Website: www.jntuk.edu.in
E-mail: registrar@jntuk.edu.in

Phone: Off: 0884-2300900
Fax: 0884-2300901

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
**Kakinada-533003, Andhra Pradesh, India**
**(Established by A.P Act.30 of 2008)**

*Letter No. DAP/DNRCE&T(9P)/BoS/2024* *Date: 15.07.2024*

**Dr. L. SUMALATHA**
*M. Tech., Ph.D.,*
**REGISTRAR**

To
The Principal
DNR College of Engineering and Technology (Autonomous)
Bhimavaram.

Sir,

Sub: JNTU Kakinada – Academic Planning – Board of Studies (BoS) Members to "DNR College of Engineering and Technology (Autonomous), (CC:9P), Bhimavaram – Reg.

Ref: Note orders of the Vice-Chancellor, JNTUK, Kakinada dated 15.07.2024.

***

With reference cited above, the Hon'ble Vice-Chancellor JNTUK, Kakinada is pleased to nominate the following members for Board of Studies (BoS) of "DNR College of Engineering and Technology, (CC:9P), (Autonomous), Bhimavaram" for three academic years i.e. 2024-25, 2025-26 and 2026-27

| S. No. | Name of the Department | Name of the BoS Members |
|---|---|---|
| 1 | Civil Engineering | Prof. P Subba Rao<br>Professor, CE Department<br>UCEK, JNTUK, Kakinada |
| 2 | EEE Department | Prof. K. Ravindra<br>Professor, EEE Department<br>UCEK, JNTUK, Kakinada |
| 3 | ME Department | Dr. D. Linga Raju<br>Assoc., Professor, ME Department<br>UCEK, JNTUK, Kakinada |
| 4 | ECE Department | Prof. B. T. Krishna<br>Professor, ECE Department<br>UCEK, JNTUK, Kakinada |
| 5 | CSE Department | Prof. N. Ramakrishaiah<br>Professor, CSE Department<br>UCEK, JNTUK, Kakinada |
| 6 | Artificial Intelligence and Data Science | Prof. ASN. Chakravarthy<br>Professor, CSE Department<br>UCEK, JNTUK, Kakinada |
| 7 | Artificial Intelligence and Machine Learning | Prof. D. Haritha<br>Professor, CSE Department<br>UCEK, JNTUK, Kakinada |

| | | |
|---|---|---|
| 8 | Information Technology | Prof. N. Ramakrishaiah<br>Professor, CSE Department<br>UCEK, JNTUK, Kakinada |
| 9 | MBA Department | Prof. P. Uma Maheswari Devi<br>Professor, Dept., of Commerce and Management Studies<br>AKNU, Rajamahendravaram |
| 10 | Mathematics Department | Prof. K. Ravindranath<br>Professor, Mathematics Department<br>UCEK, JNTUK, Kakinada |
| 11 | English Department | Prof. K. Sree Ramesh<br>Professor, Dept., of English<br>AKNU, Rajamahendravaram |
| 12 | Physics Department | Prof. G. Padmaja Rani<br>Professor, Physics Department<br>UCEK, JNTUK, Kakinada |
| 13 | Chemistry Department | Dr. S. Satya Veni<br>Asst., Professor, Chemistry Dept.,<br>UCEK, JNTUK, Kakinada |
| 14 | NSS/NCC/Scouts & Guides/Community Service Health and Wellness, Yoga and Sports | Dr. G. Syam Kumar<br>Assoc., Professor, Dept. of Physical Education<br>UCEK, JNTUK, Kakinada |

Yours Sincerely,

REGISTRAR
REGISTRAR
J.N.T. University Kakinada
Kakinada-533003

Copy to all the above Members
Copy to the Secretary to the Honorable Vice Chancellor, JNTU Kakinada
Copy to the Director, Academic Planning, JNTU Kakinada.

# D. N. R. COLLEGE OF ENGINEERING & TECHNOLOGY

## (AUTONOMOUS)

*(Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada)*

BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202

*Ph: 08816-221238, Email: dnrcet@gmail.com , Website: https://dnrcet.org*

Accredited with A++ Grade with 3.73/4 CGPA by NAAC and Accredited by NBA (B. Tech- CSE, ECE & EEE)

**Dr. G. SATYANARAYANA**
MCA, M. Tech (CSE), PhD, MISTE, MIAENG, MIACSI, MSDIWC, MCSTA, MIFREP, MIRED, MCSI
**Professor & HoD, CSE**

**Department of Computer Science & Engineering**
E-Mail: sreesatyam@dnrcet.org
Mobile: +91-9491922706, Phone: 08816-221237


## CIRCULAR

**Ref:** *DNRCET/CSE/2024-25/BoS/C-1*

**Date:** *22.07.2024*

It is to inform all BoS members of the CSE department to attend the BoS meeting to be conducted at ***2:00 p.m. on 23rd July, 2024*** on online mode. The meeting link will send to each member of the BoS to their e-mail. The discussion on the following agenda.

**Agenda:**

1. Introducing the members of Board of Studies.
2. Discussion on I year semester wise course structure for B. Tech (Computer Science & Engineering) and M. Tech (Computer Science & Engineering) Programs from the academic year 2024 – 25.
3. Discussion on preparation of course syllabus in accordance to JNTUK course structure and syllabus.
4. Discussion on Academic Regulations of both UG & PG Programs.
5. Discussion and finalizing the model paper and paper setters for the academic year 2024 – 25.
6. To discuss the Certificate Courses to be done by the students & staff.
7. To discuss the functional MoUs with the industries.
8. To discuss the feasibility of developing collaborations with other institutions.
9. To evolve a plan of action for consultancy activities.
10. Any other agenda with the permission of the chair.

**Chairperson Board of Studies /**
**Head of the Department**

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

Copy to

1. The members of BoS,
2. The Principal, DNRCET(A),
3. The Dean, Academics, DNRCET(A),
4. Office file.

# D. N. R. COLLEGE OF ENGINEERING & TECHNOLOGY

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## Department of Computer Science & Enginee

**Place:** B
**Date:**

The following members of Board of Studies are attended for the meeting held on 23.07.2024.

| S. No. | Category | Name | Position | Signature |
|---|---|---|---|---|
| 1 | Chairperson | Dr. G. Satyanarayana | Professor & HoD<br>Department of CSE<br>DNRCET, Bhimavaram | |
| 2 | Expert Nominated by Vice-Chancellor | Dr. N. Ramakrishnaiah | Professor,<br>CSE Department,<br>UCEK, JNTUK Kakinada,<br>Kakinada – 533003. | |
| 3 | Subject Experts from outside Parent Universities | Dr. V. Chandrasekhar, | Professor & HoD,<br>Department of CSE,<br>S. R. K. R. Engineering College (A),<br>BHIMAVARAM 534202. | Attended online |
| 4 | | Dr. P. Kiran Sree, | Professor & HoD,<br>Department of CSE,<br>Shri Vishnu Engineering College for Women (A),<br>Bhimavaram,<br>W.G. Dist., A.P. | Attended online |
| 5 | Member (Industrial Expert) | Rajiv Chand Kakarla | CEO, Amaravathi Software Innovations,<br>Rajahmundry,<br>East Godavari District,<br>A.P., | Attended online |
| 6 | Faculty Members | Mr. K. T. V. Subba Rao | Assistant Professor,<br>Department of CSE,<br>DNRCET, Bhimavaram. | |
| 7 | | Mr. K. S. R. Prasad | Assistant Professor,<br>Department of CSE,<br>DNRCET, Bhimavaram. | |
| | | Mr. B. Nandan Kumar | Assistant Professor,<br>Department of CSE,<br>DNRCET, Bhimavaram. | |

| | | | |
|---|---|---|---|
| | Mr. L. Bujji Babu | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | Mr. K. S. H. Prasanna Kumar | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | Mrs. N. Bharathi | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | Mr. L. Dhanaratna Kishore | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | Mr. K. Venkat Chandran | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | Mr. G. V. Sriram | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | Mrs. M. Mounica Devi | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | Mrs. P. Lalitha Rajeswari | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | P.L. Rajeswari |
| | Mr. K. Sarat Chandra | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | Ms. K. Siva Syamala | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | K.S.syamala |
| | Mrs. M. V. S. K. Prabhavathi | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | M. Prabhavathi |
| | Mr. Ch. Venkat Reddy | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | Mrs. M. P. V. Harika | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | M.P.V.Harika |
| | Mrs. K. R. S. Spandana | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | K.R.S Spandana |
| | Mrs. M. Bhargavi | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | Mr. B. Suryanarayana Murthy | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |

| | | | | |
|---|---|---|---|---|
| | | Mr. K. Rambabu | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. P. Sirish Kumar | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. G. Rajendra Kumar | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. B. Prasanna Kumar | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. K. Radha Krishna | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. G. Sai Krishna | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. Areti Mohan Manidranadh | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mrs. M. Rama Rajeswari | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Ms. D. Phani Sri Lakshmi | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. T. Venkatesh | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. Ch. Somesh Kumar | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| 8 | Member (College alumni) | K. S. Sai Kumar (219P1D5804) | Assistant Professor, Department of CE, VIT, Bhimavaram. | |

**Agenda:**

1. Introducing the members of Board of Studies.
2. Discussion on I year semester wise course structure for B. Tech (Computer Science & Engineering) and M. Tech (Computer Science & Engineering) Programs from the academic year 2024 – 25.
3. Discussion on preparation of course syllabus in accordance to JNTUK course structure and syllabus.
4. Discussion on Academic Regulations of both UG & PG Programs.
5. Discussion and finalizing the model paper and paper setters for the academic year 2024 – 25.

6. To discuss the Certificate Courses to be done by the students & staff.
7. To discuss the functional MoUs' with the industries.
8. To discuss the feasibility of developing collaborations with other institutions.
9. To evolve a plan of action for consultancy activities.
10. Any other agenda with the permission of the chair.

Chairperson Board of Studies /
Head of the Department

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

# D. N. R. COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

*(Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada)*

BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202

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## Department of Computer Science & Engineering


Date: 22.07.2024

To
Dr. N. Ramakrishnaiah,
Professor,
CSE Department,
UCEK, JNTUK Kakinada,
Kakinada – 533003.

Dear Sir,

Sub: DNR College of Engineering & Technology – Department of Computer Science & Engineering – Board of Studies Meeting – Reg.

We take the privilege in inviting you for the Board of Studies Meeting of Department of Computer Science & Engineering, DNR College of Engineering & Technology as an Expert Nominated by Vice-Chancellor, JNTUK, Kakinada. It is proposed to discuss and finalize the course structure and syllabi for the 1st year of DR24 B. Tech (CSE) course curriculum and DR24 M. Tech(CSE) course curriculum.

In this regard, you are requested to attend the meeting scheduled to be held on 23.07.2024 at 2.00 PM in online mode.

Kindly accept our invitation and make it convenient to attend the Board of Studies meeting.

Thanking You Sir

Yours Sincerely,

22/7/24

**Chairperson Board of Studies / Head of the Department**

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

# D. N. R. COLLEGE OF ENGINEERING & TECHNOLOGY

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## Department of Computer Science & Engineering

Date: 22.07.2024

To

Dr. V. Chandrasekhar,
Professor & HoD,
Department of Computer Science & Engineering,
S. R. K. R. Engineering College (A),
BHIMAVARAM 534202.

Dear Sir,

Sub: DNR College of Engineering & Technology – Department of Computer Science & Engineering – Board of Studies Meeting – Reg.

We take the privilege in inviting you for the Board of Studies Meeting of Department of Computer Science & Engineering, DNR College of Engineering & Technology as Subject Expert from outside Parent University nominated by Principal, DNRCET. It is proposed to discuss and finalize the course structure and syllabi for the 1st year of DR24 B. Tech (CSE) course curriculum and DR24 M. Tech(CSE) course curriculum.

In this regard, you are requested to attend the meeting scheduled to be held on 23.07.2024 at 2.00 PM in online mode.

Kindly accept our invitation and make it convenient to attend the Board of Studies meeting.

Thanking You Sir

Yours Sincerely,

22/7/24

**Chairperson Board of Studies /**
**Head of the Department**

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

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## Department of Computer Science & Engineering

Date: 22.07.2024

To

Dr. P. Kiran Sree,
Professor & HoD,
Department of Computer Science & Engineering,
Shri Vishnu Engineering College for Women (A),
.Bhimavaram, W.G. Dist., A.P.

Dear Sir,

Sub: DNR College of Engineering & Technology – Department of Computer Science & Engineering – Board of Studies Meeting – Reg.

We take the privilege in inviting you for the Board of Studies Meeting of Department of Computer Science & Engineering, DNR College of Engineering & Technology as Subject Expert from outside Parent University nominated by Principal, DNRCET. It is proposed to discuss and finalize the course structure and syllabi for the 1st year of DR24 B. Tech (CSE) course curriculum and DR24 M. Tech(CSE) course curriculum.

In this regard, you are requested to attend the meeting scheduled to be held on 23.07.2024 at 2.00 PM in online mode.

Kindly accept our invitation and make it convenient to attend the Board of Studies meeting.

