ACADEMIC REGULATIONS
COURSE STRUCTURE AND
DETAILED SYLLABUS

DEPARTMENT OF MATHEMATICS

For

M.Sc. Applied Mathematics
(Two Year Full Time Programme)

JNTUH COLLEGE OF ENGINEERING HYDERABAD
(Autonomous)
Kukatpally, Hyderabad – 500 085
2015
1.0 Post-Graduate Degree Program in M.Sc (PGP in M.Sc):
JNTUH offers 2 Year (4 Semesters) full-time Master of Science (M.Sc) Degree Programs, under Choice Based Credit System (CBCS) at its Constituent Autonomous College - JNTUH College of Engineering Hyderabad with effect from the Academic Year 2015-16 onwards.

2.0 Eligibility for Admission:

2.1 Admissions to the PGPs shall be made subject to the eligibility, qualifications and specializations prescribed by JNTUH College of Engineering Hyderabad, JNT University Hyderabad, for each Specialization under each M.Sc. Program, from time to time.

2.2 Admission to the PGP shall be made either on the basis of an Entrance Test conducted by the Jawaharlal Nehru Technological University Hyderabad / on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time.

2.3 The medium of instructions for all PG Programmes will be ENGLISH only.

3.0 M.Sc Program Structure:

3.1 The M.Sc Program in Physics, Chemistry and Mathematics of JNTUH-CEH are of Semester Pattern, with 4 Semesters constituting 2 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 Weeks duration (inclusive of Examinations), with a minimum of 90 Instructional Days per Semester.

3.2 UGC/AICTE specified Definitions/ Descriptions are adopted appropriately for various terms and abbreviations used in these PGP - Academic Regulations.

3.2.1 Semester Scheme:
Each Semester having - ‘Continuous Internal Evaluation (CIE)’ and ‘Semester End Examination (SEE)’. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted are taken as ‘references’ for the present set of Regulations. The terms ‘SUBJECT’ or ‘COURSE’ imply the same meaning here, and refer to ‘Theory Subject’, or ‘Lab Course’, or ‘Design/ Drawing Subject’, or ‘Seminar’, or ‘Comprehensive Viva’, or ‘Project’, as the case may be.
3.2.2 **Credit Courses:**
All Subjects (or Courses) are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject/Course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practicals Periods : Credits) Structure, based on the following general pattern.

3.2.3 **Course Nomenclature:**
The curriculum nomenclature or Course structure grouping for M.Sc Degree Program is as listed below

Each subject is assigned certain number of credits as specified below.

<table>
<thead>
<tr>
<th>Type of Subject</th>
<th>Periods / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory Subjects</td>
<td>4</td>
<td>3 or 4</td>
</tr>
<tr>
<td>Practical Subjects</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Practical Subjects</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Seminar</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Project</td>
<td></td>
<td>3 or 4</td>
</tr>
</tbody>
</table>

(Each period will be of 50 minutes duration)

4.0 **Course Work:**

4.1 A Student, after securing admission, shall pursue and complete the M.Sc PGP in a minimum period of 2 Academic Years (4 Semesters), and within a maximum period of 4 Academic Years (starting from the Date of Commencement of I Year).

4.2 Each student shall Register for and Secure the specified number of Credits required for the completion of the PGP and Award of the M.Sc Degree in respective Branch with the chosen Specialization.

4.3 I Year is structured to provide typically 22 Credits (22 C) in each of the I, II and III Semesters, and IV Semester comprises of 24 Credits (24 C), totaling to 90 Credits (90 C) for the entire M.Sc Program.

5.0 **Course Registration:**

5.1 A ‘Faculty Advisor’ shall be assigned to each M.Sc Program with respective Specialization, who will advise the Students about the M.Sc Program Specialization, its Course Structure and Curriculum, Choice/Option for Subjects/Courses, based on his competence, progress, pre-requisites and interest.

6.0 **Attendance Requirements:**

6.1 A Student shall be eligible to appear for the End Semester Examination (SEE) of any Subject, if he acquires a minimum of 75% of attendance in that Subject for that Semester.
6.2 A Student’s Seminar Report and Seminar Presentation shall be eligible for evaluation, only if he ensures a minimum of 75% of his attendance in Seminar Presentation Classes during that Semester.

6.3 Condoning of shortage of attendance up to 10% (65% and above, and below 75%) in each Subject or Seminar of a Semester may be granted by the College Academic Council on genuine and valid grounds, based on the Student’s representation with supporting evidence.

6.4 A stipulated fee per Subject/Seminar shall be payable towards condoning of shortage of attendance.

6.5 Shortage of Attendance below 65% in any Subject/Seminar shall in NO case be condoned.

6.6 A Student, whose shortage of attendance is not condoned in any Subject(s) or Seminar in any Semester, is considered as ‘Detained in that Subject(s)/Seminar’, and is not eligible to take End Examination(s) of such Subject(s) (and in case of Seminars, his Seminar Report or Presentation are not eligible for evaluation) in that Semester; and he has to seek Re-registration for those Subject(s)/Seminar in subsequent Semesters, and attend the same as and when offered.

7.0 Academic Requirements:

The following Academic Requirements have to be satisfied, in addition to the Attendance Requirements mentioned in Item No. 6.

7.1 A Student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/Course, if he secures not less than 40% Marks (28 out of 70 Marks) in the End Semester Examination, and a minimum of 50% of Marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing B Grade or above in that Subject.

7.2 A Student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to - Seminar, and Comprehensive Viva-voce, if he secures not less than 50% of the total Marks to be awarded for each. The Student would be treated as failed, if he - (i) does not attend the Comprehensive Viva-voce as per the schedule given, or (ii) does not present the Seminar as required, or (ii) secures less than 50% of Marks (< 50 Marks) in -Seminar/ Comprehensive Viva-voce evaluations. She/he may reappear for comprehensive viva where it is scheduled again; For seminar, he has to reappear in the next subsequent Semesters, as and when scheduled.

7.3 A Student shall - register for all Subjects covering 90 Credits as specified and listed in the Course Structure for the chosen PGP Specialization, put up all the Attendance and Academic requirements for securing 90 Credits obtaining a minimum of B Grade or above in each Subject, and earn all 90 Credits securing SGPA ≥ 5.0 (in each Semester) and final CGPA (i.e., CGPA at the end of PGP) ≥ 5.0, to successfully complete the PGP.
7.4 Marks and Letter Grades obtained in all those Subjects covering the above specified 90 Credits alone shall be considered for the calculation of final CGPA, which shall be indicated in the Grade Card of II Year II Semester.

7.5 Students who fail to earn 90 Credits as per the specified Course Structure, and as indicated above, within 4 Academic Years from the Date of Commencement of their I Year, shall forfeit their seats in M.Sc Program and their admissions shall stand cancelled.

7.6 When a Student is detained due to shortage of attendance in any Subject(s)/Seminar in any Semester, no Grade Allotment will be done for such Subject(s)/Seminar, and SGPA/ CGPA calculations of that Semester will not include the performance evaluations of such Subject(s)/Seminar in which he got detained. However, he becomes eligible for re-registration of such Subject(s)/Seminar (in which he got detained) in the subsequent Semester(s), as and when next offered, with the Academic Regulations of the Batch into which he gets readmitted, by paying the stipulated fees per Subject. In all these re-registration cases, the Student shall have to secure a fresh set of Internal Marks (CIE) and End Semester Examination Marks (SEE) for performance evaluation in such Subject(s), and subsequent SGPA/ CGPA calculations.

7.7 A Student eligible to appear in the End Semester Examination in any Subject, but absent at it or failed (failing to secure B Grade or above), may reappear for that Subject at the supplementary examination as and when conducted. In such cases, his Internal Marks (CIE) assessed earlier for that Subject/ Course will be carried over, and added to the marks to be obtained in the supplementary examination, for evaluating his performance in that Subject.

8.0 Evaluation - Distribution and Weightage of Marks:

8.1 The performance of a Student in each Semester shall be evaluated Subject-wise (irrespective of Credits assigned) with a maximum of 100 Marks for Theory, Practicals and 50 marks for Seminar.

8.2 a) For Theory Subjects, CIE Marks shall comprise of - Mid-Term Examination Marks (for 25 Marks), and Assignment Marks (for 5 Marks) for total of 30 marks.
b) During the Semester, there shall be 2 Mid-Term examinations. Each Mid-Term examination shall be for 25 Marks (with 120 minutes duration). The better performance out of these two Mid-Term Examinations shall be considered for the award of 25 Marks.

8.3 For Practical Subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 Internal Marks, and 70 Marks are assigned for Lab./Practicals End Semester Examination (SEE). Out of the 30 Marks for Internals, day-to-day work assessment in the laboratory shall be evaluated for 20 Marks; and the performance in an internal Lab./Practical Test shall be evaluated for 10 marks. The SEE for Lab./Practicals shall be conducted at the end of the Semester by the concerned Lab. Teacher and another faculty member of the same Department as assigned by the Head of the Department.
8.4 There shall be a Seminar Presentation in I Semester II Semester and III Semester. For the Seminar, the Student shall collect the information on a specialized topic, and submit to the Department which shall be evaluated by a Departmental committee consisting of the Head of the Department and two faculty members both appointed by HOD at the time of Seminar Presentation. The Seminar Presentation shall be evaluated for 50 Marks. There shall be no SEE or External Examination for Seminar.

