: 4

Title: Elective-II (Cloud Computing)
Class Test: 20 Marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	• To get advanced knowledge of Cloud computing • An architectural overview of Windows Azure • How to build your applications • Methods for testing applications
Unit-I	:	**Introduction** What Is the Cloud? The Emergence of Cloud Computing, The Global Nature of the Cloud Cloud-Based Service Offerings ,Grid Computing or Cloud Computing? Is the Cloud Model Reliable? Benefits of Using a Cloud Model ,What About Legal Issues When Using Cloud Models? What Are the Key Characteristics of Cloud Computing? Challenges for the Cloud **(4 Hrs)**
Unit-II	:	**Web Services Delivered from the Cloud** Communication-as-a-Service (CaaS) , Advantages of CaaS , Fully Integrated, Enterprise-Class Unified Communications , Amazon Web Services asInfrastructure-as-a-Service (IaaS), Modern On-Demand Computing , Amazon's Elastic Cloud , Amazon EC2 Service Characteristics , Mosso Rackspace),Monitoring-as-a-Service (MaaS) , Protection Against Internal and External Threats Delivering Business Value , Real-Time Log Monitoring,Enables Compliance , Google AppEngine and Windows Azure Platform as a Platform-as-a-Service (PaaS), The Traditional On-Premises Model , The New Cloud Model, Key characteristics of PaaS , Software-as-a-Service (SaaS), SaaS Implementation Issues, Key Characteristics of SaaS ,Benefits of the SaaS Model **(8 hrs)**
Unit-III	:	**Building Cloud Networks** The Evolution from the MSP Model to Cloud Computing and Software-as-a-Service From Single-Purpose Architectures to Multipurpose Architectures, Data Center Virtualization The Cloud Data Center, Collaboration, Why Collaboration? , Service-Oriented Architectures as a Step Toward Cloud Computing , Basic Approach to a Data Center-Based SOA , Planning for Capacity , Planning for Availability , Planning for SOA Security , The Role of Open Source Software in Data Centers , Where Open Source Software Is Used , Web Presence , Database Tier ,Application Tier , Systems and Network Management Tier. **(8 Hrs)**
Unit-IV	:	**Overview of the Windows Azure Platform** Introduction to Cloud Computing,Workload Patterns for the Cloud,"Introduction to Windows Azure,Under the Hood of Windows Azure,Windows Azure PLATFORM,Application Patterns & Architecture,Hands-On Demo,Case Studies. **(6 hrs)**

Unit-V	:	**Windows Azure Platform Architecture** The Windows Azure Developer Portal, Creating and Running Projects in the Azure Development Platform ,Installing Windows Azure SDK and Tools for Visual Studio, Installing and Building the Windows Azure SDK Sample Applications, The Development Fabric ,Development Storage Using Azure Application Templates for Visual Studio 2008 ,Web Cloud Services and Client Wrapper Class Libraries. **(8 Hrs)**
Unit-VI	:	**Analyzing the Windows Azure Operating System** A Quick Tour of theWindows Azure OS ,The Lifecycle of a Windows Azure Service,Creating the Host VM and the First Guest VM on a Physical Server,Adding Guest VMs to a Host VM ,Maintaining Role Instance Health ,Upgrading Service Software and Windows Azure. **(6hrs)**
Reference Books:	:	1.Roger Jennings ,"Cloud Computing with the Windows Azure Platform"Wiley Publications 2. John W. Rittinghouse, James F. Ransome, "Cloud Computing Implementation, Management,and Security",CRC Press 3. David E.V. Sarna, " Implementing and Developing Cloud Computing Applications"CRC Press.

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V & VI

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of First Year M. Tech.(Computer Science & Technology) Semester-II

Code No.:MTC693
Teaching Scheme:04 Hrs/week
Theory: 3Hrs/week
Tutorial: 1Hr/batch/week
Credits: 4

Title: Elective-II(Parallel Processing)
Class Test: 20 Marks
Theory Examination (Duration): 3 Hours
Theory Examination (Marks): 80