Thanking You Sir

Yours Sincerely,

22/7/24

**Chairperson Board of Studies / Head of the Department**

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

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## Department of Computer Science & Engineering

Date: 22.07.2024

To

Rajiv Chand Kakarla
CEO, Amaravathi Software Innovations
Rajahmundry,
East Godavari District, A.P.,

Dear Sir,

Sub: DNR College of Engineering & Technology – Department of Computer Science & Engineering – Board of Studies Meeting – Reg.

We take the privilege in inviting you for the Board of Studies Meeting of Department of Computer Science & Engineering, DNR College of Engineering & Technology as Representative from Industry/Corporate Sector/Allied Area Relating to Placement nominated by Principal, DNRCET. It is proposed to discuss and finalize the course structure and syllabi for the 1st year of DR24 B. Tech (CSE) course curriculum and DR24 M. Tech(CSE) course curriculum.

In this regard, you are requested to attend the meeting scheduled to be held on 23.07.2024 at 2.00 PM in online mode.

Kindly accept our invitation and make it convenient to attend the Board of Studies meeting.

Thanking You Sir

Yours Sincerely,

22/7/24

Chairperson Board of Studies /
Head of the Department

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

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## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING


**Ref:** *DNRCET/CSE/2024-25/BoS/MoM-1* **Date:** *23.07.2024*

## Board of Studies (BoS) Minutes of Meeting

### *23rd JULY, 2024 at 2:00 p.m.*

**Agenda:**

1. Introducing the members of Board of Studies.
2. Discussion on I year semester wise course structure for B. Tech (Computer Science & Engineering) and M. Tech (Computer Science & Engineering) Programs from the academic year 2024 – 25.
3. Discussion on preparation of course syllabus in accordance to JNTUK course structure and syllabus.
4. Discussion on Academic Regulations of both UG & PG Programs.
5. Discussion and finalizing the model paper and paper setters for the academic year 2024 – 25.
6. To discuss the Certificate Courses to be done by the students & staff.
7. To discuss the functional MoUs with the industries.
8. To discuss the feasibility of developing collaborations with other institutions.
9. To evolve a plan of action for consultancy activities.
10. Any other agenda with the permission of the chair.

The Board of Studies meeting held on 23rd July, 2024 at 2:00 p.m. through online mode with the welcome speech by Dr. G. SATYANARAYANA, Professor & Head of the department / Chairperson of BoS.

The points mentioned in the agenda were discussed, and the details are listed below:

**Agenda No. 1:** The Board of Studies (BoS) for Computer Science and Engineering department is constituted by the chairperson as per the guidelines of Academic Council. The Chairperson introduced all nominated Board of Studies members of department of Computer Science & Engineering to each other.

**Agenda No. 2, 3, 4:** The BoS members discussed on the agenda 2, 3, 4 and made the following resolutions.

**Resolution on Agenda 2, 3, 4:**

The members of the Board of Studies (BoS) and the chairperson made the decision to follow the JNTUK, Kakinada R-24 regulations for B. Tech Program and R-19 regulations for M. Tech Program that were put into place for first-year students for the academic year 2024-2025. This included adhering the academic regulations, syllabi, model papers,

and the evaluation procedure for semester-end examinations (SEE) and continuous internal evaluation (CIE).

**Agenda No.5:** The BoS members discussed on the agenda 5 and made the following resolutions.

**Resolution on Agenda 5:**

As it is decided to adhere JNTUK, Kakinada R-24 model paper without any change in agenda 4. The chairperson of the BoS discussed with the members about the composition of the paper setters total 5 members for both UG and PG Programs for the academic year 2024-25 i.e., one (1) from National Institute of Technology (NIT), one (1) from Government Universities, one (1) from Private / Deemed Universities, two (2) from Autonomous Colleges. All the members accepted unanimously and list is finalized and enclosed in annexure.

**Agenda No.6:** The BoS members discussed on the agenda 6 and made the following resolutions.

**Resolution on Agenda 6:**

To bridge the gap to first year students from their previous learning method to problem solving method it is unanimously accepted to introduce the certificate courses to the student to improve their programming skills.

Also accepted to introduce the certificate courses for the faculty members to enrich their knowledge levels in latest technological areas.

**Agenda No.7:** The BoS members discussed on the agenda 7 and made the following resolutions.

**Resolution on Agenda 7:**

To strengthen the students' skills conducting Guest Lectures, Workshops, Seminars and other co-curricular activities MoUs with reputed organizations are required. Hence the BoS members are agreed and advised to improve MoUs with reputed organizations/industries.

**Agenda No.8:** The BoS members discussed on the agenda 8 and made the following resolutions.

**Resolution on Agenda 8:**

To strengthen the department need of developing collaborations with other institutions the BoS members advised to improve the collaboration with reputed institutions towards increasing technical workshops and FDP's.

**Agenda No.9:** The BoS members discussed on the agenda 9 and made the following resolutions.

**Resolution on Agenda 9:**

To BoS members agree and advised to plan consultancy activities for the development of department.

**Agenda No.10:** Hence there is no other agenda for discussion; hence the chairperson advised to conclude the meeting with the permission of all the BoS members.

The entire meeting is recorded as video and stored in the department.

The meeting concluded at 03:00 p.m. with a vote of thanks by Dr. G. SATYANARAYANA, Chairperson of BoS / Professor & Head of the department.

24/7/2024

**Chairperson Board of Studies / Head of the Department**

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

**Copy to:**

1. Principal, DNRCET(A),
2. Dean, Academics, DNRCET(A),
3. Controller of Examinations, DNRCET(A),
4. Circulation among the faculty members, CSE Department, DNRCET(A),
5. File.

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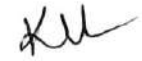
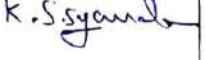
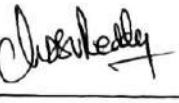
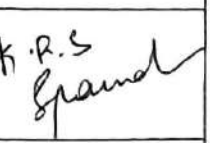
## Department of Computer Science & Engineering

**Place:** Bhimavaram,
**Date:** 23.07.2024

The following members of Board of Studies are attended for the meeting held on 23.07.2024.

| S. No. | Category | Name | Position | Signature |
|---|---|---|---|---|
| 1 | Chairperson | Dr. G. Satyanarayana | Professor & HoD<br>Department of CSE<br>DNRCET, Bhimavaram | |
| 2 | Expert Nominated by Vice-Chancellor | Dr. N. Ramakrishnaiah | Professor,<br>CSE Department,<br>UCEK, JNTUK Kakinada,<br>Kakinada – 533003. | |
| 3 | Subject Experts from outside Parent Universities | Dr. V. Chandrasekhar, | Professor & HoD,<br>Department of CSE,<br>S. R. K. R. Engineering College (A),<br>BHIMAVARAM-534202. | Attended online |
| 4 | | Dr. P. Kiran Sree, | Professor & HoD,<br>Department of CSE,<br>Shri Vishnu Engineering College for Women (A),<br>Bhimavaram,<br>W.G. Dist., A.P. | Attended online |
| 5 | Member (Industrial Expert) | Rajiv Chand Kakarla | CEO, Amaravathi Software Innovations,<br>Rajahmundry,<br>East Godavari District,<br>A.P., | Attended online |
| 6 | Faculty Members | Mr. K. T. V. Subba Rao | Assistant Professor,<br>Department of CSE,<br>DNRCET, Bhimavaram. | |
| 7 | | Mr. K. S. R. Prasad | Assistant Professor,<br>Department of CSE,<br>DNRCET, Bhimavaram. | |
| | | Mr. B. Nandan Kumar | Assistant Professor,<br>Department of CSE,<br>DNRCET, Bhimavaram. | |

| | | | | |
|---|---|---|---|---|
| | | Mr. L. Bujji Babu | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mr. K. S. H. Prasanna Kumar | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mrs. N. Bharathi | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mr. L. Dhanaratna Kishore | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mr. K. Venkat Chandran | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mr. G. V. Sriram | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mrs. M. Mounica Devi | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mrs. P. Lalitha Rajeswari | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mr. K. Sarat Chandra | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Ms. K. Siva Syamala | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mrs. M. V. S. K. Prabhavathi | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mr. Ch. Venkat Reddy | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mrs. M. P. V. Harika | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mrs. K. R. S. Spandana | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mrs. M. Bhargavi | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |
| | | Mr. B. Suryanarayana Murthy | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. |  |

| | | | | |
|---|---|---|---|---|
| | | Mr. K. Rambabu | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. P. Sirish Kumar | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. G. Rajendra Kumar | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. B. Prasanna Kumar | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. K. Radha Krishna | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. G. Sai Krishna | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. Areti Mohan Manidranadh | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mrs. M. Rama Rajeswari | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Ms. D. Phani Sri Lakshmi | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. T. Venkatesh | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| | | Mr. Ch. Somesh Kumar | Assistant Professor, Department of CSE, DNRCET, Bhimavaram. | |
| 8 | Member (College alumni) | K. S. Sai Kumar (219P1D5804) | Assistant Professor, Department of CE, VIT, Bhimavaram. | |

**Agenda:**

1. Introducing the members of Board of Studies.
2. Discussion on I year semester wise course structure for B. Tech (Computer Science & Engineering) and M. Tech (Computer Science & Engineering) Programs from the academic year 2024 – 25.
3. Discussion on preparation of course syllabus in accordance to JNTUK course structure and syllabus.
4. Discussion on Academic Regulations of both UG & PG Programs.
5. Discussion and finalizing the model paper and paper setters for the academic year 2024 – 25.

6. To discuss the Certificate Courses to be done by the students & staff.
7. To discuss the functional MoUs' with the industries.
8. To discuss the feasibility of developing collaborations with other institutions.
9. To evolve a plan of action for consultancy activities.
10. Any other agenda with the permission of the chair.

22/7/24

**Chairperson Board of Studies /**
**Head of the Department**

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

ANNEXURE - H


# D. N. R. COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

*(Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada)*

BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202

*Ph: 08816-221238, Email: dnrcet@gmail.com , Website: https://dnrcet.org*

Accredited with A++ Grade with 3.73/4 CGPA by NAAC and Accredited by NBA (B. Tech- CSE, ECE & EEE)


## Department of Computer Science & Engineering

### Course Content for Certificate Course

| | | | |
|---|---|---|---|
| Course Name | **Computer System Fundamentals** | Duration | **8 Weeks** |
| Course Type | **Core** | Category | **CSE** |
| Credit Points | **4** | Level | **Undergraduate** |

**Course Structure:**

Week 1: Introduction to Computer Systems

Week 2: Storage Organization

Week 3: Software and Hardware

Week 4: Fundamental of Operating System

Week 5: Introduction to DBMS

Week 6: Fundamentals of Data Communication

Week 7: Introduction to Communication Devices

Week 8: Information Security Concerns

Chairperson Board of Studies /
Head of the Department

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

# D.N.R. COLLEGE OF ENGINEERING &TECHNOLOGY

Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada
Accredited with A++ Grade by NAAC
Accredited by NBA (B. Tech – CSE, ECE & EEE)
Balusumudi, Bhimavaram – 534 202. W.G. Dist., (A.P.)
Fax No: 08816-221236, Phone: 08816-221237, 38, Email: dnrcet@gmail.com., web: www.dnrcet.org


**Name of the Department: Computer Science and Engineering**

**Board of Studies:**

| Description | Designation in Committee | Name(s) of the Member(s)/Nominee(s) |
|---|---|---|
| Head of the Department concerned | **Chairperson** | **Dr. G. SATYANARAYANA**<br>Professor<br>Department of Computer Science and Engineering<br>DNR College of Engineering and Technology,<br>Balusumudi, Bhimavaram – 543202,<br>West Godavari District, Andhra Pradesh. |
| All faculty members of the Department | **Member** | Dr. G. Satyanarayana<br>Mr. B. Nandan Kumar<br>Mr. K. S. R. Prasad<br>Mr. L. Bujji Babu<br>Mr. K. T. V. Subba Rao<br>Mr. K. S. H. Prasanna Kumar<br>Mrs. N. Bharathi<br>Mr. L. Dhanaratna Kishore<br>Mr. K. Venkat Chandran<br>Mr. G. V. Sriram<br>Mrs. M. Mounica Devi<br>Mrs. P. Lalitha Rajeswari<br>Mr. K. Sarat Chandra<br>Ms. K. Siva Syamala<br>Mrs. M. V. S. K. Prabhavathi<br>Mr. Ch. Venkat Reddy<br>Mrs. M. P. V. Harika<br>Mrs. M. Bhargavi<br>Mrs. K. R. S. Spandana<br>Mr. B. Suryanarayana Murthy<br>Mr. K. Rambabu<br>Mr. P. Sirish Kumar<br>Mr. G. Rajendra Kumar<br>Mr. B. Prasanna Kumar<br>Mr. K. Radha Krishna<br>Mr. G. Sai Krishna<br>Mr. Areti Mohan Manidranadh<br>Mrs. M. Rama Rajeswari<br>Ms. D. Phani Sri Lakshmi<br>Mr. T. Venkatesh<br>Mr. Ch. Somesh Kumar |

| | | |
|---|---|---|
| Subject experts from outside the parent University are to be nominated by the Academic Council. | **Member (Subject experts from outside the parent University)** | 1 **Dr. V. Chandrasekhar**<br>Professor & HoD<br>Department of Computer Science & Engineering<br>S. R. K. R. Engineering College (A)<br>BHIMAVARAM 534202.<br>chandrashekarch@gmail.com<br>9440351562<br>2. **Dr. Kiran Sree**<br>Professor & HoD<br>Department of Computer Science &Engineering,<br>Shri Vishnu Engineering College for Women (A),<br>Bhimavaram, W.G. Dist., A.P.<br>drkiransree@gmail.com<br>9493050794 |
| One expert is to be nominated by the Vice-Chancellor from a panel of six recommended by the Autonomous College Principal | **Member (University Nominee)** | **Dr. N. Ramakrishnaiah**<br>Professor<br>Department of Computer Science & Engineering<br>University College of Engineering Kakinada<br>JNTUK, Kakinada.<br>nrkrishna27@jntucek.ac.in<br>9652730019 |
| One representative from industry/corporate sector/allied areas to be nominated by the principal | **Member (Industrial Expert)** | **Rajiv Chand Kakarla**<br>CEO, Amaravathi Software Innovations<br>Rajahmundry.<br>rajivnani69@gmail.com<br>9168999618 |
| One member of the College alumni to be nominated by the principal | **Member (College alumni)** | **K. S. Sai Kumar**<br>**(219P1D5804)**<br>saikumar.k@vishnu.edu.in<br>7661078048 |
| Experts from outside the Autonomous College, whenever special courses of studies are to be formulated, to be nominated by the principal | **Member (Experts from outside the Autonomous College)** | **Not Applicable** |

**Term:** The term of the nominated members shall be three years. Meetings: Meetings of the Board of Studies shall be held at least once every six months.