8.5 a) Every PGP Student shall be required to execute his M.Sc Project, under the guidance of the Supervisor assigned to him by the Head of Department. The PGP Project shall start immediately after the completion of the II Year I Semester, and shall continue through II Year II Semester. The Student shall carry out the literature survey, select an appropriate topic and submit a Project Proposal within 2 weeks (immediately after his II Year I Semester End Examinations), for approval by the Project Review Committee (PRC). The PRC shall be constituted by the Head of Department, and shall consist of the Head of Department, Project Supervisor, and a Senior Faculty Member of the Department both appointed by HOD. The Student shall submit his/ her Project Work Proposal to the PRC, on whose approval he can ‘REGISTER for the PG Project’. Every Student must compulsorily register for his M.Sc Project Work, within the 2 weeks of time-frame as specified above. After Registration, the Student shall carry out his work, and continually submit ‘a fortnightly progress report’ to his Supervisor throughout the Project period. The PRC will monitor the progress of the Project Work Presentation and submission of M.Sc Project Work Report/ Dissertation.

b) The PRC shall evaluate the entire performance of the Student and declare the Project Report as ‘Satisfactory’ or ‘Unsatisfactory’.

8.6 a) In cases, where the Board declared the Project Work Performance as ‘unsatisfactory’, the Student is deemed to have failed in the Project Viva-voce Examination, and he has to reappear for the Viva-voce Examination as per the Board recommendations. If he fails in the second Viva-voce Examination also, he will not be considered eligible for the Award of the Degree, unless he is asked to revise and resubmit his Project Work by the Board within a specified time period.

9.0 Re-Admission / Re-Registration:

9.1 Re-Admission for Discontinued Students:
Students, who have discontinued the M.Sc Degree Program due to any reasons what so ever, may be considered for ‘Readmission’ into the same Degree Program (with same specialization) with the Academic Regulations of the Batch into which he gets readmitted, with prior permission from the concerned authorities, subject to Item 4.1.

9.2 Re-Registration for Detained Students:
When any Student is detained in a Subject (s)/ Seminar due to shortage of attendance in any Semester, he may be permitted to re-register for the same Subject in the ‘same category’ (Core or Elective Group) or equivalent Subject if the same Subject is not available, as suggested by the Board of Studies of that
Department, as when offered in the subsequent Semester(s), with the Academic Regulations of the Batch into which he seeks re-registration, with prior permission from the concerned authorities, subject to Item 4.1.

10.0 Grading Procedure:

10.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Seminar, or Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 6 above, and a corresponding Letter Grade shall be given.

10.2 As a measure of the student’s performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

<table>
<thead>
<tr>
<th>% of Marks Secured (Class Intervals)</th>
<th>Letter Grade (UGC Guidelines)</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>80% and above (≥ 80%, ≤ 100%)</td>
<td>O (Outstanding)</td>
<td>10</td>
</tr>
<tr>
<td>Below 80% but not less than 70%</td>
<td>A* (Excellent)</td>
<td>9</td>
</tr>
<tr>
<td>(≥ 70%, &lt; 80%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 70% but not less than 60%</td>
<td>A (Very Good)</td>
<td>8</td>
</tr>
<tr>
<td>(≥ 60%, &lt; 70%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 60% but not less than 55%</td>
<td>B* (Good)</td>
<td>7</td>
</tr>
<tr>
<td>(≥ 55%, &lt; 60%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 55% but not less than 50%</td>
<td>B (above Average)</td>
<td>6</td>
</tr>
<tr>
<td>(≥ 50%, &lt; 55%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 50%</td>
<td>F (FAIL)</td>
<td>0</td>
</tr>
<tr>
<td>(&lt; 50%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>Ab</td>
<td>0</td>
</tr>
</tbody>
</table>

10.3 A student obtaining F Grade in any Subject shall be considered ‘failed’ and is be required to reappear as ‘Supplementary Candidate’ in the Semester End Examination (SEE), as and when offered. In such cases, his Internal Marks (CIE Marks) in those Subjects will remain the same as those he obtained earlier.

10.4 A Letter Grade does not imply any specific % of Marks.

10.5 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course (excluding Mandatory non-credit Courses). Then the corresponding ‘Credit Points’ (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

Credit Points (CP) = Grade Point (GP) x Credits .... For a Course

10.6 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

\[ SGPA = \frac{\sum_{i=1}^{N} C_i G_i}{\sum_{i=1}^{N} C_i} \] .... For each Semester,
where ‘i’ is the Subject indicator index (takes into account all Subjects in a Semester), ‘N’ is the no. of Subjects ‘REGISTERED’ for the Semester (as specifically required and listed under the Course Structure of the parent Department), $C_i$ is the no. of Credits allotted to the $i^{th}$ Subject, and $G_i$ represents the Grade Points (GP) corresponding to the Letter Grade awarded for that $i^{th}$ Subject.

10.7 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year first semester onwards, at the end of each Semester, as per the formula

$$CGPA = \frac{\sum_{i=1}^{S} M C_i G_i}{\sum_{j=1}^{M} C_j} \ldots$$ for all S Semesters registered (ie., upto and inclusive of S Semesters, $S \geq 1$),

where ‘M’ is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has ‘REGISTERED’ from the 1st Semester onwards upto and inclusive of the Semester $S$ (obviously $M > N$), ‘j’ is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), $C_j$ is the no. of Credits allotted to the $j^{th}$ Subject, and $G_j$ represents the Grade Points (GP) corresponding to the Letter Grade awarded for that $j^{th}$ Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

10.8 For Merit Ranking or Comparison Purposes or any other listing, ONLY the ‘ROUNDED OFF’ values of the CGPAs will be used.

10.9 For Calculations listed in Item 10.5 – 10.8, performance in failed Subjects/ Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/ Courses will also be included in the multiplications and summations. However, Mandatory Courses will not be taken into consideration.

10.10 Passing Standards :

10.10.1 A student shall be declared successful or ‘passed’ in a Semester, only when he gets a SGPA $\geq 5.00$ (at the end of that particular Semester); and a student shall be declared successful or ‘passed’ in the entire PGP, only when gets a CGPA $\geq 5.00$; subject to the condition that he secures a GP $\geq 6$ (B Grade or above) in every registered Subject/ Course in each Semester (during the entire PGP) for the Degree Award, as required.

10.10.2 After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the Registered Students of that Semester, indicating the Letter Grades and Credits earned. It will show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned etc.), Credits earned, SGPA, and CGPA.

11.0 Declaration of Results:

11.1 Computation of SGPA and CGPA are done using the procedure listed in 10.5 – 10.8.
11.2 For Final % of Marks equivalent to the computed CGPA, the following formula may be used..

\[
\text{% of Marks} = (\text{CGPA} - 0.5) \times 10
\]

12.0 Award of Degree and Class:

12.1 A Student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of 90 Credits (with GP ≥ 6.0), shall be declared to have ‘QUALIFIED’ for the award of the M.Sc Degree in the chosen specialization as he/she admitted.

12.2 Award of Class

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree, he shall be placed in one of the following four classes based on the % CGPA:

<table>
<thead>
<tr>
<th>Class Awarded</th>
<th>CGPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Class with Distinction</td>
<td>≥ 7.75</td>
</tr>
<tr>
<td>First Class</td>
<td>6.75 ≤ CGPA &lt; 7.75</td>
</tr>
<tr>
<td>Second Class</td>
<td>6.0 ≤ CGPA &lt; 6.75</td>
</tr>
</tbody>
</table>

12.3 A student with final CGPA (at the end of the PGP) < 6.00 will not be eligible for the Award of Degree.

13.0 Withholding of Results:

13.1 If a Student has not paid fees to University/College at any stage, or has pending dues against his name due to any reason whatsoever, or if any case of indiscipline is pending against him, the result of the Student may be withheld, and he will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

14.0 Transitory Regulations:

14.1 A Student - who has discontinued for any reason, or who has been detained for want of attendance as specified, or who has failed after having undergone PGP, may be considered eligible for readmission to the same PGP with same set of Subjects/Courses (or equivalent Subjects/Courses as the case may be), and same Professional Electives (or from same set/category of Electives or equivalents as suggested), as and when they are offered (within the time-frame of 4 years from the Date of Commencement of his I Year I Semester).

15.0 Student Transfers:

15.1 There shall be no Branch/ Specialization transfers after the completion of Admission Process.

15.2 There shall be no transfer among the Constituent Colleges and Units of Jawaharlal Nehru Technological University Hyderabad.
### MALPRACTICES RULES:

<table>
<thead>
<tr>
<th>Nature of Malpractices</th>
<th>Punishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the candidate:</td>
<td></td>
</tr>
<tr>
<td>1 (a) Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject only.</td>
</tr>
<tr>
<td>1 (b) Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.</td>
</tr>
<tr>
<td>2 Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.</td>
<td>Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled.</td>
</tr>
<tr>
<td>3 Impersonates any other candidate in connection with the examination.</td>
<td>The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.</td>
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<tr>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.</td>
</tr>
<tr>
<td>5</td>
<td>Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.</td>
</tr>
<tr>
<td>6</td>
<td>Refuses to obey the orders of the Chief Superintendent / Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in-charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.</td>
</tr>
<tr>
<td>7</td>
<td>Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>---</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Possess any lethal weapon or firearm in the examination hall.</td>
</tr>
<tr>
<td>9</td>
<td>If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.</td>
</tr>
<tr>
<td>10</td>
<td>Comes in a drunken condition to the examination hall.</td>
</tr>
<tr>
<td>11</td>
<td>Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.</td>
</tr>
<tr>
<td>12</td>
<td>If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the College / University for further action to award suitable punishment.</td>
</tr>
</tbody>
</table>
17. GENERAL:

- **Credit**: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

- **Credit Point**: It is the product of grade point and number of credits for a course.

- The Academic Regulations should be read as a whole for the purpose of any interpretation.