Objectives	:	To get the knowledge related to current technologies and architectures so as to find research oriented topics.
Unit-I	:	**Introduction to Parallel Processing:** Why Parallel architecture?- Application trends, Technology trends, Convergence-Communication , Shared memory, Message passing, Fundamental design issues-Communication Abstraction, naming. **(6 Hrs)**
Unit-II	:	**Parallel Programs:** Parallel application case studies, The parallelization process- Steps in the Process, Goals Simulating the evolution of galaxies, Computation Vs data. **(6 Hrs)**
Unit-III	:	**Interconnection Network Design** Introduction, organizational structure, Topologies, Routing, Switch design, Flow Control,Case studies. **(8 Hrs)**
Unit-IV	:	**Workload-driven Evaluation** Introduction, Scaling workload and machines-parameters, models. Evaluating a real machine, Evaluating architectural tradeoff. **(6 Hrs)**
Unit-V	:	**Shared Memory Multiprocessors** Introduction, Cache coherence, Memory consistency, Design space for snooping protocols, synchronization. **(8 Hrs)**
Unit-VI		**Scalable Multiprocessors** Introduction, Scalability, Realizing programming models, Physical DMA, User level access, Dedicated message processing. Shared physical address space, Comparison of communication performance. **(6 Hrs)**

Reference Books	:	1. Parallel Computer Architecture-A hardware/Software approach- David Culler, Jaswinder Pal Singh, Anoop Gupta. 2. John Hennessy and David Patterson, Computer Architecture: A Quantitative Approach, Morgan Kauffman Publisher. 3. Research Papers to be available in the class 4. Kai Hwang, "Advanced Computer Architecture", McGraw Hill International, 1993. 5. William Stallings, "Computer Organization and Architecture", Macmillan Publishing Company, 1990. 6. M. J. Quinn, "Designing Efficient Algorithms for Parallel Computers", McGraw Hill International, 1994. 7. John L. Hennessy and David A. Patterson, Computer Architecture A Quantitative approach, Morgan Kaufman Publishers. Inc., 1990. 8. D.P. Siewiorek, G.G. Bell, A. Newell, Computer Structures, Principle and Examples, McGraw Hill, 1982.

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of First Year M.Tech (Computer Science and Technology) Semester-II

Code No.: MTC671	**Title: Software Development Laboratory -III**
Teaching Scheme:04 Hours/week	**Term Work(Marks): 50**
Practical:4 Hrs/week	
Credits: 2	**Total Examination (Marks):50**

Software Development Laboratory -III shall be based on the subjects Advanced Operating systems & Software Reliability

The assessment of term work shall be done on the basis of the following.

- Continuous assessment.
- Performing the experiments in the laboratory.
- Oral examination conducted on the syllabus and term work mentioned above.

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Code No.: MTC672	**Title: Software Development Laboratory-IV**
Teaching Scheme:02 Hours/week	**Viva Voce: 50**
Practical:2 Hrs/week	
Credits: 1	**Total Examination (Marks):50**

Software Development Laboratory -IV shall be based on the subjects Advanced Data Mining and Warehousing and Elective-II.

The assessment of term work shall be done on the basis of the following.

- Continuous assessment.
- Performing the experiments in the laboratory.
- Oral examination conducted on the syllabus and term work mentioned above.

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Code No.: MTC673	**Title: Seminar- II**
Teaching Scheme:02 Hours/week	**Viva Voce: 50 Marks**
Practical:2 Hrs/week	**Total Examination (Marks):50**
Credits: 1	

The students will deliver a talk on their experience during the semester referring to at least two research papers and will deliver a seminar on topic of current interest in Information technology, Computer science, and Engineering field. The student is expected to review and study at least four research papers from IEEE transactions based on the theory subjects

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Code No.: MTC 731	**Title: Dissertation Phase I**
Teaching Scheme:12 Hours/week	**Term Work: 50 Marks**
Contact Hours:12 Hrs/week	**Viva Voce: 50 Marks**
Credits: 12	**Total Examination (Marks):100**

Students are required to complete the details like Introduction, Literature Survey, and system/problem definition. The stage of implementation needs to be started in this semester. Project report must be submitted in the prescribed format only. The dissertation will consist of a type written report covering the work completed so far. The work will be judged by two examiners (one internal guide and one external) by taking viva-voce and marks will be given accordingly.

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Syllabus of Second Year M. Tech.(Computer Science and Technology) Semester-IV

Code No.: MTC 781	**Title: Dissertation Phase II**
Teaching Scheme:20 Hrs /week	**Term Work: 100 Marks**
Contact Hours:20 Hrs/week	**Viva Voce: 200 Marks**
Credits: 20	**Total Examination (Marks):300**

The students need to complete the dissertation work taken in Semester-III. They should complete the remaining work till the conclusion. Term work marks will be awarded internally based on the dissertation work completed till then. The work will be judged by two examiners (one internal guide and one external) by taking viva-voce and marks will be given accordingly.