**Functions:**
The Board of Studies shall recommend the following to the Academic Council:
(a) Courses of studies;
(b) Measures for the improvement of the standards of teaching and research;
(c) Any other academic matter

**Head of the Department**
**Computer Science and Engineering**

Head of the Department
Department of Computer Science & Engineering
S.R.K.R. College of Engineering & Technology
BHIMAVARAM-534 202.

# D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY
## AUTONOMOUS

Approved by AICTE, New Delhi & Permanently Affiliated to JNTUK, Kakinada
Accredited with A$^{++}$ Grade by NAAC & Accredited by NBA (B. TECH – CSE, ECE & EEE)
Ph: 08816-221238 Email: dnrcet@gmail.com website: https://dnrcet.org


**Ref:DNRCET/ Autonomous/BOS/Nomination/2024-25/25** **Date: 17-07-2024**

To

Dr. Ch. Chandrasekhar,

Professor & HoD, Department of Computer Science & Engineering.

S. R. K. R. Engineering College (A), BHIMAVARAM - 534202.

Sir,

Sub: D.N.R.College of Engineering & Technology, (Autonomous), Bhimavaram – Constitution of Board of Studies – Appointment of Experts from Acdemia / Industry as members of the respective Board of Studies for a tenure of 3 years (2024-25 to 2026-27) – Reg.

Ref: 1. UGC letter No. F-2-10/2023(AC-Policy) dated 10-07-2024.
2. JNTUK Letter No. DAP/DNRCE&T(9P)/BoS/2024, Dt:15-07-2024.

****

I am pleased to inform you that the University Grants Commission (UGC), New Delhi, and JNTUK, Kakinada, have conferred Autonomous Status to D.N.R. College of Engineering & Technology (Autonomous), Bhimavaram,

In the light of the facts stated above, you are nominated as member of the Board of Studies of CSE of D.N.R. College of Engineering & Technology, (Autonomous), Bhimavaram for a tenure of 3 years (2024-25 to 2026-27). So, you are requested to attend the meeting of Board of Studies of CSE as member hereafter.

Your vast experience and deep knowledge will be an addition to the Board of Studies of CSE department. Your insights and contributions will be crucial in shaping the curriculum and enhancing the academic standards of our CSE program.

We are confident that your involvement will greatly benefit stakeholders, fostering an environment of excellence and innovation. We look forward to your guidance and support in our ongoing efforts to achieve academic distinction.

Thank you for accepting this responsibility. We honestly appreciate your willingness to contribute your expertise to our academic endeavors.

Yours sincerely,

PRINCIPAL

D.N.R College of Engg. & Tech.
BHIMAVARAM-534 202.

# D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY
## AUTONOMOUS

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Accredited with A++ Grade by NAAC & Accredited by NBA (B. TECH – CSE, ECE & EEE)
Ph: 08816-221238 Email: dnrcet@gmail.com website: https://dnrcet.org

**Ref:DNRCET/ Autonomous/BOS/Nomination/2024-25/27** **Date: 17-07-2024**

To
Rajiv Chand Kakarla,
CEO, Amaravathi Software Innovations,
Rajahmundry, E.G. Dist., Andhra Pradesh.

Sir,

Sub: D.N.R.College of Engineering & Technology, (Autonomous), Bhimavaram – Constitution of Board of Studies – Appointment of Experts from Acdemia / Industry as members of the respective Board of Studies for a tenure of 3 years (2024-25 to 2026-27) – Reg.

Ref: 1. UGC letter No. F-2-10/2023(AC-Policy) dated 10-07-2024.
2. JNTUK Letter No. DAP/DNRCE&T(9P)/BoS/2024, Dt:15-07-2024.

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Yours sincerely,

PRINCIPAL
D.N.R.College of Engg. & Tech.
BHIMAVARAM-534 202.

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Ph: 08816-221238 Email: dnrcet@gmail.com website: https://dnrcet.org


**Ref:DNRCET/ Autonomous/BOS/Nomination/2024-25/26** **Date: 17-07-2024**

To

Dr. Kiran Sree Professor & HoD, Department of Computer Science &Engineering,
Shri Vishnu Engineering College for Women (A),
Bhimavaram, W.G. Dist., A.P.

Sir,

Sub: D.N.R.College of Engineering & Technology, (Autonomous), Bhimavaram – Constitution of Board of Studies – Appointment of Experts from Acdemia / Industry as members of the respective Board of Studies for a tenure of 3 years (2024-25 to 2026-27) – Reg.

Ref: 1. UGC letter No. F-2-10/2023(AC-Policy) dated 10-07-2024.
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Yours sincerely,

**PRINCIPAL**
D.N.R.College of Engg. & Tech.
BHIMAVARAM-534 202.

**D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY**
**(Autonomous)**
**BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202**

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**
**I B.Tech I-Sem**

| B.Tech. – I Year I Semester (for Group-A Branches) S.No. | Category | Title | L/D | T | P | Cre s |
|---|---|---|---|---|---|---|
| 1 | BS&H | Communicative English | 2 | 0 | 0 | 2 |
| 2 | BS&H | Engineering Chemistry/ Chemistry/Fundamental Chemistry | 3 | 0 | 0 | 3 |
| 3 | BS&H | Linear Algebra & Calculus | 3 | 0 | 0 | 3 |
| 4 | Engineering Science | Basic Civil & Mechanical Engineering | 3 | 0 | 0 | 3 |
| 5 | Engineering Science | Introduction to Programming | 3 | 0 | 0 | 3 |
| 6 | BS&H | Communicative English Lab | 0 | 0 | 2 | 1 |
| 7 | BS&H | Engineering Chemistry/ Chemistry/Fundamental Chemistry Lab | 0 | 0 | 2 | 1 |
| 8 | Engineering Science | Engineering Workshop | 0 | 0 | 3 | 1.5 |
| 9 | Engineering Science | Computer Programming Lab | 0 | 0 | 3 | 1.5 |
| 10 | BS&H | Health and wellness, Yoga and Sports | - | - | 1 | 0.5 |
| **Total** | **14** | **00** | **11** | | | **19.5** |

24/7/24
Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

# D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY
## (Autonomous)
## BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202

## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
## I B.Tech II-Sem

**B.Tech. – I Year II Semester**

| S.No. | Category | Title | L/D | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | BS&H | Engineering Physics | 3 | 0 | 0 | 3 |
| 2 | BS & H | Differential Equations & Vector Calculus | 3 | 0 | 0 | 3 |
| 3 | Engineering Science | Basic Electrical and Electronics Engineering | 3 | 0 | 0 | 3 |
| 4 | Engineering Science | Engineering Graphics | 1 | 0 | 4 | 3 |
| 5 | Engineering Science | IT Workshop | 0 | 0 | 2 | 1 |
| 6 | Professional Core | Data Structures / Electrical Circuit Analysis – I(Branch specific) | 3 | 0 | 0 | 3 |
| 7 | BS&H | Engineering Physics Lab | 0 | 0 | 2 | 1 |
| 8 | Engineering Science | Electrical and Electronics Engineering Workshop | 0 | 0 | 3 | 1.5 |
| 9 | Professional Core | Data Structures Lab / Electrical Circuit Analysis – I Lab | 0 | 0 | 3 | 1.5 |
| 10 | | NSS/NCC/Scouts & Guides/Community Service | - | - | 1 | 0.5 |
| **Total** | | | **13** | **00** | **15** | **20.5** |

24.7.24
Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

Course Code: DR24051101

**D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY (A)** | **DR 24**

**I B.Tech. I Semester MODEL QUESTION PAPER**

**INTRODUCTION TO PROGRAMMING**

**AIDS, AIML, CSBS, CSG, CSE, CSIT, CIC & IT**

**Time: 3 Hrs.** **Max. Marks: 70 M**

Answer Question No.1 compulsorily

Answer **ONE Question** from **EACH UNIT**

Assume suitable data if necessary

**10 x 2 = 20Marks**

| | | | CO | KL | M |
|---|---|---|---|---|---|
| 1. | a). | Find the output of the following code:<br>#include<stdio.><br>int main(void)<br>{<br>int i=1,j=0,k;<br>k=(i&j)+(i\|j)+(i^i)+!i+j;<br>printf(%d",k);<br>return 0;<br>} | 1 | 3 | 2 |
| | b). | Differentiate pre and post increment with an example. | 1 | 3 | 2 |
| | c). | Show an example for continue statement in a loop. | 2 | 2 | 2 |
| | d). | Give an example for event-controlled loop. | 2 | 2 | 2 |
| | e). | Write a code snippet to print alternate elements of a one-dimensional array of n integers. | 3 | 2 | 2 |
| | f). | Apply nested loops and write a code snippet to find the sum of all elements of a two-dimensional array of size n x m. | 3 | 3 | 2 |
| | g). | State the disadvantages of pointers. | 4 | 1 | 2 |
| | h). | Identify the operations are not allowed on pointers? | 4 | 2 | 2 |
| | i). | Write a macro to find the largest of two numbers. Use conditional operator. | 5 | 3 | 2 |
| | j). | Find the output of the following code: | 5 | 3 | 2 |

```
#include <stdio.h>
int main(void) {
    FILE *f = fopen("file","w");
    int i;
    fputs("12A",f);
    fclose(f);
    f = fopen("file","r");
    fscanf(f,"%d",&i);
    fclose(f);
    printf("%d",i);
    return 0;
}
```

5 x 10 =50Marks

| | | | CO | KL | M |
|---|---|---|---|---|---|
| | | **UNIT-1** | | | |
| 2. | a). | Draw a flow chart to find the largest of three numbers. | 1 | 3 | 5 |
| | b). | Explain operator precedence and associativity with two examples. | 1 | 3 | 5 |
| | | **OR** | | | |
| 3. | a). | List all the bitwise operators and give one example for each with numerical values represented in binary. | 1 | 3 | 5 |
| | b). | Write a C program to calculate simple and compound interest. Given the term in months. | 1 | 3 | 5 |
| | | | | | |
| | | **UNIT-2** | | | |
| 4. | a). | Differentiate while and do-while loops with an example for each. | 2 | 3 | 5 |
| | b). | Write a C program to check if the given number is prime or not. Use for loop. | 2 | 3 | 5 |
| | | **OR** | | | |
| 5. | a). | Write a C program to find the sum of individual digits of a given integer number. | 2 | 3 | 5 |
| | b). | Use switch case to find the grade of a student given the marks. Show five grades. A, B, C, D, E and F for fail. If the marks are less than 40 then the grade is fail. | 2 | 3 | 5 |
| | | | | | |
| | | **UNIT-3** | | | |
| 6. | a). | Write a C program to sort the given array using bubble sort. | 3 | 3 | 5 |
| | b). | List any five string handling functions and show its usage. | 3 | 2 | 5 |
| | | **OR** | | | |
| 7. | a). | Write a C program to implement string concatenation of two strings str1 and str2, store the result in str3. (Do not use string function) | 3 | 3 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| | b). | Develop C program to find the transpose of a matrix. | 3 | 3 | 5 |
| | | | | | |
| | | **UNIT-4** | | | |
| 8. | a). | Explain about structures and pointers. How can you access elements of a structure using its pointer notation. Discuss with an example. | 4 | 3 | 5 |
| | b). | Differentiate structures and unions. | 4 | 2 | 5 |
| | | **OR** | | | |
| 9. | a). | Apply bit fields and write a C program to demonstrate its use. | 4 | 3 | 5 |
| | b). | Write a C program to copy one structure variable to another structure of the same type | 4 | 3 | 5 |
| | | | | | |
| | | **UNIT-5** | | | |
| 10. | a). | Differentiate malloc and calloc with an example program. | 5 | 3 | 5 |
| | b). | Explain the storage classes in C. | 5 | 2 | 5 |
| | | **OR** | | | |
| 11. | a). | Write a C program to copy the contents of file1 to file2. | 5 | 3 | 5 |
| | b). | Discuss the random file access functions in C. | 5 | 2 | 5 |