- The University/College reserves the right of altering the Academic Regulations and/or Syllabus/Course Structure, as and when necessary. The modifications or amendments may be applicable to all the candidates on rolls, as specified by the University/College.

- Wherever the words ‘he’ or ‘him’ or ‘his’ occur in the above regulations, they will also include ‘she’ or ‘her’ or ‘hers’.

- Wherever the word ‘Subject’ occurs in the above regulations, it implies the ‘Theory Subject’, ‘Practical Subject’ or ‘Lab.’ and ‘Seminar’.

- In case of any ambiguity or doubt in the interpretations of the above regulations, the decision of the Vice-Chancellor will be final.

   *****
### I YEAR

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Code</th>
<th>Subject</th>
<th>L</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>APM05101</td>
<td>Analysis- I</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>APM05102</td>
<td>Algebra</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>APM05103</td>
<td>Theory of Ordinary Differential Equations</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>APM05104</td>
<td>Numerical Analysis</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>APM05105(i)</td>
<td>Departmental Elective-I</td>
<td>4</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>APM05105(ii)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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#### Departmental Elective-I

One of the following is to be selected:

i) Calculus of variations
ii) Mechanics
iii) Differential Geometry

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### II SEMESTER

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#### Departmental Elective-II

One of the following is to be selected:

i) Discrete Mathematics
ii) Advanced Differential Equations
iii) Galois Theory

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Total: **22**
### II YEAR

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#### II-SEMESTER

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JNTUH COLLEGE OF ENGINEERING HYDERABAD

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101- ANALYSIS- I

Pre Requisites: No Pre Requisites. Foundation Course.

Objectives:
- To train the students thoroughly in mathematical concepts of Basic analysis.
- To impart firm foundation in analysis which is useful in many other subjects of mathematics

UNIT-I

UNIT-II
Infinite Series: Series of Non-negative Terms- The Number e- The Root and Ratio Tests- Power Series- Summation by parts- Absolute Convergence- Additional and Multiplication of Series.

UNIT-III
Continuity: Limits of Functions- Continuous Functions- Continuity and Compactness- Continuity and Connectedness- Discontinuities- Monotonic Functions- Infinite limits and Limits at infinity.

UNIT-IV

UNIT-V
The Riemann-Stieltjes Integral-Definition and Existence of the Integral- Properties of Integral- Integration and Differentiation

Scope as in:

References:
Outcomes:

- The students become familiar with basic concepts of analysis.
- The students attain the ability to use this knowledge to understand and to solve many problems on other subjects like Differential Equations, Partial Differential equations etc.
- This is a foundation course and students can use this as a pre requisite for many other subjects in their upcoming semesters.
102- ALGEBRA

Pre Requisites: No Pre Requisites. Foundation Course.

Objectives:
- To train the students thoroughly in mathematical concepts of algebra.
- To impart firm foundation in algebra which is useful in many other subjects of mathematics.

UNIT-I
Group Theory: Definition of a Group – Some examples of group – Some preliminary Lemmas – Subgroups – A counting principle – Normal subgroups and Quotient groups.

UNIT-II
Group Theory: Homomorphisms – Automorphisms – Cayley’s Theorem – Permutation Group

UNIT-III
Another counting principle – Sylow’s Theorem – Direct products – Finite abelian groups

UNIT-IV
Ring Theory: Definition and examples of rings – Some special classes of rings – Homomorphisms – Ideals and quotient rings – More ideals and quotient rings – The field of quotients of an integral domain.

UNIT-V
Ring Theory: Euclidean rings – A particular Euclidean ring – Polynomial rings – Polynomials over the rational field – Polynomial rings over commutative rings.

Scope as in:

References:
1. Topics in Algebra- I.N. Herestein, John Willey-
2. Algebra- M.Artin, PHI.
5. Basic Algebra- P.B. Cohn, Springer.

Outcomes:
- The students become familiar with basic concepts of algebra.
- The students attain the ability to use this knowledge to understand and to solve many problems on other subjects like galois theory.
- This is a foundation course and students can use this as a pre requisite for many other subjects in their upcoming semesters.
103- THEORY OF ORDINARY DIFFERENTIAL EQUATIONS

Pre Requisites: No Pre Requisites. Foundation Course.

Objectives:
- To train the students thoroughly in mathematical concepts of Theory of Ordinary Differential Equations.
- To impart firm foundation in Theory of Ordinary Differential Equations which is useful in many other subjects of mathematics.
- To train the students to use this knowledge in mathematical modeling and some related research areas.

UNIT-I

UNIT-II
Linear Equations with Regular Singular points: Introduction- The Euler equation- Second order equations with Regular Singular points- the general case- A convergence proof- The exponential case- The Bessel Equation- Regular Singular points at infinity.

UNIT-III

UNIT-IV

UNIT-V

Scope as in:
1. An Introduction to Ordinary Differential Equations- Earl A. Coddington, PHI.

References:
1. Differential Equation with Applications and Historical notes. –G.F.Simmons- Tata MC.GrawHill.

**Outcome:**
- The students now ready to take higher courses in Differential Equations and Dynamical Systems.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

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104- NUMERICAL ANALYSIS

Pre Requisites: No Pre Requisites. Foundation Course.

Objectives:
- To give a firm foundation on numerical techniques involved in the study of higher mathematics

UNIT-I
Introduction- Computer Arithmetic-Errors- Transcendental and Polynomial Equations:
Introduction- Bisection Method-Iteration methods based on First Degree Equation- Rate of Convergence – Iteration Methods – Methods for Complex Roots-Polynomial Equations-
Choice of an Iterative Method and Implementation Problems.

UNIT-II

UNIT-III
Bivariate Interpolation- Application-Least Squares Approximation- Rational Approximation-
Choice of the Method- Problems.

UNIT-IV

UNIT-V
Ordinary Differential Equations: Introduction- Numerical Methods- Single step Methods-

Scope as in:
   Iyengar, R.K.Jain, New Age International.

References:
1. Elementary Numerical Analysis-Atkinson and Hahn, John Willey.
2. An Introduction to Numerical Analysis-. Atkinson and Hahn, John Willey.
3. Introductory Methods of Numerical Analysis- S.S. Sastry, PHI.

Outcome:
- The student is able to solve all kinds of equations including algebraic, ODE, PDE,
  Differentiate, and Integrate using numerical techniques.
Pre Requisites: No Pre Requisites. Foundation Course.

Objectives:
• To teach students variational techniques,

UNIT-I
The methods of variations in problems with Fixed Boundaries: Variation and its properties- Euler’s equation- Functionals of the form
\[ \int_{x_0}^{x_1} F(x, y_1, y_2, \ldots, y_n, y_1', y_2', \ldots, y_n') \, dx \] - Functionals dependent on Higher order derivatives.

UNIT-II
Functionals dependent on the functions of several independent variables- Variational problems in parametric form- Some applications.

UNIT-III
Variational problems with moving boundaries and certain other problems: An elementary problem with moving boundaries- The moving boundary problem for a functional of the form
\[ \int_{x_0}^{x_1} F(x, y, z, y', z') \, dx \] - Extremals with corners- One sided variations.

UNIT-IV
Sufficient conditions for an Extremum: Field of extremals- The function \( E(x, y, p, y') \) - Transforming the Euler equations to the canonical form.

UNIT-V
Variational problems involving a conditional extremum: Constraints of the form
\( \phi(x, y_1, y_2, \ldots, y_n) = 0 \) - Constraints of the form \( \phi(x, y_1, y_2, \ldots, y_n, y_1', y_2', \ldots, y_n') = 0 \) - Isoperimetric problems.

Scope as in:

References:
1. Methods of Applied Mathematics, 2nd Edition - Francis B. Hildebrand, PHI.
2. Calculus of variations- Gelfand, Prentice Hall, Inc.

Outcomes:
• The student can apply variational techniques to different problems in mathematics.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

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105(II). MECHANICS

Pre Requisites: No Pre Requisites. Foundation Course.

Objectives:  
- To give an overview of some important concepts in applied mathematics like principles of least action, an introduction to the mathematical physics.

UNIT-I  

UNIT-II  

UNIT-III  
The principle of least action- the equation of canonical transformation- examples of canonical transformation- Poisson and Lagrange brackets and their invariance under canonical transformation- Jacobi’s identity- Poisson’s theorem- Equations of motion infinite estimal canonical transformation in the Poisson bracket formulation.

UNIT-IV  
Hamilton Jacobi equations for Hamilton’s principle function- The harmonic oscillator problems as an example of the Hamilton- Jacobi method- New concept of space and time-postulates of special theory of relativity.

UNIT-V  
Lorentz transformation equation- Lorentz contraction- Time dilation- Simultaneity- Relativistic formulae for composition of velocities and accelerations- Proper time- Lorentz transformations form a group.

Scope as in:  

References:  
1. Relevant topics from special relativity- W. Rindler- Oliver & Boyd, 1060.  
2. An elementary treatise on the dynamics of a particle and of rigid bodies- S. L. Loney.  
3. A first course in mechanics, Grant R. Fowler, PHI.  

Outcome:  
- The student can apply mathematical concepts to real world systems.
Pre Requisites: No Pre Requisites. Foundation Course.

Objectives:
- To train the students thoroughly in mathematical concepts of Differential Geometry.
- To impart firm foundation in Differential Geometry which is useful in many other subjects of mathematics.
- To train the students to use this knowledge in mathematical modeling and some related research areas.

UNIT-I

UNIT-II

UNIT-III
The First Fundamental Form: Length of curves on surfaces- Isometric of Surfaces- Conformal mapping of surfaces- Surfaces area- Equiareal maps and a theorem of Archimedes- Curvature of surfaces: The second fundamental form- the curvature of curves on a surface- The normal and principle curvatures.

UNIT-IV
Gaussian Curvature and the Gauss Map: The Gaussian and mean curvatures- The pseudosphere- Flat surfaces- Surfaces of constant mean curvature- Gaussian curvature of compact surfaces- The gauss map- Geodesics: Definition and basic properties- Geodesics on surfaces of revolution- Geodesics as shortest paths- Geodesic coordinates.

UNIT-V
Minimal Surfaces: Plateau's problem- Examples of minimal surfaces- Gauss map of a minimal surface- Minimal surfaces and holomorphic functions- Gauss’s theorems Egregium: Gauss’s remarkable theorem- Isometries of surfaces- the codazzi- Mainardi equations – Compact surfaces of constant Gaussian curvature.

Scope as in:
1. Elementary differential geometry- Andrew Pressley, Springer.

Reference:
2. Three Dimensional differential Geometry- Bansilal.

Outcome:
- The students now ready to take higher courses in Differential Equations and Dynamical Systems
JNTUH COLLEGE OF ENGINEERING HYDERABAD
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106- ‘C’ PROGRAMMING LAB

Pre Requisites: No Pre Requisites. Foundation Course.

Objectives:
- To provide students with a comprehensive study of the C programming language. Classroom lectures stress the strengths of C, which provide programmers with the means of writing efficient, maintainable, and portable code. The lectures are supplemented with non-trivial lab exercises.

UNIT-I


UNIT-II

Arrays: Introduction- Array Initialization- Definition of Array- Characteristics of Array- One Dimensional Array- predefined streams- Two dimensional Array- Three or Multi-dimensional Arrays.

Strings: Declaration and Initialization of Strings-Display of Strings with Different Formats- Strings Standard Functions-Application of Strings.


UNIT-III


UNIT- IV

UNIT-V

Files: Introduction-Streams and File Types-Steps For File Operations-File I/O-Structures Read and Write-Other File Function-Searching Errors in Reading/Writing Files-low Level Disk I/O-Command Line Arguments-Application of Command Line Arguments-Environment Variables-I/O Re Direction.

Scope as in:

References:
1. Let Us C-.C. Programming - - Kanitkar Schaum series.

Outcome:
Upon completion of this course, students will be able to:

- Write C programs that are non-trivial.
- Use the variety of data types appropriate to specific programming problems.
- Utilize the modular features of the language.
- Demonstrate efficiency and readability.
- Demonstrate the use of the various control flow constructs.
- Use arrays as part of the software solution.
- Utilize pointers to efficiently solve problems.
- Include the structure data type as part of the solution.
- Create their own data types.
- Use functions from the portable C library.

Lab Practice:
1. Write a program for addition of two numbers.
2. Write a program for finding area and circumference of a circle.
3. Write a program for finding simple interest.
4. Write a program for finding area and perimeter of a rectangle.
5. Write a program to read 5 subject marks of a student and find average marks of that student.
6. Write a program to convert the given KMPH to Meter per second.
7. Write a program to convert the given number of days into months and days.
8. Write a program to check whether the given number is even or odd.
9. Write a program to check whether the given number is positive or negative.
10. Write a program to calculate the division obtained by a student.
11. Write a program to demonstrate the use of sizeof() operator
12. Write a program to swap two numbers using 3 variables and 2 variables.
13. Write a program to find the biggest of three numbers.
14. Write a program to check whether the given year is leap year or not.
15. Write a program to read a date from the key board, and check whether the given date is in correct format or not. (dd/ mm/ yyyy)
16. Write a program to convert the given temperature from Fahrenheit to centigrade.
17. Write a program to count number of hundred notes, fifty notes and ten notes for the given amount.
18. Write a program to read an integer and check whether the entered value is palindrome or not.
19. Write a program to read an integer value, and print that integer in reverse order
20. Write a program to read an integer and check whether the entered value is Armstrong or not.
21. Write a program to evaluate arithmetic operations using switch case.
22. Write a program to evaluate arithmetic operations on complex numbers using switch case.
23. Write a program to determine whether the given character is vowel or not using switch case.
24. Write a program to calculate sum of all the numbers between 1 and 50 excluding multiples of 3 and 5.
25. Write a program to calculate the sum of digits of an integer.
26. Write a program to check whether the given number is prime or not.
27. Write a program to solve the following series
28. Write a program to calculate the sum of N- Terms of the following series
29. Write a program to calculate the sum of N- Terms of the following series
30. Write a program to print Fibonacci series of N terms.
31. Write a program to calculate the sum of odd numbers between 1 and 50.
32. Write a program to determine whether the given character is alphabet, digit or any other special character. (use character test functions)
33. Write a program to read a character from the keyboard and print that character in reverse case. (use character test functions)
34. Write a program to find a large number in a given array.
35. Write a program to find the average, min and max value for the given array of elements.
36. Write a program to find Fibonacci series using arrays.
37. Write a program to read Two M X N Matrix and perform Addition Operation.
38. Write a program to read Two M X N Matrix and perform Subtraction Operation
39. Write a program to read Two M X N Matrix and perform Multiplication Operation
40. Write a program to read a M X N Matrix and find the Transpose of that matrix.
41. Write a program to read M X N and find the trace of the Matrix.
42. Write a program to read a M X N Matrix and print the diagonal elements.
43. Write a program to read a string and find the number of vowels in the given string.
44. Write a program to read a string and check whether the given string is palindrome or not.
45. Write a program to find the length of the given string including and excluding spaces.
46. S1, S2, S3 are three string variables. Write a program to read two string constants into S1 and S2 and compare whether they are equal or not. If they are not equal join them together. Copy the contents of S1 into the variable S3. At last the program should print the contents of all the three variables and their lengths.
47. Write a program to print a Fibonacci series using functions.
48. Write a program to find the factorial of a given number using recursive function.
49. Write a program to obtain prime factors of given number using functions.
50. Write a program to calculate sum of digits of an integer with and without recursion.
51. Write a program to pass a user defined function as an argument to another function.
52. Write a program to print structure elements.
53. Write a program to display the difference between structure and union.
54. Write a program to use structure within union.
55. Write a program to pass a structure variable as an argument to a user defined function.
56. Write a program to read and display car details using nested structures.
57. Write a program to print the Pascal triangle
58. Write a program to print the Parallelogram.
59. Write a program to swap two numbers using pointers.
60. Write a program to print the values and addresses of variables and pointer variables.
61. Write a program to perform different arithmetic operations using pointers.
62. Write a program to declare void pointer, assign address of integer, float and character to the pointer variable using type casting, and display the contents of the various variables.
63. Write a program to declare a pointer variable to a structure and display the contents of the structure.
64. Write a program to show the effect of increment operator on pointer variable. Display the memory location of integer, character and float variables before and after increment operation on pointer variables.
65. Write an example program for call by value concept.
66. Write an example program for call by reference concept.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

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201- ANALYSIS-II

Pre Requisites: Analysis- I.

Objectives:
- To train the students thoroughly in mathematical concepts of advanced Mathematical analysis.
- To impart firm foundation in analysis which is useful in many other subjects of mathematics

UNIT-I
Sequences and Series of Functions: Discussion of main problem – Uniform convergence - Uniform convergence and continuity - Uniform convergence and integration - Uniform convergence and differentiation.

UNIT-II
Equicontinuous families of functions – The stone - weierstrass theorem.

UNIT-III
The algebraic completeness of the complex field – Fourier series – The gamma function

UNIT –IV
Functions of several variables: Linear transformations – Differentiation – The contraction principle – The inverse function theorem – The implicit function theorem.

UNIT-V
The rank theorem – Determinants – Derivatives of higher order – Differentiation of integrals.

Scope as in:

References:

Outcomes:
- The students become familiar with advanced concepts of analysis.
- The students attain the ability to use this knowledge to understand and to solve many problems on other subjects like Differential Equations, Partial Differential equations etc.
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202- LINEAR ALGEBRA

Pre Requisites: Algebra

Objectives:
- To train the students thoroughly in mathematical concepts of Linear Algebra.
- To impart firm foundation in linear algebra which is useful in many other subjects of mathematics.

UNIT-I

UNIT-II
Inner product spaces- length and angle in inner product spaces Ortho normal- basis- Gram-Schmidt process –Coordinates- change of basis.

UNIT-III
Linear Transformations : Introduction to Linear transformation –Properties of Linear transformations – Kernel and Range- Linear transformations from R to R Geometry of linear transformations from R² to R² - Matrices of Linear transformations – Similarity.

UNIT-IV

UNIT-V
Applications: Applications to differential relations – Application to approximation –Problem-quadratic forms- Applications to conic sections- Application to Quadratic surfaces.

Scope as in:

Reference:
4. Linear Algebra- Kenneth Hoffman and Ray Kunge, PHI.
5. Linear Algebra with Applications- Olto Bretscher, Pearson Education.

Outcomes:
- The students become familiar with advanced concepts of algebra.
- The students attain the ability to use this knowledge to understand and to solve many problems on other subjects like Galois Theory.
- This is a foundation course and students can use this as a pre requisite for many other subjects in their upcoming semesters.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Sc. I Year II-Sem (Applied Mathematics)                                      L  T  P  C
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203- COMPLEX ANALYSIS

Pre Requisites: Analysis- I

Objectives:
• To train the students thoroughly in mathematical concepts of complex analysis.
• To impart firm foundation in analysis which is useful in many other subjects of mathematics

UNIT-I The complex Plane and Elementary Functions: Complex numbers- Polar representation - Stereographic Projections- The Square and Square Root Functions- The Exponential Function- The Logarithm Function- Power Functions and Phase Factors- Trigonometric and Hyperbolic Functions.