**CO-COURSE OUTCOME** **KL-KNOWLEDGE LEVEL** **M-MARKS**



NOTE: Questions can be given as **a, b** splits or as a single Question for 10 marks

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

Course Code: DR24051201

**D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY (A)** | **DR 24**

**I B.Tech. II Semester MODEL QUESTION PAPER**

**DATA STRUCTURES**

**AIDS, AIML, CSBS, CSG, CSE, CSIT, CIC & IT**

**Time: 3 Hrs.** **Max. Marks: 70 M**

Answer Question No.1 compulsorily

Answer **ONE Question** from **EACH UNIT**

Assume suitable data if necessary

**10 x 2 = 20 Marks**

| | | | CO | KL | M |
|---|---|---|---|---|---|
| 1. | a). | Explain about different types of Data structures. | 1 | 2 | 2 |
| | b). | Explain about Data structure operations. | 1 | 2 | 2 |
| | c). | Write applications of singly linked list. | 2 | 2 | 2 |
| | d). | Write a syntax of create a node in doubly linked list. | 2 | 2 | 2 |
| | e). | Explain about representation of stack. | 3 | 2 | 2 |
| | f). | Construct prefix expression from the following infix expression (A + B) * (C-D). | 3 | 2 | 2 |
| | g). | Write about disadvantage of Queue. | 4 | 2 | 2 |
| | h). | Write applications of Deques | 4 | 2 | 2 |
| | i). | Explain about tree traversal | 5 | 2 | 2 |
| | j). | Explain about collision. | 5 | 2 | 2 |

**5 x 10 = 50 Marks**

| | | UNIT-1 | CO | KL | M |
|---|---|---|---|---|---|
| 2. | a). | Explain time and space complexity of Algorithm | 1 | 2 | 5 |
| | b). | Apply selection sort algorithm to sort the following list: 10, 6, 3, 7, 17, 26, 56, 32, 72, 2, 23, 5, 77 | 1 | 3 | 5 |
| | | **OR** | | | |
| 3. | a). | Explain about Linear and Non-linear data structures | 1 | 2 | 5 |
| | b). | Write a recursive algorithm for Binary search and apply algorithm to search the element 87 in the list 2, 5, 6, 12, 23, 33, 44, 54, 65. | 1 | 3 | 5 |
| | | | | | |
| | | **UNIT-2** | | | |
| 4. | a). | Develop a procedure to Delete an element at given position in singly linked list | 2 | 3 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| | b). | explain polynomial representation using linked list with an example | 2 | 2 | 5 |
| | | **OR** | | | |
| 5. | a). | Develop an algorithm to insert an element at end in doubly linked list. | 2 | 3 | 5 |
| | b). | Differentiate the array and linked list | 2 | 3 | 5 |
| | | | | | |
| | | **UNIT-3** | | | |
| 6. | a). | Develop primitive operation functions that performed on Stack using array | 3 | 3 | 5 |
| | b). | Construct postfix expression from the following infix expression ((M+ N) * O - (P - Q)) $ (R + S) using stack. | 3 | 3 | 5 |
| | | **OR** | | | |
| 7. | a). | Write an algorithm for postfix evaluation. Apply algorithm to evaluate the following postfix expression 4 3 1- - 2 5 1 / + * 7 / 7 + | 3 | 3 | 5 |
| | b). | Discuss various steps for reversing list using stack. | 3 | 2 | 5 |
| | | | | | |
| | | **UNIT-4** | | | |
| 8. | a). | Develop primitive operation functions that performed on Queue using linked list | 4 | 3 | 5 |
| | b). | Develop procedure to Delete an element to the circular queue | 4 | 3 | 5 |
| | | **OR** | | | |
| 9. | a). | Develop primitive operation functions that performed on double-ended queue. | 4 | 3 | 5 |
| | b). | Differentiate the Queue and Stack. | 4 | 3 | 5 |
| | | | | | |
| | | **UNIT-5** | | | |
| 10. | a). | Build a BST for the following list of elements 54,84,26,39,98, 62,9,18, 42,53,64,73,68,71,65, and perform tree traversals for above list | 5 | 3 | 10 |
| | | **OR** | | | |
| 11. | a). | Explain about tree representations | 5 | 2 | 5 |
| | b). | Using linear probing insert the keys 27,72,63,42,36,18,29, and 101 into the table with hash size=10 | 5 | 3 | 5 |

**CO-COURSE OUTCOME** **KL-KNOWLEDGE LEVEL** **M-MARKS**

NOTE: Questions can be given as **a, b** splits or as a single Question for 10 marks

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# INTRODUCTION TO PROGRAMMING

**(Common to All branches of Engineering)**

**Course Objectives:**

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects.

**Course Outcomes:** A student after completion of the course will be able to

CO1: Understand basics of computers, the concept of algorithm and algorithmic thinking.
CO2: Analyse a problem and develop an algorithm to solve it.
CO3: Implement various algorithms using the C programming language.
CO4: Understand more advanced features of C language.
CO5: Develop problem-solving skills and the ability to debug and optimize the code.

**UNIT I Introduction to Programming and Problem Solving**

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program-Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

**UNIT II Control Structures**

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue.

**UNIT III Arrays and Strings**

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

**UNIT IV Pointers & User Defined Data types**

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

**UNIT V Functions & File Handling**

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

**Note:** The syllabus is designed with C Language as the fundamental language of implementation.

**Textbooks:**


1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996


**Reference Books:**


1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.

2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

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# COMPUTER PROGRAMMING LAB

**(Common to All branches of Engineering)**

**Course Objectives:**

The course aims to give students hands – on experience and train them on the concepts of the C-programming language.

**Course Outcomes:**

CO1: Read, understand, and trace the execution of programs written in C language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers.
CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

**UNIT I**

**WEEK 1**

**Objective:** Getting familiar with the programming environment on the computer and writing the first program.

**Suggested Experiments/Activities:**

**Tutorial 1:** Problem-solving using Computers.

**Lab1:** Familiarization with programming environment

i Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii Exposure to Turbo C, gcc
iii Writing simple programs using printf(), scanf()

**WEEK 2**

**Objective:** Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

**Suggested Experiments /Activities:**

**Tutorial 2:** Problem-solving using Algorithms and Flow charts.

**Lab 1:** Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

i Sum and average of 3 numbers
ii Conversion of Fahrenheit to Celsius and vice versa
iii Simple interest calculation

**WEEK 3**
Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.
**Suggested Experiments/Activities:**

**Tutorial 3:** Variable types and type conversions:
**Lab 3:** Simple computational problems using arithmetic expressions.
i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

**UNIT II**

**WEEK 4**
**Objective:** Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.
**Suggested Experiments/Activities:**

**Tutorial4:** Operators and the precedence and as associativity:
**Lab4:** Simple computational problems using the operator' precedence and associativity
Evaluate the following expressions. A+B*C+(D*E) + F*G
A/B*C-B+A*D/3
A+++B---A
J= (i++) + (++i)

Find the maximum of three numbers using conditional operator
Take marks of 5 subjects in integers, and find the total, average in float

**WEEK 5**
**Objective:** Explore the full scope of different variants of "if construct" namely if-else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".
**Suggested Experiments/Activities:**

**Tutorial 5:** Branching and logical expressions:
**Lab 5**: Problems involving if-then-else structures.

i Write a C program to find the max and min of four numbers using if-else.
ii Write a C program to generate electricity bill.
iii Find the roots of the quadratic equation.
iv Write a C program to simulate a calculator using switch case.
v Write a C program to find the given year is a leap year or not.

**WEEK 6**
**Objective:** Explore the full scope of iterative constructs namely while loop, do-while loop and

for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

**Suggested Experiments/Activities:**

**Tutorial 6:** Loops, while and for loops

**Lab 6:** Iterative problems e.g., the sum of series

i Find the factorial of given number using any loop.

ii Find the given number is a prime or not.

iii Compute sine and cos series

iv Checking a number palindrome

v Construct a pyramid of numbers.

**UNIT III**

**WEEK 7:**

**Objective:** Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

**Suggested Experiments/Activities:**

**Tutorial 7:** 1 D Arrays: searching.

**Lab 7:**1D Array manipulation, linear search

i Find the min and max of a 1-D integer array.

ii Perform linear search on1D array.

iii The reverse of a 1D integer array

iv Find 2's complement of the given binary number.

v Eliminate duplicate elements in an array.

**WEEK 8:**

**Objective:** Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

**Suggested Experiments/Activities:**

**Tutorial 8:** 2 D arrays, sorting and Strings.

**Lab 8:** Matrix problems, String operations, Bubble sort

i Addition of two matrices

ii Multiplication two matrices

iii Sort array elements using bubble sort

iv Concatenate two strings without built-in functions

v Reverse a string using built-in and without built-in string functions

**UNIT IV**

**WEEK 9:**

**Objective:** Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array

and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

**Suggested Experiments/Activities:**

**Tutorial 9:** Pointers, structures and dynamic memory allocation

**Lab 9:** Pointers and structures, memory dereference.

i Write a C program to find the sum of a 1D array using malloc()

ii Write a C program to find the total, average of n students using structures

iii Enter n students data using calloc() and display failed students list

iv Read student name and marks from the command line and display the student details along with the total.

v Write a C program to implement realloc()

**WEEK 10:**

**Objective:** Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

**Suggested Experiments/Activities:**

**Tutorial 10:** Bitfields, Self-Referential Structures, Linked lists

**Lab10 :** Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

i Create and display a singly linked list using self-referential structure.

ii Demonstrate the differences between structures and unions using a C program.

iii Write a C program to shift/rotate using bitfields.

iv Write a C program to copy one structure variable to another structure of the same type.

**UNIT V**

**WEEK 11:**

**Objective:** Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

**Suggested Experiments/Activities:**

**Tutorial 11:** Functions, call by value, scope and extent,

**Lab 11:** Simple functions using call by value, solving differential equations using Eulers theorem.

i Write a C function to calculate NCR value.

ii Write a C function to find the length of a string.

iii Write a C function to transpose of a matrix.

iv Write a C function to demonstrate numerical integration of differential equations using Euler's method

**WEEK 12:**

**Objective:** Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

**Suggested Experiments/Activities:**

**Tutorial 12:** Recursion, the structure of recursive calls
**Lab 12:** Recursive functions

i Write a recursive function to generate Fibonacci series.
ii Write a recursive function to find the lcm of two numbers.
iii Write a recursive function to find the factorial of a number.
iv Write a C Program to implement Ackermann function using recursion.
v Write a recursive function to find the sum of series.

**WEEK 13:**
**Objective:** Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers
**Suggested Experiments/Activities:**

**Tutorial 13:** Call by reference, dangling pointers
**Lab 13:** Simple functions using Call by reference, Dangling pointers.

i Write a C program to swap two numbers using call by reference.
ii Demonstrate Dangling pointer problem using a C program.
iii Write a C program to copy one string into another using pointer.
iv Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

**WEEK14:**
**Objective:** To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.
**Suggested Experiments/Activities:**

**Tutorial 14:** File handling
**Lab 14:** File operations

i Write a C program to write and read text into a file.
ii Write a C program to write and read text into a binary file using fread() and fwrite()
iii Copy the contents of one file to another file.
iv Write a C program to merge two files into the third file using command-line arguments.
v Find no. of lines, words and characters in a file
vi Write a C program to print last n characters of a given file.

**Textbooks:**

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

**Reference Books:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India

2.C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

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# IT WORKSHOP

**(Common to all branches of Engineering)**

**Course Objectives:**

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

**Course Outcomes:**

CO1: Perform Hardware troubleshooting.
CO2: Understand Hardware components and inter dependencies.
CO3: Safeguard computer systems from viruses/worms.
CO4: Document/ Presentation preparation.
CO5: Perform calculations using spreadsheets.

**PC Hardware** & Software Installation

**Task 1:** Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

**Task 2:** Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

**Task 3:** Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

**Task 4:** Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

**Task 5:** Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

**Internet & World Wide Web**

**Task1:** Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

**Task 2:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

**Task 3**: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

**Task 4:** Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

**LaTeX and WORD**

**Task 1 –** Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

**Task 2:** Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

**Task 3:** Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

**Task 4:** Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

**EXCEL**

**Excel Orientation:** The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

**Task 1:** Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

**Task 2:** Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

**LOOKUP/VLOOKUP**

**Task 3**: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

**POWER POINT**

**Task 1:** Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

**Task 2:** Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

**Task 3:** Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

**AI TOOLS – ChatGPT**

**Task 1:** Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

**Task 2:** Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

**Task 3:** Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

**Reference Books:**

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition

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# DATA STRUCTURES

(Common to CSE, IT & allied branches)

**Course Objectives:**

- To provide the knowledge of basic data structures and their implementations.
- To understand importance of data structures in context of writing efficient programs.
- To develop skills to apply appropriate data structures in problem solving.

**Course Outcomes:** At the end of the course, Student will be able to

CO1: Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.

CO2: Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.

CO3: Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.