UNIT –IV

UNIT-V

Scope as in:

References:
3. Complex Analysis- Serge Lang, springer.

Outcomes:
• The students become familiar with concepts of complex analysis.
• The students attain the ability to use this knowledge to understand and to solve many problems on other subjects like Differential Equations, Partial Differential equations etc.
204. INTEGRAL TRANSFORMS AND INTEGRAL EQUATIONS

Pre Requisites: Analysis- I and TODE

Objectives:
- The student is trained to learn various techniques of transforms.
- To train the student in order to learn how to apply the techniques in applications.


Scope as in:
1. Operational Mathematics- R.V.Churchil.
2. Transforms-I. N Sneddon

Reference:
1. Operational Mathematics- R.V.Churchil.
2. Laplace Transforms- Springer.
3. Introduction to Integral equations with applications- Abdul J Jerri, Marcel, Dekker Inc

Outcome:
- The student is able to solve differential equations, boundary value problems and integral equations by using various transform techniques
205- Departmental Electives
205(I). DISCRETE MATHEMATICS

Pre Requisites: Algebra.

Objectives:
- To train the students thoroughly in mathematical concepts of discrete mathematics.
- To impart firm foundation in discrete mathematics which is useful in many other subjects of mathematics.
- The student is made to learn the logic and the applications into computer science.

UNIT-I
Recurrence Relations: Generating Functions-Coefficients of Generating Functions-Recurrence Relations-Inhomogeneous recurrence relations.

UNIT-II
Relations and Digraphs: Product Sets and Partitions- Relations and Digraphs- Paths in relation and Digraphs- Properties of Relations- Equivalence Relations -Data structures for Relations and Digraphs- Operations on Relations- Transitive Closure and Warshall’s Algorithm- Adjacency Matrices.

UNIT-III
Functions: Functions- Functions for Computer Science- Growth of Functions- Permutation Functions.

UNIT-IV
Order Relations and Structure:-Partially Order Sets- External Elements of Partially Ordered Sets- Lattices- Finite Boolean Algebras- Functions on Boolean Algebras- Circuit Design.

UNIT-V

Scope as in:

References:
1. Discrete Mathematics- Trembly Manohar
7. Discrete Mathematics with Graph Theory- Edgar G. Goodaire, Michael M. Palmenter, PHI.

**Outcomes:**
- The students become familiar with concepts of discrete mathematics.
- The students attain the ability to use this knowledge to understand and to solve many problems on other subjects like galois theory.
Pre Requisites: Analysis- I and TODE.

Objectives:
• To the students concepts of more advanced deferential equations including linear as well as non linear.

UNIT-I

UNIT-II

UNIT-III

UNIT-IV
Oscillations of Second Order Equations: Fundamental Results- Sturm’s comparison theorem- Elementary linear oscillations- Comparison theorem of Hille wintner- Oscillations of \( x'' + a(t)x = 0 \).

UNIT-V

Scope as in:

References:

Outcome:
• The student can perform phase plane analysis, analyze systems of equations. For example linearising and non linear equations.
Pre Requisites: Algebra.

Objectives:
- To teach the students advanced algebra like Galois Theory and extension fields.

UNIT-I
Field Theory: Field definition and examples- Irreducible polynomials and Eisenstein criterion- Adjunction of roots.

UNIT-II
Algebraic extensions- Algebraically closed fields- Normal and separable extensions: splitting fields

UNIT-III
Normal extensions- Multiple roots- Finite fields- Separable extensions

UNIT-IV
Galois Theory: Automorphism groups and fixed fields- Fundamental Theorem of Galois theory- Fundamental theorem of algebra.

UNIT-V
Applications of Galois Theory to classical problems: Roots of unity and cyclotomic polynomials- Cyclic extensions- Polynomials solvable by radicals.

Scope as in:
2. Topics in Algebra- I.N. Herestein, John Willey-

References:
2. Algebra- M.Artin, PHI.
5. Basic Algebra- P.B. Cohn, Springer.

Outcome:
Students can take subjects like coding theory by knowing Galois Theory.
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206- DATA STRUCTURES THROUGH ‘C’

Pre Requisites: No Pre Requisites. Foundation Course

Objectives:

- Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- Choose the appropriate data structure and algorithm design method for a specified application.
- Solve problems using data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs and writing programs for these solutions.

UNIT-I
Array and Records - Storages structures for arrays strings- sting operations- sparse matrices representation records- Linear data structures- Linear lists- operations on linear lists sequential allocation and linked allocation linked lists- single linked lists- double linked lists- insertion and deletion operations- simple applications of linked lists- multiple linked structures- Circular Linked Lists.

UNIT-II
Stacks - Stack operations- array and pointer implementations of stacks- simple applications of stacks - infix to postfix expression conversions- postfix expression evaluation recursion.

UNIT- III
Queues - Queue operations- array and pointer implementation of queues- circular queues- insertion and deletion operations on circular queues- Simple applications of queues.

UNIT-IV

UNIT-V

Scope as in:
1. An introduction to data structures with application M.C.M.- Trem Bay Ad Sorenson.

Reference:
1. DataStructure- Kochen

Outcome:
- To describe the usage of various data structures
- To explain the operations for maintaining common data structures
• To write programs using linked structures such as List, trees, and graphs
• To analyze algorithms and to determine algorithm correctness and time efficiency
• To demonstrate various methods of organizing large amounts of data.
• To design and apply appropriate data structures for solving computing problems

Lab Practice:-
1. Implement the following data structures using Arrays.
   i) Stacks
   ii) Linear Queues
   iii) Circular Queues
   iv) Dequeue
2. Implement Polynomial addition and multiplication with linked list sparse matrix.
3. Implement binary search tree using linked list and perform the following operations.
   i) Insertion
   ii) Deletion
   iii) Inorder Traversal
   iv) Preorder Traversal
   v) Preorder Traversal
4. Singly Linked list and doubly lists.
   i) Insertion
   ii) Deletion
   iii) Lockup
5. i) Implement Stack using Linked list.
   ii) Implement Queue using Linked list.
6. Implement the following sorting Techniques.
   i) Bubble sort
   ii) Insertion sort
   iii) Quick sort
   iv) Heap sort
7. Implementation the following Searching method.
   i) Sequential Search
   ii) Binary Search
   iii) Fibonacci
8. i) Conversion of Infix expression to Postfix notation.
   ii) Simple expression evaluation that can handle +--- /and*
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301- TOPOLOGY

Pre Requisites: Analysis- I and Analysis- II

Objectives:
- The object of Topology is to stress on the ideas of abstraction, aesthetics and the development of mathematical tools and the use of the language of mathematics.

UNIT-I
Topological Spaces: The definition and some examples – Elementary concepts – Open bases and open subbases – Weak topologies.

UNIT-II
The function algebras $C(X, R)$ and $C(X, C)$

UNIT-III
Compactness for metric spaces – Ascoli’s theorem.
Separation: $T_1$- spaces and Hausdorff spaces.

UNIT-IV

UNIT-V

Scope as in:
1. Introduction to Topology and Modern Analysis- G.F. Simmons, Tata Mc graw-Hill.

References:
1. Topology -James R. Munkers, PHI.

Outcome:
- Students should be familiar with basic concepts of topology.
- Student should gain mathematical maturity.
- Students should become competent in writing proofs.
- Apply special imagination to theory.
302- PROBABILITY AND STATISTICS

Pre Requisites: No Pre Requisites. Foundation Course.

Objectives: The student will be able to:

- Define experiment, outcome, event, probability and equally likely.
- Restate the formula for finding the probability of an event.
- Determine the outcomes and probabilities for experiments.
- Interact with die rolls and spinners to help predict the outcome of experiments.
- Distinguish between an event and an outcome for an experiment.
- Recognize the difference between outcomes that are equally likely and not equally likely to occur.

UNIT-I
Probability: Sample spaces and events - Basic set theory - Definitions of probability - Axioms of probability - Joint probability (addition Theorems) - Conditional probability (Multiplication Theorem) - Total probability - Baye’s Theorem - Independent events – random variables - Introduction - Types of Random variables - Discrete Random variable.

UNIT-II
Regression And Correlation: Correlation Analysis- Types of correlation - Positive and negative correlation - Simple - partial and Multiple Correlation - Linear and Non-Linear Correlation - Methods of Studying Correlation - Scatter Diagram correlation - Graphic method – Karl-Pearson’s Coefficient of correlation - Rank Correlation - Partial correlation - Multiple Correlation - Regression Analysis.

UNIT-III
Tests of statistical hypothesis - large sample tests - Introduction - Statistical Hypothesis - test of a statistical hypothesis - Procedure of Testing Hypothesis - Set up a Hypothesis - Set up a Suitable significance Level - Setting’s test criterion - Doing computations - Making decisions - Type I and Type II errors - Two-tailed and one-tailed test of Hypothesis - Large sample tests: Test of significance of single mean - Test of significance for difference of standard deviation - Test of Significance for single proportion - Test of significance for difference of proportions.

UNIT-IV
Tests of statistical hypothesis small sample tests: Introduction - student’s t-distribution - Properties of t-distributing - test of significance of single mean - Test of significance for inference between two mean of independent sample - Test of significance for difference between Two Means (dependent samples) - Test of Significance of an observed correlation.
coefficient - F-test for equality of Population Variance - Chi-square distribution : Properties of chi-square distribution - Applications of Test of a statistical \( \chi^2 \) distributions - Chi-square test for goodness of fit - Conditions for applying \( \chi^2 \) test - degree of freedom - Chi-square test for independence of attributes.

UNIT-V

Scope as in:
2. Probability and Random Process- Murugesan

Reference:
1. Probability and Statistics for Engineers and Scientists- Miller & Freund.
3. Introduction to Probability charts- M.Grininstead- J. Laurie Snell.

Outcomes:
The student will be able to:

- Define certain event, impossible event.
- Describe and list the contents of a standard deck of 52 playing cards.
- Examine the probabilities of experiments with certain outcomes.
- Examine the probabilities of experiments with impossible outcomes.
- Evaluate interactive die rolls and spinners in relation to certain and impossible events.
- Explain the difference between certain and impossible events.
- Compute the probability of a certain event.
- Compute the probability of an impossible event.
303- PARTIAL DIFFERENTIAL EQUATIONS

Pre Requisites: Ordinary differential equations and Linear Algebra

Objectives:
- Where and how PDEs arise in applications.
- Fundamental concepts of PDE theory.
- Analytical methods for solving PDEs

UNIT-I
Simultaneous Differential equations of the first order and the first degree in three variables
Method of solution of \( \frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R} \) – orthogonal trajectories of a system of curves on a surface – Partial differential forms and equations.

UNIT-II

UNIT-III

UNIT-IV
Laplace Equations: The occurrence of Laplace’s equation in physics Elementary solution of Laplace equation – Boundary Value Problems Separation of variables – The two dimensional Laplace equation.

UNIT-V
The Wave equation: The occurrence of the Wave equation in Physics – Elementary solution of the one – dimensional wave equation. Green’s function for the wave equation.

Scope as in:

Reference:

Outcome:
- Describe real-world systems using PDEs.
- Solve first order PDEs using the method of characteristics.
- Determine the existence, uniqueness, and well-posedness of solution of PDEs.
- Solve linear second order PDEs using canonical variables for initial-value problems, Separation of Variables and Fourier series for boundary value problems
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304- OPTIMIZATION TECHNIQUES

Pre Requisites: Linear Algebra

Objectives:
- To lay a strong foundation in various optimization techniques. So that the student can solve problems that arise in subjects like fluid dynamics.

UNIT-I

UNIT-II
Transportations Models: Matrix form of transportation problem, existence of feasible solution, existence of optimal solution, loops in transportation table and their properties, The initial basic solution in transportation table and their properties, The initial basic feasible solution to transportation problem, methods for initial Basic feasible solution, Moving towards optimum solution, To examine the initial basic feasible solution for Non-degeneracy, Determination of Net evaluations, the Optimality test, Degeneracy in Transportation problem, Unbalanced transportation problem.

UNIT-III

UNIT-IV
Replacement Models: The Replacement problem, Failure Mechanism of items, Replacement policy for items whose maintenance cost increases with time and money value is constant.

UNIT-V
Job Sequencing: Terminology and notations, Principle Assumptions, solution of sequencing problem processing n jobs through two, three and m machines, processing two jobs through ‘m’ machines (Graphical method).

Scope as in:

Reference:
1. Data Structures in Pascal- Horowitz And Sahni, Galgotia publications.
2. Linear programming by M.K.Venkata Raman.

Outcome:
- The student can apply optimization techniques to solve and understand problems in statistics, fluid dynamics etc.
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Departmental Elective- III
305(i)- DISCRETE TIME CONTROL SYSTEMS

Pre Requisites: Differential Equations.

Objectives:
- To train and motivate the students towards mathematical modeling and to understand various real world problems which use applications of mathematics.

UNIT-I

UNIT-II
Z-Plane Analysis of Discrete-Time Control Systems: Introduction - Impulse Sampling and data hold - Obtaining the Z Transform by the Convolution integral Method - The pulse transfer function.

UNIT-III

UNIT-IV

UNIT-V
Pole placement and observer design: Introduction - Controllability - Observability - Useful transformations in state - Space analysis and design - Design via pole placement - State observers.
Scope as in:

References:

Outcome:
- After the completion of this course the student can apply these techniques to learn and understand mathematical modeling, dynamical systems and mathematical biology.
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305(ii)- DIFFERENTIAL EQUATIONS AND DYNAMICAL SYSTEMS

Pre Requisites: Theory of Ordinary differential equations

Objectives:
By the end of the course, you would/should have:

- Learned and used various tools for the analysis and control of nonlinear systems.
- Got a feeling and gained insight into the complexity of nonlinear systems.
- Known and played around with a wide variety of interesting, inherently nonlinear examples.

UNIT – I

UNIT-II

UNIT-III

UNIT-IV

UNIT-V

Scope as in:

References:
1. Differential Equations and Dynamical Systems- Lawrence Perko, Springer.
Outcome:

- Knowledge. The student has knowledge of basic concepts and methods from the theory of differential equations and dynamical systems, including analytical and geometrical techniques for the study of qualitative properties of solutions. In particular, the student is familiar with linear and nonlinear systems, existence and uniqueness, continuous dependence, phase plane analysis, equilibria, limit cycles, stability, Lyapunov's Direct Method, index theory, the Poincaré-Bendixson theorem, the additional topics and examples of applications.

- Skills. The student is able to apply his or her knowledge to the study of concrete examples. The student masters central techniques of proof and is able to apply these to related problems.
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305(iii)- ARTIFICIAL NEURAL NETWORKS

Pre Requisites: Linear algebra.

Objectives:
The student will able to know the following topics.

- Basic neuron models, Basic neural network models, multilayer perceptron, Basic learning algorithms: the delta learning rule, the back propagation algorithm, self-organization learning, Applications: pattern recognition, function approximation, information visualization, etc.

UNIT-I

UNIT-II

UNIT-III
Functional Units of ANN for Pattern Recognition Tasks: Pattern Recognition Problem- Basic Functional Units- Pattern Recognition Tasks by the Functional Units.

UNIT-IV
Feedforward Neural Networks: Introduction- Analysis of Pattern Association Networks- Analysis of Pattern Classification Networks- Analysis of Pattern Mapping Networks- Summary and Discussion.

UNIT-V
Feedback Neural Networks: Introduction- Components of a Competitive Learning Network- Analysis of Feedback Layer for Different Output Functions- Analysis of Pattern Clustering Networks- Analysis of Feature Mapping Network- Summary.

Scope as in:

References:
3. Neural Networks and Fuzzy Systems- Bart Kosko.

Outcome:
- After this course, the student should be able to know how to use neural networks for solving different problems related to pattern recognition, function approximation, data visualization, and so on.
Pre Requisite: No Pre Requisites. Foundation Course

Objectives:
- The goal of this course is to introduce students to the fundamental concepts of Scientific Programming using MATLAB and we introduce the necessary mathematical concepts as we go.
- The course will cover the syntax and semantics of MATLAB including data types, control structures, comments, variables, functions, and other abstraction mechanisms.

UNIT-I
Introduction to MATLAB: Starting and ending a MATLAB-MATLAB Environment- Help future- Types of Files- Platform- Search Path.

Constants, Variables and Expression:- Character Set- Data Types- Constants and Variables- Operators- Hierarchy of Operations- Built-in Functions- Assignment Statement-Illustrative Programs.

UNIT-II


UNIT-III
Input-output Statements:-Data input- Interactive Inputs- Reading/Storing File Data- Output Commands- Low-level Input-Output Functions.

MATLAB Graphics:-Two Dimensional Plots- Multiple Plots - Style Option -Sub plots-Specialized Two–Dimensional Plots- Three dimensional Plots.

UNIT-IV
Loops: While loop- For loop- Break and Continue Statements- Nesting loops- Branches Control Structures.

Writing Programs and Functions:-MATLAB Editor- MATLAB Programming- Function Subprograms- Types of Functions - Function handles - Errors and Warnings.

UNIT- V
Database Tool Box:-Create a Database and Data Source- Export data from MATLAB Workspace to Database- Import data from Data base to MATLAB workspace - Sub Query from Multiple tables Using VQB (Visual Query Builder) - MATLAB functions with Examples.

Scope as in:
1. MATLAB and Its Application In Eginerring- Rajkumar Banasal, Ashok Kumar Geo, Manoj Kumar Sharma, Pearson Publications.
References: Numerical Methods using MATLAB- John H. Mathews, D.fink, PHI.

Outcome:
Students who successfully complete this course will:

• Become familiar with general concepts in computer science
• Gain an understanding of the general concepts of programming
• Obtain a solid foundation in the use of MATLAB.

Lab Practice:-
1. Let a 4X3 Matrix A =
\[
\begin{bmatrix}
2 & 3 & 4 \\
3 & 4 & 5 \\
4 & 5 & 6 \\
5 & 6 & 7 \\
\end{bmatrix}
\]
, Using matlab Commands
   a) Delete a 1st row of A
   b) Delete the 1st & 2nd columns of all rows of matrix.
   c) Replace the elements A(3,4), A(4,3) with 9 and 8.

2. Express the following sets of algebraic equation in the matrix form AY=B.
   \[
   \begin{align*}
   x_1 + x_2 - x_3 &= 2 \\
   -x_1 + 3x_2 - x_3 &= 2 \\
   3x_1 - 5x_2 - 2x_3 &= 0
   \end{align*}
   \]
   \[
   \begin{align*}
   x_1 + x_2 + x_3 &= 4 \\
   -x_1 + 3x_2 - x_3 &= 4 \\
   4x_1 - 4x_2 &= 0
   \end{align*}
   \]
   a) Find the inverse of both matrices.
   b) Obtain the solution for the variables \(x_1, x_2, x_3\).
   c) Find the eigen values and eigen vectors of both matrices.
   d) Find rank, trace and transpose of both matrices.

3. Draw multiple plots using hold command and also use legend command.

4. Draw the multiple plots of the following curves \(y_1 = \sqrt{x^2 + 1}, \ y_2 = 5x + 20\), using Line command X varies from 0 to 100 and step size is 10.