CO4: Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.

CO5: Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.

CO6: Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

**UNIT I**

**Introduction to Linear Data Structures:** Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Insertion Sort

**UNIT II**

**Linked Lists:** Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

**UNIT III**

**Stacks:** Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

**UNIT IV**

**Queues:** Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.

**Deques:** Introduction to deques (double-ended queues), Operations on deques and their applications.

**UNIT V**

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversal

**Hashing: Brief** introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

**Textbooks:**

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

**Reference Books:**

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick

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# DATA STRUCTURES LAB
(Common to CSE, IT & allied branches)

**Course Objectives:**
The course aims to strengthen the ability of the students to identify and apply the suitable data structure for the given real-world problem. It enables them to gain knowledge in practical applications of data structures.

**Course Outcomes:** At the end of the course, Student will be able to
CO1: Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
CO2: Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
CO3: Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
CO4: Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues and apply them appropriately to solve data management challenges.
CO5: Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

**List of Experiments:**

**Exercise 1: Array Manipulation**

i Write a program to reverse an array.
ii C Programs to implement the Searching Techniques – Linear & Binary Search
iii C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

**Exercise 2: Linked List Implementation**

i Implement a singly linked list and perform insertion and deletion operations.
ii Develop a program to reverse a linked list iteratively and recursively.
iii Solve problems involving linked list traversal and manipulation.

**Exercise 3: Linked List Applications**

i Create a program to detect and remove duplicates from a linked list.
ii Implement a linked list to represent polynomials and perform addition.
iii Implement a double-ended queue (deque) with essential operations.

**Exercise 4: Double Linked List Implementation**

i Implement a doubly linked list and perform various operations to understand its properties and applications.
ii Implement a circular linked list and perform insertion, deletion, and traversal.

**Exercise 5: Stack Operations**

i Implement a stack using arrays and linked lists.
ii Write a program to evaluate a postfix expression using a stack.
iii Implement a program to check for balanced parentheses using a stack.

**Exercise 6: Queue Operations**

i Implement a queue using arrays and linked lists.
ii Develop a program to simulate a simple printer queue system.
iii Solve problems involving circular queues.

**Exercise 7: Stack and Queue Applications**

i Use a stack to evaluate an infix expression and convert it to postfix.
ii Create a program to determine whether a given string is a palindrome or not.
iii Implement a stack or queue to perform comparison and check for symmetry.

**Exercise 8: Binary Search Tree**

i Implementing a BST using Linked List.
ii Traversing of BST.

**Exercise 9: Hashing**

i Implement a hash table with collision resolution techniques.
ii Write a program to implement a simple cache using hashing.

**Textbooks:**

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

**Reference Books:**

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick

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## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
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|---|---|---|---|---|---|---|---|
| 1 | MTCSE1101 | **Program Core-1**<br>Mathematical Foundations of Computer Science | PC | 3 | 0 | 0 | 3 |
| 2 | MTCSE1102 | **Program Core-2**<br>Advanced Data Structures & Algorithms | PC | 3 | 0 | 0 | 3 |
| 3 | MTCSE1103 | **Program Elective-1**<br>1. Big Data Analytics<br>2. Digital Image Processing<br>3. Advanced Operating Systems | PE | 3 | 0 | 0 | 3 |
| 4 | MTCSE1104 | **Program Elective-2**<br>1. Advanced Computer Networks<br>2. Internet of Things<br>3. Object Oriented Software Engineering | PE | 3 | 0 | 0 | 3 |
| 5 | MTCSE1105 | **Research Methodology and IPR** | CC | | | 0 | 2 |
| 6 | MTCSE1106 | **Laboratory-1**<br>Advanced Data Structures & Algorithms Lab | LB | 0 | 0 | 4 | 2 |
| 7 | MTCSE1107 | **Laboartory-2**<br>Advanced Computing Lab | LB | 0 | 0 | 4 | 2 |
| 8 | MTCSE1108 | **Audit Course-1*** | AC | 2 | 0 | 0 | 0 |
| | | **Total Credits** | | | | | 18 |

***Student has to choose any one audit course listed below.***

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## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
I M.Tech II-Sem

II SEMESTER

| S.No | Course Code | Courses | Cate Gory | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | MTCSE1201 | **Program Core-3**<br>Machine learning | PC | 3 | 0 | 0 | 3 |
| 2 | MTCSE1202 | **Program Core-4**<br>MEAN Stack Technologies | PC | 3 | 0 | 0 | 3 |
| 3 | MTCSE1203 | **Program Elective-3**<br>1. Advanced Databases and Mining<br>2. Ad Hoc & Sensor Networks<br>3. Soft Computing | PE | 3 | 0 | 0 | 3 |
| 4 | MTCSE1204 | **Program Elective-4**<br>1. Cloud Computing<br>2. Principles of computer security<br>3. High Performance Computing | PE | 3 | 0 | 0 | 3 |
| 5 | MTCSE1205 | **Laboratory-3**<br>Machine Learning with python lab | LB | 0 | 0 | 4 | 2 |
| 6 | MTCSE1206 | **Laboartory-4**<br>MEAN Stack Technologies Lab | LB | 0 | 0 | 4 | 2 |
| 7 | MTCSE1207 | **Mini Project with Seminar** | MP | 2 | 0 | 0 | 2 |
| 8 | MTCSE1208 | **Audit Course-2 *** | AC | 2 | 0 | 0 | 0 |
| **Total Credits** | | | | | | | 18 |

***Student has to choose any one audit course listed below.***

**Audit Course 1 & 2:**

1. English for Research Paper
5. Constitution of India

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# Mathematical Foundations of Computer Science (MTCSE1101)

**Course Objectives:** This course is aimed at enabling the students to

- To understand the mathematical fundamentals that is prerequisites for variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems bioinformatics, Machine learning.
- To develop the understanding of the mathematical and logical basis to many modern techniques in computer science technology like machine learning, programming language design, and concurrency.
- To study various sampling and classification problems.

**Course Outcomes:**

After the completion of the course, student will be able to

- To apply the basic rules and theorems of probability theory such as Baye's Theorem, to determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.
- Able to perform and analyze of sampling, means, proportions, variances and estimates the maximum likelihood based on population parameters.
- To learn how to formulate and test hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests.
- Design various ciphers using number theory.
- Apply graph theory for real time problems like network routing problem.

**UNIT I: Basic Probability and Random Variables:** Random Experiments, Sample Spaces Events, the Concept of Probability the Axioms of Probability, Some Important Theorems on Probability Assignment of Probabilities, Conditional Probability Theorems on Conditional Probability, Independent Events, Bayes Theorem or Rule. Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables

**UNIT II: Sampling and Estimation Theory:** Population and Sample, Statistical Inference Sampling With and Without Replacement Random Samples, Random Numbers Population Parameters Sample Statistics Sampling Distributions, Frequency Distributions, Relative Frequency Distributions, Computation of Mean, Variance, and Moments for Grouped Data. Unbiased Estimates and Efficient Estimates Point Estimates and Interval Estimates. Reliability Confidence Interval Estimates of Population Parameters, Maximum Likelihood Estimates

**UNIT III: Tests of Hypothesis and Significance**: Statistical Decisions Statistical Hypotheses. Null Hypotheses Tests of Hypotheses and Significance Type I and Type II Errors Level of Significance Tests Involving the Normal Distribution One-Tailed and Two-Tailed Tests P Value Special Tests of Significance for Large Samples Special Tests of Significance for Small Samples Relationship between Estimation Theory and Hypothesis Testing Operating Characteristic Curves. Power of a Test Quality Control Charts Fitting Theoretical Distributions to Sample Frequency Distributions, The Chi-Square Test for Goodness of Fit Contingency Tables Yates' Correction for Continuity Coefficient of Contingency.

**UNIT IV: Algebraic Structures and Number Theory:** Algebraic Systems, Examples, General [redacted] Theorem and Euler's Theorem)

**UNIT V: Graph Theory:** Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).

**Text Books:**

1. Foundation Mathematics for Computer Science, John Vince, Springer.
2. Probability & Statistics, 3rd Edition, Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-Hill Publishers
3. Probability and Statistics with Reliability, K. Trivedi, Wiley.
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, H. Rosen, Tata McGraw Hill.

**Reference Books:**

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis, M. Mitzenmacher and E. Upfal.
2. Applied Combinatorics, Alan Tucker, Wiley.

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# Advanced Data Structures & Algorithms (MTCSE1102)

**Course Objectives:** From the course the student will learn

- Single Linked, Double Linked Lists, Stacks, Queues, Searching and Sorting techniques, Trees, Binary trees, representation, traversal, Graphs- storage, traversal.
- Dictionaries, ADT for List, Stack, Queue, Hash table representation, Hash functions, Priority queues, Priority queues using heaps, Search trees.
- AVL trees, operations of AVL trees, Red- Black trees, Splay trees, comparison of search trees.

**Course Outcomes:**

After the completion of the course, student will be able to

- Ability to write and analyze algorithms for algorithm correctness and efficiency
- Master a variety of advanced abstract data type (ADT) and data structures and their Implementation
- Demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of real life
- Design and implement variety of data structures including linked lists, binary trees, heaps, graphs and search trees
- Ability to compare various search trees and find solutions for IT related problems

**UNIT I: Introduction to Data Structures**, Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms. **Stacks and Queues**: Algorithm Implementation using Linked Lists.

**UNIT II: Searching**-Linear and Binary, Search Methods, **Sorting**-Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort. **Trees**- Binary trees, Properties, Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix). **Graphs**-Basic Concepts, Storage structures and Traversals.

**UNIT III: Dictionaries**, ADT, The List ADT, Stack ADT, Queue ADT, Hash Table Representation, Hash Functions, Collision Resolution-Separate Chaining, **Open Addressing**-Linear Probing, Double Hashing.

**UNIT IV: Priority queues**- Definition, ADT, Realizing a Priority Queue Using Heaps, Definition, Insertion, Deletion .**Search Trees**- Binary Search Trees, Definition, ADT, Implementation, **Operations**-Searching, Insertion, Deletion.

**UNIT V: Search Trees**- AVL Trees, Definition, Height of AVL Tree, Operations-, Insertion, Deletion and Searching, Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

**Text Books:**

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage
2. Data Structures, Algorithms and Applications in java, 2/e, Sartaj Sahni, University Press

**Reference Books:**

1. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.

2. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, N.B.Venkateswarulu, E.V.Prasad and S Chand & Co, 2009

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**Program Elective-1**

# Big Data Analytics ( MTCSE11XX)

**Course Objectives:** This course is aimed at enabling the students to

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- To optimize business decisions and create competitive advantage with Big Data analytics

**Course Outcomes:**

After the completion of the course, student will be able to

- Illustrate on big data and its use cases from selected business domains.
- Interpret and summarize on No SQL, Cassandra
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore on Big Data applications Using Hive.
- Make use of Apache Spark, RDDs etc. to work with datasets.
- Assess real time processing with Spark Streaming.

**UNIT I:** What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

**UNIT II:** Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra ,Table creation, loading and reading data.

**UNIT III:** Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance ,with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

**UNIT IV:** Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames ,RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers-

Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

**UNIT V:** Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

**Text Books:**


1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj
2. SPARK: The Definitive Guide, Bill Chambers & Matei Zaharia, O'Reilley, 2018 Edition
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012


**Reference Books:**


1. "Hadoop Operations", O'Reilley, Eric Sammer, 2012
2. "Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012
3. "HBase: The Definitive Guide", O'Reilley, Lars George, 2011
4. "Cassandra: The Definitive Guide", O'Reilley, Eben Hewitt, 2010
5. "Programming Pig", O'Reilley, Alan Gates, 2011

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**Program Elective-1**

# Digital Image Processing ( MTCSE11XX)

**Course Objectives:**

□ Describe and explain basic principles of digital image processing.

□ Design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement).

□ Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation).

□ Assess the performance of image processing algorithms and systems.

**Course Outcomes:**

After the completion of the course, student will be able to

□ Demonstrate the components of image processing

□ Explain various filtration techniques.

□ Apply image compression techniques.

□ Discuss the concepts of wavelet transforms.

□ Analyze the concept of morphological image processing.

**UNIT I: Introduction:** Fundamental steps in Image Processing System, Components of Image Processing System, Elements of Visual Perception, Image Sensing and acquisition, Image sampling & Quantization, Basic Relationship between pixels. **Image Enhancement Techniques:** Spatial Domain Methods: Basic grey level transformation, Histogram equalization, Image subtraction, image averaging.

**UNIT II: Spatial filtering**: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters, Smoothing and sharpening filters, Homomorphism is filtering. **Image Restoration & Reconstruction**: Model of Image Degradation/restoration process, Noise models, Spatial filtering, Inverse filtering, Minimum mean square Error filtering, constrained least square filtering, Geometric mean filter, Image reconstruction from projections. Color Fundamentals, Color Models, Color Transformations.

**UNIT III: Image Compression**: Redundancies- Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information Theory; Loss Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization, Entropy coding, LZW coding; Image Compression Standards-JPEG, JPEG 2000, MPEG; Video compression.

**UNIT IV: Wavelet Based Image Compression**: Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous, Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding.

**UNIT V: Image Segmentation**: Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications; basic gray-scale morphology operations; Feature extraction; Classification; Object recognition.