5. Draw the graph of the equation \(Y = 3X + 5\) for X varies from 0 to 5, add label to it using gtext command.

6. Plot the curve given by the equation \(y = \sin(x)\) as X varies from 0 to \(2\pi\) also label the X and Y axis produce a suitable title to plot and also show grid lines on the plot.

7. Illustrate the use of pie function to show the concentration of different industries in the regions as per the following data.

<table>
<thead>
<tr>
<th>Name of the industry</th>
<th>No. of Industrial Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>4</td>
</tr>
<tr>
<td>Textile</td>
<td>8</td>
</tr>
<tr>
<td>Software</td>
<td>20</td>
</tr>
<tr>
<td>Chemical</td>
<td>2</td>
</tr>
<tr>
<td>Telecom</td>
<td>7</td>
</tr>
<tr>
<td>Banking</td>
<td>10</td>
</tr>
</tbody>
</table>
8. Divide the figure window into 4 sub windows and plot the following functions
   i) Plot V v/s I , where V=4*I and I=1,2,3,4
   ii) Plot Y v/s X, where Y=X^2 and X=1,2,3,4
   iii) For t=0 : 2*pi in step t=pi/60, plot sin(t) v/s t.
   iv) For t=0 : pi/30 : 2*pi, plot cos(t) v/s t
9. Plot the graph for the equation y=X^3+2X^2-5, X varies from -10 to 10, use gtext command to write this equation on the curve plotted.
10. Write a program to plot the curve for equation A=10e^{-0.2t} for t=0 to 50, show the grid lines on the graph.
11. Plot a bar graph to show the comparison of average temperature in city A, B, C for the months from September to February.

<table>
<thead>
<tr>
<th></th>
<th>City - A</th>
<th>City - B</th>
<th>City - C</th>
</tr>
</thead>
<tbody>
<tr>
<td>September</td>
<td>31</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>October</td>
<td>29</td>
<td>26</td>
<td>22</td>
</tr>
<tr>
<td>November</td>
<td>28</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>December</td>
<td>27</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td>January</td>
<td>26</td>
<td>22</td>
<td>17</td>
</tr>
<tr>
<td>February</td>
<td>29</td>
<td>25</td>
<td>20</td>
</tr>
</tbody>
</table>
12. Plot the following function on polar plot, the function is f(θ)= sin(4 θ) for -π/2 ≤ θ ≤ π/2, where θ is in Radians.
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401- FUNCTIONAL ANALYSIS

Pre Requisites: Analysis- I and Analysis- II.

Objectives:
- The objective of the module is to study linear mappings defined on Banach spaces and Hilbert spaces, especially linear functionals and some sequence spaces. In particular, the four big theorems in functional analysis, namely, Hahn-Banach theorem, uniform boundedness theorem, open mapping theorem and Banach-Steinhaus theorem will be covered.

UNIT- I
Normed Space- Banach Space: Normed Space- Banach Space –Further Properties Of Normed Spaces –Finite Dimensional Normed Spaces and Subspaces –Compactness and Finite Dimension.

UNIT-II
Linear Operators -Bounded and Continuous Linear Operators – Linear Functionals –Linear Operators and Functionals on Finite Dimensional Spaces –Normed Spaces of Operators-Dual Space.

UNIT-III

UNIT-IV
Fundamental Theorems for Normed and Banach Spaces: Zorn’s Lemma-Hahn-Banach Theorem-Hahn-Banach Theorem for Complex Vector Space and Normed Spaces-Application to Bounded Linear Functionals on C[a,b] -Adjoint Operator-Reflexive Spaces-Category Theorem- Uniform Boundedness Theorem.

UNIT-V
Strong and Weak Convergence-Convergence of Sequences of operators and Functionals-Application to Summability of Sequences -Weak Convergence –Open Mapping Theorem – Closed Linear Operators- Closed Graph Theorem.

Scope as in:
1. Introductory Functional Analysis with Applications– Erwin Kreyszig, John Wiley.

References:
1. Introduction to topology and modern Analysis- G.F Simmons – Tata Mc Graw-Hill.
2. Functional Analysis- B.V. Limaye.
5. Functional Analysis-A problem oriented approach– V.K. Krishnan, PHI

Outcome:
This is a basic Foundation course in functional analysis with which student gets a better understanding of advanced courses in ODE and PDE.
402- OPERATIONS RESEARCH

Pre Requisites: Optimization Techniques
Objectives:
- Model decision making problems using major modeling formalisms of artificial intelligence and operations research, including propositional logic, constraints, linear programs and Markov processes
- Evaluate the computational performance of search, satisfaction, optimization and learning algorithms.
- Apply search, satisfaction, optimization and learning algorithms to real world problems.

UNIT-I
Theory of Games: Characteristics of Games Theory, Basic definitions. Minimax Criterion and optimal strategy, saddle point optional strategies and value of game, solution of games with saddle points, Rectangular Games without saddle point, Minimax principle, Equivalence of Rectangular Game and Linear Programming, Fundamental theorem of Game theory, solution of m x n games by Linear programming, Two by two Games without Saddle point by Arithmetic method, Dominance method, Graphical method for 2xn and nx2 Games matrix method, Algebraic method, iterative method.


UNIT-III
Inventory Production Management: Introduction - Definition - Types of Inventory - Inventory decisions - How to develop an inventory model. Costs involved in Inventory problems - Variables in inventory problem - classification of characteristics of inventory systems. A list of symbols used Graphical method. The EOQ model without shortage.

UNIT-IV: Project scheduling by PERT/ CPM: Introduction, Basic Difference between PERT and CPM, Construction of the net work, critical path analysis, Floats of an activity, Three time estimates for PERT.

UNIT-V
Queueing theory: Introduction Queueing system, queuing problem, Transient and steady states, Traffic intensity, Distributions of Arrivals, Poisson process (Pure Birth process) properties of Poisson process of Arrivals, Distribution of inter, Arrival Linear (exponential process).Markovian property of inter arrival times, Distribution of Departure (Pure Death process) Classification of Queuing Models Solution of Queuing models and limitations for its applications. Model (M/M/1) (/FCFS) Birth and death model.

Scope as in:
References:

Outcome:
Upon successful completion of this course, students will be able to:

- Describe at an initiative level the process of artificial intelligence and operations research: a real-time cycle of problem understanding, formulation, solution and implementation.
- Formulate simple reasoning, learning and optimization problems, in terms of the representations and methods presented.
- Manipulate the basic mathematical structures underlying these methods, such as system state, search trees, plan spaces, model theory, propositional logic, constraint systems, Markov decision processes, decision trees, linear programs and integer programs.
- Demonstrate the hand execution of basic reasoning and optimization algorithms on simple problems.
- Formulate more complex, but still relatively simple problems, and apply implementations of selected algorithms to solve these problem.
- Evaluate analytically the limitations of these algorithms, and assess tradeoffs between these algorithms.
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403- THEORY OF COMPUTATION

Pre Requisites: No Pre Requisites. Foundation Course.

Objectives:
- The primary objective of a Theory of Computation (TOC) course is to introduce the fundamental mathematical and computational principles that are the foundation of computer science. These include topics such as Turing machines, Automata, grammars and formal languages, decidability, halting problem, the P = NP question and NP-Completeness reductions.

UNIT-I
The Theory of Automata: Definition of an automata- Description of a Finite Automation- Transition Systems- Properties of Transition Functions- Acceptability of a string by a finite Automation- Non Deterministic finite State Machines- The Equivalence of DFA and NDFA- Mealy and Moore models- Minimization of Finite Automaton.

UNIT-II
Formal Languages: Basic definitions and examples- Chomsky classification of Languages- Languages and their relation- Recursive and recursively enumerable sets- operations of languages- Languages and Automaton.

UNIT-III
Regular sets and Regular Grammars: regular expressions- Finite Automata and regular expressions- Pumping lemma for Regular sets- Application of Pumping lemma- Closure properties of regular sets- Regular sets and Regular grammars.

UNIT-IV

UNIT-V
Turing Machines: Turing Machine model- Representation of Turing Machines- Languages Acceptability by Turing Machines- Design of Turing Machines- Universal Turing Machines and other modifications.

Scope as in:
   Chapters: 2-3-4-5.1 to 5.4 and 7.1 to7.5 By K.L.P. Mishra- N. Chandrasekharan, Second Edition, PHI.

References:
1. Introduction to Automata theory-languages and computation- Hopcroft H E and Ullman J D.

Outcome:
- The foundation of the theory of computer science is learnt. Student is able to write programs on theory of automata after the completion of this course.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Sc. II Year II-Sem (Applied Mathematics)

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404- ANALYTIC NUMBER THEORY

Pre Requisites: Algebra and Complex Analysis..

Objectives:
• It is to make the students to learn about basic number theory, number theoretic functions and their applications in the proof of prime number theory and in algebra

UNIT-I
Review of Basic Concepts of Number Theory (Not to be examined)

Arithmetical Functions and Dirichlet Multiplication: Introduction-The mobius function μ(n)-The euler totient function φ(n)- A relation connecting φ and μ- A product formula for φ(n)-Dirichlet product of arithmetical functions- Dirichlet inverses and mobius inversion formula-The Mangoldt function \( \Lambda(n) \)-Multiplicative functions- Multiplicative functions and Dirichlet Multiplication- The inverse of a completely multiplicative function-Liouville’s function \( \lambda(n) \)-The divisor functions \( \sigma_a(n) \)- Generalized convolution.