**Digital Image Watermarking**: Introduction, need of Digital Image Watermarking, applications of watermarking in copyright protection and Image quality analysis.

**Text Books:**

1. Digital Image Processing. 2nd ed. Gonzalez, R.C. and Woods, R.E. India: Person Education, (2009)

**Reference Books:**

1. Digital Image Processing. John Wiley, Pratt, W. K, (2001)

2. Digital Image Processing, Jayaraman, S., Veerakumar, T. and Esakkiranjan, S. (2009),Tata McGraw-Hill

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**Program Elective-1**

# Advanced Operating Systems ( MTCSE11XX)

**Course Objectives:** This course is aimed at enabling the students to

- To provide comprehensive and up-to-date coverage of the major developments in distributed Operating System, Multi-processor Operating System and Database Operating System and to cover important theoretical foundations including Process Synchronization, Concurrency, Event ordering, Mutual Exclusion, Deadlock, Agreement Protocol, Security, Recovery and fault tolerance.

**Course Outcomes:**
After the completion of the course, student will be able to

CO1.Illustrate on the fundamental concepts of distributed operating systems, its architecture and distributed mutual exclusion.
CO2. Analyze on deadlock detection algorithms and agreement protocols.
CO3. Make use of algorithms for implementing DSM and its scheduling.
CO4. Apply protection and security in distributed operating systems.
CO5. Elaborate on concurrency control mechanisms in distributed database systems.

**UNIT-1:** 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.

**UNIT-2:**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, and applications of agreement algorithms. Distributed resource management: introduction-architecture, mechanism for building distributed file systems design issues, log structured file systems.

**UNIT- 3:** 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. 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.

**UNIT- 4:** Protection and security, preliminaries, the access matrix model and its implementations.-safety in matrix model, advanced models of protection. Data security,

cryptography: Model of cryptography, conventional cryptography modern cryptography, private key cryptography, data encryption standard public key cryptography, multiple encryptions, authentication in distributed systems.

**UNIT-5:** 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. 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, optimistic algorithms, concurrency control algorithms, data replication.

**Text Books:**

1. "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", Mukesh Singhal, Niranjan and G.Shivaratri, TMH, 2001

**Reference Books:**

1. "Modern operating system", Andrew S.Tanenbaum, PHI, 2003
2. "Distributed operating system-Concepts and design", Pradeep K.Sinha, PHI, 2003
3. "Distributed operating system", Pearson education, AndrewS.Tanenbaum, 2003

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**Program Elective-2**

# ADVANCED COMPUTER NETWORKS (MTCSE11YY)

**Course Objectives:** This course is aimed at enabling the students to

- The course is aimed at providing basic understanding of Computer networks starting with OSI Reference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.
- Some of the major topics which are included in this course are CSMA/CD, TCP/IP implementation, LANs/WANs, internetworking technologies, Routing and Addressing.
- Provide the mathematical background of routing protocols.
- Aim of this course is to develop some familiarity with current research problems and research methods in advance computer networks.

**Course Outcomes:**
After the completion of the course, student will be able to

CO1. Illustrate reference models with layers, protocols and interfaces.

\CO2. Describe the routing algorithms, Sub netting and Addressing of IP V4and IPV6.

CO3. Describe and Analysis of basic protocols of computer networks, and how they can be used to assist in network design and implementation.

CO4. Describe the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks

CO5. Describe the emerging trends in networks-MANETS and WSN

**Unit-I:Network layer:** Network Layer design issues: store-and forward packet switching, services provided transport layers, implementation connection less services, implementation connection oriented services, comparison of virtual –circuit and datagram subnets, Routing Algorithms-shortest path routing, flooding, distance vector routing, link state routing, Hierarchical routing, **congestion control algorithms :**Approaches to congestion control, Traffic aware routing, Admission control, Traffic throttling, choke Packets, Load shedding, Random early detection, Quality of Service, Application requirements, Traffic shaping, Leaky and Token buckets

**Unit-II: Internetworking and IP protocols:** How networks differ, How net works can be connected, internetworking, tunneling, The network layer in the internet,IPV4 Protocol, IP addresses, Subnets, CIDR, classful and Special addressing, network address translation (NAT),IPV6 Address structure address space, IPV6 Advantages, packet format, extension Headers, Transition from IPV4 to IPV6 , Internet Control Protocols-IMCP, ARP, DHCP

**Unit-III: Transport Layer Protocols:** Introduction, Services, Port numbers,
User Datagram Protocol: User datagram, UDP services, UDP Applications, Transmission control Protocol: TCP services, TCP features, Segment, A TCP connection, State transition diagram, Windows in TCP, Flow control and error control, TCP Congestion control, TCP Timers, **SCTP:** SCTP services SCTP features, packet format, An SCTP association, flow control, error control.

**Unit- IV: Wireless LANS:** Introduction, Architectural comparison, Access control, The IEEE 802.11 Project: Architecture, MAC sub layer, Addressing Mechanism, Physical Layer, Bluetooth:

Architecture, Bluetooth Layers **Other Wireless Networks:** WIMAX: Services, IEEE project 802.16, Layers in project 802.16, Cellular Telephony: Operations, First Generation (1G), Second Generation (2G), Third Generation (3G), Fourth Generation (4G), Satellite Networks: Operation, GEO Satellites, MEO satellites, LEO satellites.

**Unit–V: Emerging trends in Computer networks:**

**Mobile computing:** Motivation for mobile computing, Protocol stack issues in mobile computing environment, mobility issues in mobile computing, security issues in mobile networks, MOBILE Ad Hoc Networks: Applications of Ad Hoc Networks, Challenges and Issues in MANETS, MAC Layer Issues Routing Protocols in MANET, Transport Layer Issues, Ad hoc Network Security. **Wireless Sensor Networks:** WSN functioning, Operating system support in sensor devices, WSN characteristics, sensor network operation, Sensor Architecture: Cluster management, Wireless Mesh Networks: WMN design , Issues in WMNs, Computational Grids, Grid Features, Issues in Grid construction design, Grid design features,P2P Networks: Characteristics of P2P Networks, Classification of P2P systems, Gnutella, BitTorrent, Session Initiation Protocol(SIP) , Characteristics and addressing, Components of SIP, SIP establishment, SIP security.

**Text Books:**

1. Data communications and networking 4th edition Behrouz A Fourzan,TMH
2. Computer networks 4th edition Andrew S Tanenbaum, Pearson
3. Computer networks, Mayank Dave, CENGAGE

**Reference Books:**

1. Computer networks, A system Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier

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**Program Elective-2**

# Internet of Things ( MTCSE11YY)

**Course Objectives:**

- To Understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

**Course Outcomes:**
After the completion of the course, student will be able to

CO1. Summarize on the term 'internet of things' in different contexts.
CO2. Analyze various protocols for IoT.
CO3. Design a PoC of an IoT system using Rasperry Pi/Arduino
CO4. Apply data analytics and use cloud offerings related to IoT.
CO5. Analyze applications of IoT in real time scenario

**UNIT I: FUNDAMENTALS OF IoT:** Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum ( IoTWF ) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

**UNIT II: IoT PROTOCOLS:** IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

**UNIT III: DESIGN AND DEVELOPMENT:** Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

**UNIT IV: DATA ANALYTICS AND SUPPORTING SERVICES:** Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.

**UNIT V: CASE STUDIES/INDUSTRIAL APPLICATIONS:** Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

**Text Books:**

1.IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

**Reference Books:**

1. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015

2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).

3. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.

4. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.

5. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.

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**Program Elective-2**

# Object Oriented Software Engineering (MTCSE11YY)

**Course Objectives:**

- To elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project.
- To understand the what software life cycle is, how software projects are planned and managed, types of resources involved in software development projects, risks are identified and assessed, predictions and assessments are made.
- To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements

**Course Outcomes:**

After the completion of the course, student will be able to

CO1. Apply the Object Oriented Software-Development Process to design software

CO2. Analyze and Specify software requirements through a SRS documents.

CO3. Design and Plan software solutions to problems using an object-oriented strategy.

CO4. Model the object oriented software systems using Unified Modeling Language (UML)

CO5. Estimate the cost of constructing object oriented software.

**UNIT I:** Introduction to Software Engineering: Software, Software Crisis, Software Engineering definition, Evolution of Software Engineering Methodologies, Software Engineering Challenges. Software Processes: Software Process, Process Classification, Phased development life cycle, Software Development Process Models, Process, use, applicability and Advantages/limitations.

**UNIT II:** Object oriented Paradigm, Object oriented Concepts, Classes, Objects, Attributes, Methods and services, Messages, Encapsulation, Inheritance, Polymorphism, Identifying the elements of object model, management of object oriented Software projects, Object Oriented Analysis, Domain Analysis, Generic Components of OOA model,OOA Process, Object Relationship model, Object Behavior Model.

**UNIT III:** Object Oriented Design: Design for Object- Oriented systems, The Generic components of the OO design model, The System design process, The Object design process, Design Patterns, Object Oriented Programming.

**UNIT IV:** Object Oriented testing: Broadening the view of Testing, Testing of OOA and OOD models, Object-Oriented testing strategies, Test case design for OO software, testing methods applicable at the class level, Interclass test case design.

**UNIT V:** Technical Metrics for Object Oriented Systems: The Intent of Object Oriented metrics, The distinguishing Characteristics, Metrics for the OO Design model, Class-Oriented metrics, Operation-Oriented Metrics, Metrics foe Object Oriented testing, Metrics for Object Oriented projects. CASE Tools.

**Text Books:**

1. Object oriented and Classical Software Engineering, 7/e, Stephen R. Schach,

TMH.

2. Object oriented and Classical Software Engineering, Timothy Lethbridge,

Robert Laganiere, TMH

3. Software Engineering by Roger S Pressman, Tata McGraw Hill Edition

**Reference Books:**

1. Component based software engineering: 7th International symposium, ivicaCrnkovic, Springer, CBSE 2004

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## RESEARCH METHODOLOGY AND IPR

**UNIT 1:**
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

**UNIT 2:**
Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

**UNIT 3:**
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

**UNIT 4:**
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

**UNIT 5:**
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**REFERENCES:**
(1) Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
(2) Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
(3) Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
(4) Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
(5) Mayall, "Industrial Design", McGraw Hill, 1992.
(6) Niebel, "Product Design", McGraw Hill, 1974.
(7) Asimov, "Introduction to Design", Prentice Hall, 1962.
(8) (8) Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
(9) T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

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# Advanced Data Structures & Algorithms Lab (MTCSE1106)

**Course Objectives:**
From the course the student will learn
- Knowing about oops concepts for a specific problem.
- Various advanced data structures concepts like arrays, stacks, queues, linked lists, graphs and trees.

**Course Outcomes:**
After the completion of the course, student will be able to
- Identify classes, objects, members of a class and relationships among them needed for a specific problem.
- Examine algorithms performance using Prior analysis and asymptotic notations.
- Organize and apply to solve the complex problems using advanced data structures (like arrays, stacks, queues, linked lists, graphs and trees.)
- Apply and analyze functions of Dictionary

**Experiment 1:**
Write a java program to perform various operations on single linked list
**Experiment 2:**
Write a java program for the following
a) Reverse a linked list
b) Sort the data in a linked list
c) Remove duplicates
d) Merge two linked lists
**Experiment 3:**
Write a java program to perform various operations on doubly linked list.
**Experiment 4:**
Write a java program to perform various operations on circular linked list.
**Experiment 5:**
Write a java program for performing various operations on stack using linked list.
**Experiment 6:**
Write a java program for performing various operations on queue using linked list.
**Experiment 7:**
Write a java program for the following using stack
a) Infix to postfix conversion.
b) Expression evaluation.
c) Obtain the binary number for a given decimal number.
**Experiment 8:**
Write a java program to implement various operations on Binary Search Tree
Using Recursive and Non-Recursive methods.
**Experiment 9:**
Write a java program to implement the following for a graph.

a) BFS b) DFS

**Experiment 10:**

Write a java program to implement Merge & Heap Sort of given elements.

**Experiment 11:**

Write a java program to implement Quick Sort of given elements.

**Experiment 12:**

Write a java program to implement various operations on AVL trees.

**Experiment 13:**

Write a java program to perform the following operations:

a) Insertion into a B-tree b) Searching in a B-tree

**Experiment 14:**

Write a java program to implementation of recursive and non-recursive functions to Binary tree Traversals

**Experiment 15:**

Write a java program to implement all the functions of Dictionary (ADT) using Hashing.

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# Advanced Computing Lab (MTCSE1107)

**Course Objectives:**
From the course the student will learn
□ The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.

**Course Outcomes:**
After the completion of the course, student will be able to
□ The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.
□ Development and use of s IoT technology in Societal and Industrial Applications.
□ Skills to undertake high quality academic and industrial research in Sensors and IoT.
□ To classify Real World IoT Design Constraints, Industrial Automation in IoT.

**Experiment 1:** Start Raspberry Pi and try various Linux commands in command terminal window: ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc.
**Experiment 2:** Study and Install IDE of Arduino and different types of Arduino.
**Experiment 3:** Study and Implement Zigbee Protocol using Arduino / RaspberryPi.
**Experiment 4:** Write a map reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.
**Experiment 5:** Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together.
Write a single Spark application that
□ Transposes the original Amazon food dataset, obtaining a PairRDD of the type<user_id>→ <list of the product_ ids reviewed by user_id>
□ Counts the frequencies of all the pairs of products reviewed together.
□ Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

**Experiment 6:**
Write a program to Implement Bankers algorithm for Dead Lock Avoidance.
**Experiment 7:**
Write a program to Producer-consumer problem Using semaphores.
**Experiment 8:**
Write a program for an image enhancement using pixel operation.
**Experiment 9:**
Write a Program to enhance image using image arithmetic and logical operations.
**Experiment 10:**
Write a program of bit stuffing used by Data Link Layer.
**Experiment 11:**
Write a program to configure a Network using Distance Vector Routing protocol.
**Experiment 12:**

Write a program to perform the function oriented diagram: DFD and Structured chart.

**Experiment 13:**

Write a program to perform the system analysis: Requirement analysis, SRS.

**Experiment 14:**

Write a program to draw the structural view diagram: Class diagram, object diagram.

**Experiment 15:**

Write C programs for implementing the Demorgan's law.

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## Audit Course-1*

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**Program Core-3**

# Machine Learning

**Course Objectives:**
Machine Learning course will

- Develop an appreciation for what is involved in learning from data.
- Demonstrate a wide variety of learning algorithms.
- Demonstrate how to apply a variety of learning algorithms to data.
- Demonstrate how to perform evaluation of learning algorithms and model selection.

**Course Outcomes:**
After the completion of the course, student will be able to

CO1.Domain Knowledge for Productive use of Machine Learning and Diversity of Data.
CO2.Demonstrate on Supervised and Computational Learning
CO3.Analyze on Statistics in learning techniques and Logistic Regression
CO4.Illustrate on Support Vector Machines and Perceptron Algorithm
CO5.Design a Multilayer Perceptron Networks and classification of decision tree

**Unit I: Introduction:** Towards Intelligent Machines Well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining, Basic Linear Algebra in Machine Learning Techniques.

**Unit II: Supervised Learning:** Rationale and Basics: Learning from Observations, Bias and Why Learning Works: Computational Learning Theory, Occam's Razor Principle and Over fitting Avoidance Heuristic Search in inductive Learning, Estimating Generalization Errors, Metrics for assessing regression, Metris for assessing classification.

**Unit III: Statistical Learning:** Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in learning techniques, Bayesian Reasoning: A probabilistic approach to inference, K-Nearest Neighbor Classifier. Discriminant functions and regression functions, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification, Minimum Description Length Principle.

**Unit IV: Support Vector Machines (SVM):** Introduction, Linear Discriminant Functions for Binary Classification, Perceptron Algorithm, Large Margin Classifier for linearly seperable data, Linear Soft Margin Classifier for Overlapping Classes, Kernel Induced Feature Spaces, Nonlinear Classifier, and Regression by Support vector Machines.
**Learning with Neural Networks:** Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptrons, Linear neuron and the Widrow-Hoff Learning Rule, The error correction delta rule.

**Unit V:** Multilayer Perceptron Networks and error back propagation algorithm, Radial Basis Functions Networks. **Decision Tree Learning:** Introduction, Example of classification decision tree, measures of impurity for evaluating splits in decision trees, ID3, C4.5, and CART decision trees, pruning the tree, strengths and weakness of decision tree approach.
**Textbooks:**

1. Applied Machine Learning, 1st edition, M.Gopal, McGraw Hill Education,2018
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC) 1st Edition-2014

**Reference Books:**

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William WHsieh, Cambridge Univ Press. *1* edition (August 31, 2009)
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley &SonsInc., 2nd Edition-2001
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
4. Machine Learning by Peter Flach , Cambridge-1st Edition 2012

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## Program Core-4
## MEAN Stack Technologies

**Course Objectives:**
From the course the student will learn

- Translate user requirements into the overall architecture and implementation of new systems and Manage Project and coordinate with the Client.
- Writing optimized front end code HTML and JavaScript.
- Monitor the performance of web applications & infrastructure and Troubleshooting web application with a fast and accurate a resolution
- Design and implementation of Robust and Scalable Front End Applications.

**Course Outcomes:**
CO1.After the completion of the course, student will be able to
CO2. Identify the Basic Concepts of Web & Markup Languages.
CO3. Develop web Applications using Scripting Languages & Frameworks.
CO4. Make use of Express JS and Node JS frameworks
CO5. Illustrate the uses of web services concepts like restful, react js.
CO6. Adapt to Deployment Techniques & Working with cloud platform.

**UNIT I: Introduction to Web:** Internet and World Wide Web, Domain name service, Protocols: HTTP, FTP, SMTP. **Html5** concepts, **CSS3**, Anatomy of a web page. **XML:** Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches.

**UNIT II: JavaScript: The** Basic of JavaScript: Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions. **Angular Java Script** Angular JS Expressions: ARRAY, Objects, $eval, Strings, Angular JS Form Validation & Form Submission, Single Page Application development using Angular JS

**UNIT III: Node.js:** Introduction, Advantages, Node.js Process Model, Node JS Modules. **Express.js:** Introduction to Express Framework, Introduction to Nodejs , What is Nodejs, Getting Started with Express, Your first Express App, Express Routing, Implementing MVC in Express, Middleware, Using Template Engines, Error Handling , API Handling , Debugging, Developing Template Engines, Using Process Managers, Security & Deployment.

**UNIT IV: RESTful Web Services:** Using the Uniform Interface, Designing URIs, Web Linking, Conditional Requests. **React Js:** Welcome to React, Obstacles and Roadblocks, React's Future, Keeping Up with the Changes, Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, ReactDOM, Children, Constructing Elements with Data, React Components, DOM Rendering, Factories

**UNIT V: Mongo DB**: Introduction, Architecture, Features, Examples, Database Creation & Collection in Mongo DB. Deploying Applications: Web hosting & Domains, Deployment Using Cloud Platforms.

**Text Books:**
1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford

3. Pro Mean Stack Development, ELadElrom, Apress
4. Restful Web Services Cookbook, Subbu Allamraju, O'Reilly
5. JavaScript & jQuery the missing manual, David sawyer mcfarland, O'Reilly
6. Web Hosting for Dummies, Peter Pollock, John Wiley Brand

**Reference Books:**

1. Ruby on Rails up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006)
2. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012)
3. Web Technologies, HTML< JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech
4. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
5. Express.JS Guide, The Comprehensive Book on Express.js, Azat Mardan, Lean Publishing.

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# Program Elective-3
## Advanced Databases and Mining

**Course Objectives:**

- This Subject deals with dealing data in the real world, maintaining data without any redundancy, several techniques involved in DBMS to recover the problems caused due to redundancy, storing data for quick insertion, manipulation and deletion operations in order to retrieve data from the database.
- This subject provides an introduction to multidisciplinary field of data mining, the general data features, techniques for data preprocessing, general implementation of data warehouses and OLAP, the relationship between data warehousing and other generalization methods
- The concepts of data clustering includes a different methods of clustering such as k-means, k-mediods, db scan algorithm, role of data mining in web mining.

**Course Outcomes:**
After the completion of the course, student will be able to

CO1. Analyze on normalization techniques.
CO2. Elaborate on concurrency control techniques and query optimization.
CO3. Summarize the concepts of data mining, data warehousing and data preprocessing strategies.
CO4. Apply data mining algorithms.
CO5. Assess various classification & cluster techniques.

**UNIT I: Introduction**: Concepts and Definitions, Relational models, Data Modeling and Query Languages, Database Objects. **Normalization Techniques:** Functional Dependency, 1NF, 2NF, 3NF, BCNF; Multi valued Dependency; Loss-less Join and Dependency Preservation.

**UNIT II: Transaction Processing:** Consistency, Atomicity, Isolation and Durability, Serializable Schedule, Recoverable Schedule, Concurrency Control, Time-stamp based protocols, Isolation Levels, Online Analytical Processing,
**Database performance Tuning and Query optimization:** Query Tree, Cost of Query, Join, Selection and Projection Implementation Algorithms and Optimization Database Security: Access Control, MAC, RBAC, Authorization, SQL Injection Attacks.

**UNIT III: Data Mining:** stages and techniques, knowledge representation methods, data mining approaches (OLAP, DBMS, Statistics and ML). **Data warehousing:** data warehouse and DBMS, multidimensional data model, OLAP operations. **Data processing:** cleaning, transformation, reduction, filters and discretization with weka.

**UNIT IV: Knowledge representation:** background knowledge, representing input data and output knowledge, visualization techniques and experiments with weka. **Data mining algorithms:** association rules, mining weather data, generating item sets and rules efficiently, correlation analysis.

**UNIT V: Classification & Clustering:** 1R algorithm, decision trees, covering rules, task prediction, statistical classification, Bayesian network, instance based methods, linear models, Cluster/2, Cobweb, k-means, Hierarchical methods. **Mining real data:** preprocessing data from a real medical domain, data mining techniques to create a comprehensive and accurate model of data. **Advanced topics:** text mining, text classification, web mining, data mining software.

**Text Books:**

1. Fundamentals of Database Systems, RamezElmasri, Shamkant B. Navathe, Addison-Wesley,6th edition-
2. Data Mining: Concepts and Techniques, J. Han and M. Kamber, Morgan Kaufmann C.J. Date, Database Systems, Pearson, 3rd edition-

**Reference Books:**

1. Principles of Distributed Database Systems, Prentice Hall, P. Valduriez, M. TamerOzsu 3rd edition-2000
2. Database systems: Design, implementation and Management, C.M. Coronel, S. Morris, P. Rob, Boston: Cengage Learning,9th edition-2011

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## Program Elective-3
# Ad Hoc & Sensor Networks

**Course Objectives:**

- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understandings of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks

**Course Outcomes:**
After the completion of the course, student will be able to

CO1. Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks
CO2. Discuss the MAC protocol issues of ad hoc networks
CO3. Enumerate the concept of routing protocols for ad hoc wireless networks with respect to TCP design issues
CO4. Analyze & Specify the concepts of network architecture and MAC layer protocol for WSN
CQ5. Discuss the WSN routing issues by considering QoS measurements

**UNIT I: Introduction** : Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, Radio propagation Mechanisms ,Characteristics of the Wireless channel mobile ad hoc networks (MANETs), **Wireless Sensor Networks (WSNs):** concepts and architectures, Applications of Ad Hoc and Sensor Networks, Design Challenges in Ad hoc and Sensor Networks.

**UNIT II: MAC Protocols For Ad Hoc Wireless Networks:** Issues in designing a MAC Protocol, Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention based protocols, Contention based protocols with Reservation Mechanisms, Contention based protocols with Scheduling Mechanisms, Multi channel MAC - IEEE 802.11.

**UNIT III: Routing Protocols And Transport Layer In Ad Hoc Wireless Networks**: Routing Protocol: Issues in designing a routing protocol for Ad hoc networks, Classification, proactive routing, reactive routing (on-demand), hybrid routing, Transport Layer protocol for Ad hoc networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer solutions-TCP over Ad hoc wireless, Network Security, Security in Ad Hoc Wireless Networks, Network Security Requirements.

**UNIT IV: Wireless Sensor Networks (WSNS) And Mac Protocols**: Single node architecture - hardware and software components of a sensor node, **WSN Network architecture:** typical network architectures, data relaying and aggregation strategies, **MAC layer protocols:** self-organizing, Hybrid TDMA/FDMA and CSMA based MAC -IEEE 802.15.4.

**UNIT V: WSN Routing, Localization & Qos:** Issues in WSN routing, OLSR, Localization, Indoor and Sensor Network Localization, absolute and relative localization, triangulation, QOS in WSN, Energy Efficient Design, Synchronization.

**Text Books:**

1. "Ad Hoc Wireless Networks: Architectures and Protocols ", C. Siva Ram Murthy, and B. S. Manoj, Pearson Education, 2008
2. "Wireless Adhoc and Sensor Networks", Labiod. H, Wiley, 2008
3. "Wireless ad -hoc and sensor Networks: theory and applications", Li, X, Cambridge University Press, 2008.

**Reference Books:**

1. "Ad Hoc & Sensor Networks: Theory and Applications", 2nd edition, Carlos De Morais Cordeiro, Dharma Prakash Agrawal ,World Scientific Publishing Company, 2011
2. "Wireless Sensor Networks", Feng Zhao and Leonides Guibas,Elsevier Publication.
3. "Protocols and Architectures for Wireless Sensor Networks", Holger Karl and Andreas Willig,Wiley, 2005 (soft copy available)
4. "Wireless Sensor Networks Technology, Protocols, and Applications", Kazem Sohraby, Daniel Minoli, & TaiebZnati, John Wiley, 2007. (soft copy available)

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## Program Elective-3
## Soft Computing

**Course Objectives:**

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
- To implement soft computing based solutions for real-world problems.
- To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
- To provide student a hand-on experience on MATLAB to implement various strategies.