UNIT-II
Averages of Arithmetical functions: Introduction-The big oh notation. Asymptotic equality of functions- Eular’s summation formula- Some elementary Asymptotic formulas- The Average order of d(n)- The Average order of the divisor functions \( \sigma_a(n) \)-The average order of φ(n)-An application to the distribution of lattice points visible from the origin-The average order of μ(n) and \( \Lambda(n) \)-The partial sums of a Dirichlet product- Application to μ(n) and \( \Lambda(n) \)-Another identity for the partial sums of a Dirichlet product.

UNIT-III
Some Elementary Theorems on the Distribution of Prime Numbers: Introduction-Chebyshev’s functions \( \psi(x) \) and \( \pi(x) \)- Relations connecting \( \psi(x) \) and \( \pi(x) \)- Some equivalent forms of the prime number theorem- Inequalities for \( \pi(n) \) and \( p_n \)- Shapiro’s Tauberian Theorem- An Asymptotic formula for the partial sums \( \sum_{p \leq x} \left( \frac{1}{p} \right) \)- The partial sums of the Mobius function- Brief sketch of an elementary proof of the prime number theorem-Selberg’s asymptotic formula.

UNIT-IV
Finite Abelian Groups and Their Characters: Definition- Examples of groups and subgroups- Elementary properties of groups- Construction of subgroups- Characters of finite abelian groups. The character group- The orthogonality relations for characters- Dirichlet Characters- Sums involving Dirichlet Characters- The non-vanishing of \( L(1-x) \) for real nonprincipal x.

UNIT-V
Dirichlet’s theorem on Primes in Arithmetic Progressions: Introduction- Dirichlet’s theorem for primes of the form 4n-1 and 4n+1 – The plan of the proof of Dirichlet’s theorem-Proof of Lemma 7.4 - Proof of Lemma 7.5- Proof of Lemma 7.6- Proof of Lemma 7.8- Proof of Lemma 7.7-Distribution of primes in arithmetic progressions.
Scope as in:

References:

Outcome:
- After completion of this course students can learn the applications number theory in advanced subjects like cryptography, cryptology, and coding theory.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Sc. II Year II-Sem (Applied Mathematics)  
Departmental Elective - IV  
405(i). MEASURE AND INTEGRATION

Pre Requisites: Analysis- I and Analysis- II.

Objectives:
• This course is intended to train the students in the advanced analysis whose usage is multidisciplinary.

UNIT-I  

UNIT-II  
The Lebesgue Integral: The Riemann Integral - The Lebesgue integral of a bounded function over a set of finite measure.

UNIT-III  
The integral of a non-negative function - The general Lebesgue integral - Convergence in measure.

UNIT-IV  
Differentiation and integration: Differentiation of monotone functions - Functions of bounded variation - Differentiation of an integral - Absolute continuity - Convex functions.

UNIT-V  

Scope as in:

References:
1. Measure Theory- P.R. Halmos- Springer.
2. Measure Theory and Integration- G. de Berra, New Age International (P)Ltd.

Outcome:
• After this advanced analysis course students are able to work with theories involving advanced ordinary differential equations and their applications.
405(ii). DYNAMIC MODELS AND CONTROL OF BIOLOGICAL SYSTEMS

Pre Requisites: TODE and PDE.

Objectives:

- To introduce students to the application of mathematical modeling in the analysis of biological systems comprising populations of molecules, cells and organisms.
- To show how mathematics, statistics and computing can be used in an integrated way to analyze Mathematical biology.
- To develop students' skills in algebraic manipulation, the calculus of elementary differential equations and statistical methods.
- To examine students in the theory of Mathematical biology at the end of the course.

UNIT-I


UNIT-II


UNIT-III


UNIT-IV


UNIT- V

Properties of Solutions - Existence of Periodic Solutions - A Model with Discrete Delay in Growth Response - Stability Results - Discussion.

Scope as in:


References:

Outcome:

At the end of the course, students should:

- have an enhanced knowledge and understanding of mathematical modeling in the analysis of biological systems;
- be better able to assess biological inferences that rest on mathematical
- be able to analyze data from experiments and draw sound conclusions about the underlying processes using their understanding of mathematics;
Pre Requisites: Mechanics.

Objectives:
- Develop an understanding of fluid dynamics in aerospace engineering as well as a variety of other fields.
- Learn to use control volume analysis to develop basic equations and to solve problems.
- Understand and use differential equations to determine pressure and velocity variations in internal and external flows.

UNIT-I
General Orthogonal Curve linear Coordinates: Arc length gradient- Divergence and curl in orthogonal coordinates- Laplacian kinematic of fluids in motion real fluid and ideal fluids- Velocity of fluid at a point- Stream lines and path lines- Steady flow and unsteady flow- Velocity potential- velocity vector- Local and partial of fluid- Conditions at a rigid boundary general analysis of fluid motion.

UNIT-II
Equations of Motion of a Fluid: Pressure at a point in a fluid at rest- Pressure at a point in a moving- Fluid conditions at boundary of two in viscid in compressive fluids- Euler’s equation of motion- Bernoulli’s equation- Steady motion under conservative body forces- Potential theorems- flow involving axial symmetry- special two dimensional flows- impulsive motion- Further aspects of vortex motion.

UNIT-III
Three Dimensional Flows: Sources, Sinks, Doublets, Images in a rigid infinite plane- Images in solid spheres- ax symmetric flows- Stokes stream function for ax symmetrical irrotational motions.

UNIT-IV
Two-Dimensional Flows: Meaning of two dimensional flow- Use of cylindrical polar coordinates- Stream function- Complex potential for two dimensional irrotational in compressive flow- Complex velocity potentials for standard two dimensional flow.

UNIT-V
Uniform stream line sources and line sinks- Line doublets line vortices- Two dimensional image stream- Milne Thomson circle theorem- Applications of circle theorems extensions of circle theorem- theorem of blassius- Use of conformal transformation- Hydro dynamical aspects of a conformal transformation- Schwarz chistoffel transformation- Vertex rows- Single infinity row of line vortices- The karman vortex street.

Scope as in:
References:
5. A First Course in Fluid Dynamics, Cambridge University press.

Outcome:
Students successfully completing this course, we expect the following outcomes

- An understanding of fluid mechanics fundamentals, including concepts of mass and momentum conservation.
- An ability to apply the Bernoulli equation to solve problems in fluid mechanics.
- An ability to apply control volume analysis to problems in fluid mechanics.
Pre Requisites: MATLAB- I.

Objectives:

- The goal of this course is to introduce students to the fundamental concepts of Scientific Programming using MATLAB and we introduce the necessary mathematical concepts as we go.
- The course will cover the syntax and semantics of Matlab including data types, control structures, comments, variables, functions, and other abstraction mechanisms.
- Once the foundations of the language have been established students will explore different types of scientific programming problems including curve fitting, optimization, integration, differentiation, statistical analysis, ODE solving, image processing, clustering, and simulation.

UNIT-I

Curve Fitting Tool Box:- Introduction to TOOL Box- Importing the Data Sets -Viewing the Data sets - Smoothing Data- Moving Average Filtering- Low less and Less: Local Regression Smoothing- Fitting Data: - The Fitting Process- Parametric Fitting- Basic Assumptions about the Error.

UNIT-II


UNIT-III

Numerical Integration programs by Using MATLAB:-Trapezoidal Rule- Simpson’s 1/3-rule- Simpson’s 3/8-rule- Interpolation:-Newton’s Forward and Backward Interpolation Formulas.

UNIT-IV


UNIT- V

MATLAB Applications in Control Systems: Laplace transforms – Inverse Laplace transforms- Partial fraction expansion using MATLAB- Transfer function representation- State space representation of dynamic systems- Transfer function to state space conversion and vice versa- Series/ cascade, parallel and feedback connections- time response of control systems- Standard input test signals- Step response of linear dynamic systems- Performance indices- Impulse and ramp response of control systems- Response to arbitrary input- Steady state errors- - Steady state errors for different types of inputs and systems- Stability of control systems- Routh Hurwitz criterion.
Scope as in:
1. MATLAB and Its Application In Engineering- Rajkumar Banasal, Ashok Kumar Geol-Manoj Kumar Sharma -Pearson Publications.

References:

Outcome:
Students who successfully complete this course will:

- Become familiar with general concepts in computer science
- Gain an understanding of the general concepts of programming
- Obtain a solid foundation in the use of MATLAB

Lab Practice:-
1. Write a program for Bisection method.
2. Write a program for Newton Raphson method
3. Write a program for Regula Falsi method
4. Write a program for Runge kutta method.
5. Write a program for Simpson’s 1/3 rule
6. Write a program for Simpson’s 3/8 rule
7. Write a program for Trapezoidal Method.
8. Write a program for Legranges Interpolation.
9. Write a program for Newton forward Interpolation.
10. Write a program for Newton backward Interpolation.
11. Write a program to implement logic gates.
12. Write a program to solve explicit ODE.
13. Write a program to solve implicit ODE.
14. Write a program to solve Boundary Value Problem (BVP).
15. Write a program to solve Delay Differential Equation (DDE).
16. Write a program to solve Partial Differential Equation (PDE).
17. Write a program to implement Unit Step Response and Unit Ramp Response.
   Eg: \[
   \frac{0.5151z^{-1} - 0.1452z^{-2} - 0.2963z^{-3} + 0.5528z^{-4}}{1 - 1.8528z^{-1} + 1.5906z^{-2} - 0.6642z^{-3} + 0.0528z^{-4}}
   \]
18. Write a program to find inverse Z Transform of the given function.
   Eg: \[
   \frac{0.4637z^{-1} - 0.3393z^{-2}}{1 - 1.5927z^{-1} + 0.6607z^{-2}}
   \]
19. Write a program to generate Fibonacci Series.
20. Write a program to implement Unit Step response in Laplace Transform for Different Problems.