**Course Outcomes:**
After the completion of the course, student will be able to

CO1. Elaborate fuzzy logic and reasoning to handle uncertainty in engineering problems.
CO2.□ Make use of genetic algorithms to combinatorial optimization problems.
CO3. Distinguish artificial intelligence techniques, including search heuristics, knowledge representation, planning and reasoning.
CO4. Formulate and apply the principles of self-adopting and self organizing neuro fuzzy inference systems.
CO5. Evaluate and compare solutions by various soft computing approaches for a given problem

**UNIT I: Fuzzy Set Theory:** Introduction to Neuro, Fuzzy and Soft Computing, Fuzzy Sets, Basic function and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.

**UNIT II: Optimization:** Derivative based Optimization, Descent Methods, and The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing, and Random Search, Downhill Simplex Search.

**UNIT III: Artificial Intelligence:** Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning Under Uncertainty Basic knowledge Representation Issues Knowledge acquisition, Heuristic Search: Techniques for Heuristic search Heuristic Classification State Space Search: Strategies Implementation of Graph Search based on Recursion Patent-directed Search Production System and Learning.

**UNIT IV: Neuro Fuzzy Modeling:** Adaptive Neuro-Fuzzy Inference Systems, Architecture Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks Neuro Fuzzy Spectrum.

**UNIT V: Applications Of Computational Intelligence:** Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Coloripe Prediction.

**Text Books:**

1. "Neuro-Fuzzy and Soft Computing", J.S.R.Jang, C.T.Sun and E.Mizutani, PHI, 2004, Pearson Education 2004
2. Artificial Intelligence by Saroj Koushik, Cengage Learning
3. "Artificial Intelligence and Intelligent Systems", N.P.Padhy, Oxford University Press, 2006

**Reference Books:**

1. Artificial Intelligence, Second Edition, Elaine Rich & Kevin Knight, Tata McGraw Hill Publishing Comp., New Delhi, , 2006
2. "Fuzzy Logic with Engineering Applications", Timothy J.Ross, McGraw-Hill, 1997

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**Program Elective-4**

# Cloud Computing

**Course Objectives:**

- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- Broadly educate to know the impact of engineering on legal and societal issues involved.

**Course Outcomes**: At the end of the course, student will be able to

CO1. Interpret the key dimensions of the challenge of Cloud Computing.

CO2. Examine the economics, financial, and technological implications for selecting cloud computing for own organization.

CO3. Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications.

CO4. Evaluate own organizations' needs for capacity building and training in cloud computing-related IT areas.

CO5. To Illustrate Virtualization for Data-Center Automation.

**UNIT I: Introduction:** Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing. **Parallel and Distributed Systems:** Introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, model concurrency with Petri Nets.

**UNIT II: Cloud Infrastructure:** At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing, **Cloud Computing:** Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research.

**UNIT III: Cloud Resource virtualization:** Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades, **Cloud Resource Management and Scheduling**: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feedback control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling

**UNIT IV: Storage Systems:** Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system. Apache Hadoop, Big Table, Megastore (text book 1), Amazon Simple Storage Service(S3) (Text book 2),

**Cloud Security:** Cloud security risks, security – a top concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks.

**UNIT V: Cloud Application Development:** Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming ( Text Book 1), **Google:** Google App Engine, Google Web Toolkit (Text Book 2), **Microsoft:** Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2).

**Text Books:**

1. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH

**Reference book:**

1. Mastering Cloud Computing, Foundations and Application Programming, Raj

Kumar Buyya, Christen vecctiola, S Tammarai selvi, TMH

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## Program Elective-4
## Principles of Computer Security

**Course Objectives:**
In the course the student will learn

- This course provides an overview of modern cryptographic theories and techniques, mainly focusing on their application into real systems.
- Topics include Database and Cloud Security, Malicious Software, Denial-of-Service Attacks, Software Security, Operating System Security, Wireless Network Security and mobile device security.

**Course Outcomes:**
After the completion of the course, student will be able to

CO1. Describe the key security requirements of confidentiality, integrity, and availability, types of security threats and attacks and summarize the functional requirements for computer security.

CO2. Explain the basic operation of symmetric block encryption algorithms, use of secure hash functions for message authentication, digital signature mechanism.

CO3. Discuss the issues involved and the approaches for user authentication and explain how access control fits into the broader context that includes authentication, authorization, and audit.

CO4. Explain the basic concept of a denial-of-service attack, nature of flooding attacks, distributed denial-of-service attacks and describe how computer security vulnerabilities are a result of poor programming practices.

CO5. List the steps used to secure the base operating system, specific aspects of securing Unix/Linux systems, Windows systems, and security in virtualized systems and describe the security threats and countermeasures for wireless networks.

**Unit I: Introduction:** Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, Computer Security Strategy. **Cryptographic Tools:** Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers.

**Unit II: User Authentication:** Electronic User Authentication Principles, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication. **Access Control:** Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, UNIX File Access Control, Role-Based Access Control, Attribute-Based Access Control, Identity, Credential, and Access Management, Trust Frameworks.

**Unit III: Database and Cloud Security:** The Need For Database Security, Database Management Systems, Relational Databases, Sql Injection Attacks, Database Access Control, Database Encryption, Cloud Computing, Cloud Security Risks And Countermeasures, Data Protection In The Cloud, Cloud Security As A Service. **Malicious Software:** Types of Malicious Software (Malware), Advanced Persistent Threat, Propagation, Infected Content, Viruses, Propagation, Vulnerability Exploit, Worms, Propagation, Social Engineering, Spam E-Mail, Trojans, Payload, System Corruption, Payload, Attack Agent, Zombie, Bots, Payload, Information Theft, Key loggers, Phishing, Spyware, Payload, Stealthing, Backdoors, Root kits, Countermeasures.

**Unit IV: Denial-of-Service Attacks:** Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack. **Software Security:** Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with theOperating System and Other Programs.

**Unit V: Operating System Security:** Introduction To Operating System Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/Unix Security, Windows Security, Virtualization Security. **Wireless Network Security:** Wireless Security, Mobile Device Security, IEEE 802.11Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

**Text Book:**

1. Computer Security: Principles and Practices, 3e, William Stallings, Lawrie Brown, Pearson

**Reference book:**

1. Network Security Essentials, Principles and Practices, William Stallings, Pearson

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## Program Elective-4
# High Performance Computing

**Course Objectives:**
The objective of the subject is to

- Introduce the basic concepts related to HPC architecture and parallel computing.
- To discuss various computational techniques for studying soft matter systems.
- To apply these concepts to examine complex bimolecular/materials systems that generally require large-scale HPC platform with hybrid CPU-GPU architectures.

**Course Outcomes:**
After the completion of the course, student will be able to

CO1. Design, formulate, solve and implement high performance versions of standard single threaded algorithms.
CO2. Demonstrate the architectural features in the GPU and MIC hardware accelerators.
CO3. Design programs to extract maximum performance in a multicore, shared memory execution environment processor.
CO4. Analyze Symmetric and Distributed architectures.
CO5. Develop and deploy large scale parallel programs on tightly coupled parallel systems using the message passing paradigm.

**UNIT I: Graphics Processing Units:** Introduction to Heterogeneous Parallel Computing, GPU architecture, Thread hierarchy, GPU Memory Hierarchy.

**UNIT II: GPU Programming:** Vector Addition, Matrix Multiplication algorithms. 1D, 2D, and 3D Stencil Operations, Image Processing algorithms – Image Blur, Gray scaling. Histogramming, Convolution, Scan, Reduction techniques.

**UNIT III: Many Integrated Cores:** Introduction to Many Integrated Cores. MIC, Xeon Phi architecture, Thread hierarchy, Memory Hierarchy, Memory Bandwidth and performance considerations.

**UNIT IV: Shared Memory Parallel Programming:** Symmetric and Distributed architectures, OpenMP Introduction, Thread creation, Parallel regions. Work sharing, Synchronization.

**UNIT V: Message Passing Interface:** MPI Introduction, Collective communication, Data grouping for communication.

**Text Books:**
1. Programming Massively Parallel Processors A Hands-on Approach, 3e, Wen-Mei W Hwu, David B Kirk and Morgan Kaufmann-2019
2. Intel Xeon Phi Coprocessor Architecture and Tools, Rezaur Rahman, Apress Open, 1st edition-2013
3. Using OpenMP, Barbara Chapman, Gabriele Jost, Rudd Vander Pas, MIT Press, 2008

**Reference books:**
1. "A Parallel Algorithm Synthesis Procedure for High-Performance Computer Architectures" by Dunn Ian N, 2003

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# Laboratory-3
# Machine Learning with Python Lab

**Course Objectives:**
This course will enable students to

- To learn and understand different Data sets in implementing the machine learning algorithms.
- Implement the machine learning concepts and algorithms in any suitable language of choice.

**Course Outcomes(COs)**: At the end of the course, student will be able to

CO1. Implement procedures for the machine learning algorithms
CO2. Design Python programs for various Learning algorithms
CO3. Apply appropriate data sets to the Machine Learning algorithms
CO4. Identify and apply Machine Learning algorithms to solve real world problems

**Experiment-1:**
Exercises to solve the real-world problems using the following machine learning methods:
a) Linear Regression
b) Logistic Regression.

**Experiment-2:**
Write a program to Implement Support Vector Machines.

**Experiment-3:**
Exploratory Data Analysis for Classification using Pandas and Matplotlib.

**Experiment-4:**
Implement a program for Bias, Variance, and Cross Validation.

**Experiment-5:**
Write a program to simulate a perception network for pattern classification and function approximation.

**Experiment-6:**
Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

**Experiment-7:**
Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

**Experiment-8:**
Write a program to implement the naïve Bayesian classifier for Iris data set. Compute the accuracy of the classifier, considering few test data sets.

**Experiment-9:**
Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

**Experiment-10:**
Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

**Experiment-11:**
Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

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# Laboartory-4
# MEAN Stack Technologies Lab

**Course Objectives:**
From the course the student will

- Learn the core concepts of both the frontend and backend programming course.
- Get familiar with the latest web development technologies.
- Learn all about SQL and Mongo databases.
- Learn complete web development process.

**Course Outcomes:** At the end of the course, student will be able to

CO1. Identify the Basic Concepts of Web & Markup Languages.
CO2. Develop web Applications using Scripting Languages & Frameworks.
CO3. Creating & Running Applications using JSP libraries.
CO4. Creating Our First Controller Working with and Displaying in Angular Js and Nested Forms with ng-form.
CO5. Working with the Files in React JS and Constructing Elements with Data.

**Experiment-1:**
Develop static pages (using only HTML) of an online Book store. The pages should resemble: www.amazon.com. The website should consist of the following pages. Home page

a) Registration and user Login
b) User profile page
c) Books catalog
d) Shopping cart
e) Payment by credit card Order Conformation

**Experiment-2:**
Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.

**Experiment-3:**
Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems:
a) Input: Click on Display Date button using on click ( ) function Output: Display date in the textbox
b) Input: A number n obtained using prompt Output: Factorial of n number using alert
c) Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert
d) Input: A number n obtained using prompt and add another number using confirm Output: Sum of the entire n numbers using alert

**Experiment-4:**
Create a simple visual bean with a area filled with a color. The shape of the area depends on the property shape. If it is set to true then the shape of the area is Square and it is Circle, if it is false. The color of the area should be changed dynamically for every mouse click.

**Experiment-5:**
Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.

**Experiment-6:**
Develop and demonstrate PHP Script for the following problems:
a) Write a PHP Script to find out the Sum of the Individual Digits.
b) Write a PHP Script to check whether the given number is Palindrome or not

**Experiment-7:**
Implement the following in CSS
a) Implementation of 'get' and 'post' methods.
b) Implementation in colors, boarder padding.
c) Implementation button frames tables, navigation bars.

**Experiment-8:**
Implement the web applications with Database using
a) PHP,
b) Servlets and
c) JSP.

**Experiment-9:**
Write a program to design a simple calculator using
a) JavaScript
b) PHP
c) Servlet and
d) JSP.

**Experiment-10:**
Create registration and login forms with validations using Jscript query.

**Experiment-11:**
Jscript to retrieve student information from student database using database connectivity.

**Experiment-12:**
Implement the following in React JS
a) Using React Js creating constructs data elements.
b) Using React Js implementations DoM.

**Experiment-13:**
Implement the following in Angular JS
a) Angular Js data binding.
b) Angular JS directives and Events.
c) Using angular Js fetching data from MySQL.

**Experiment-14:**
Develop and demonstrate Invoking data using Jscript from Mongo DB.

**Experiment-15:**
Create an Online fee payment from using JSCript and MangoDB.

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# Mini project with seminar

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**The List of Paper Setters are: (for B. Tech I Year):**

| S. No. | Name of the Expert | Address for Communication | Category of the Institution |
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| 2 | Dr. Ande Prasad | Professor & Chairman BoS<br>Department of CSE<br>Vikram Simhapuri University,<br>Nellore<br>Mobile: 9885934309<br>E-mail: andeprasadvsn@gmail.com | Govt. University |
| 3 | Dr. N. Srinivas | Professor<br>Department of CSE,<br>KLEF Deemed to be University,<br>Green Fields, Vaddeswaram,<br>Guntur District, A.P. | Deemed University |
| 4 | Dr. G. Ratnakanth | Professor<br>Department of IT,<br>SVECW, Bhimavaram,<br>W.G. Dist, AP.<br>Mobile: 9505018999<br>E-mail: ratnakanth@sevecw.edu.in | Autonomous |
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