POLICY ON ADVANCED AND SLOW LEARNERS

THAMIRABHARANI ENGINEERING COLLEGE

(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)
Chathirampudukulam, Chidambaranagar - Vepemkulam Road.
Thatchanallur, Tirunelveli 627 358, Tamil Nadu.

2.2.1 The institution assesses the learning levels of the students and organizes special Programmes for advanced learners and slow learners

POLICY ON ADVANCED AND SLOW LEARNERS

This policy paper is recognized as the "Policy on Advanced and Slow Learners" of the Thamirabharani Engineering College, Thatcahanallur. Through this policy the college pronounces its assurance to the vital facilitation and prop up to the advanced learners to be excellent achievers and slow learners to be better performing and achieving students in the academic and personal life. The policy also persuades the teaching Departments to develop significant strategies and scientific implementations to benefit both the advanced learners and slow learners in the University education system without forgetting the average performers.

Policy Guidelines for Advanced learners

1. Advanced learners are motivated to strive for higher goals. They are provided with additional inputs for better career planning and growth through offering special coaching for higher level competitive examinations

2. Motivating them to involve in research projects to inculcate research orientation and higher studies aspirations

3. Helping them to participate in group discussions, technical quizzes to develop analytical and problem solving abilities in them and thereby, to improve their presentation skills. Encouraging them to participate in National International Conferences and also to make presentations

4. Stirring the advanced learners to make quality publications and creative contributions to the academic as well as to the practical world

5. They are given special prizes and special facilities like digital library laptops and special scholarships for making their ideas become visible.

6. Startups are offered the advanced learners. Seed money can be offered to advanced learners to make their innovative proposals implemented.

7. The mentors give higher goals and also make the advanced learners get higher levels of personality development and stress management trainings.

8. They are made the supporters to the average and the slow learners.

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Policy Guidelines for Slow learners

1. The slow learners are not labeled as poor achievers or problem students in the class or department so that their motivation and their interest are not negatively affected. This can also make them more stressed, and introvert in the class.

2. They should be treated as any other student in the class but they can be provided extra classes for improvement and achievement.

3. The Department and individual teachers help the slow learners by giving proper guidance and support to them.

4. Organize bridge classes and remedial programmes for them.

5. Conduct extra classes for the difficult subjects (based on the previous university results) in the curriculum.

6. Special attention is given to the students in the tutorial classes, who are identified as the slow learners.

7. Slow learners are specially advised and counseled by a teacher guardian and the subject expert.

8. Corrective classes are conducted for the weaker students based on the results of class tests.

9. The students are given with training on communication skills, personality development, time management and motivational sessions.

10. Design special coaching sessions or tutorial sessions to bridge the gap between the slow learners and advanced learners are provided.

11. Academic and personal counseling are given to the slow learners by the tutor, mentor and the counseling cell.

Strategies for the advanced learners:

- The institution organizes Orientation programmes/Induction programmes for freshers in the start of every academic year both at the college level as well as the department level. Bridge Courses are conducted at the department level to lift the students to the standard of higher education.

- The Department of Computer Science of our college selected and focused two specific areas in conducting the Bridge Course - Basics of Computers and Advances in Computer Science.

- The English Department of TEC organizes Orientation / Bridge Course in Basic English Grammar to enable Tamil medium students to cope with the course.

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- The Department of Mathematics organizes Bridge Course to all the first year students are admitted to cope up with the knowledge requirement of the course opted by the student.

- Coaching classes are conducted for Advanced Learners to face competitive exams. Students are encouraged to enroll in NPTEL Courses – Swayam.

- Coaching is also given in Skill Development Programme like Communicative English, Aptitude and Placement.

- Students are encouraged to have an internship with their relevant discipline of studies to learn and analyse the current needs of industrial aspects. Based on the industrial needs the following core courses and inter-disciplinary courses are conducted to encourage our students to learn as advanced learner programme in every semester after the working hours.

Strategies adopted for slow learners:

- The institution assesses the learning levels of the students in means of two things-students enrolled in various disciplines are identified as slow and advanced learners based on their performance in Internal Assessment Test and University Examination.

- All the departments draw up the schedule for organising remedial classes for slow learners. This exercise is done in a discreet manner and slow learners are encouraged and stimulated to recognize their shortcomings and register on their own without compulsion.

- Teachers are able to give one to one attention in remedial classes and focus on individual problems in a better manner when compared to a regular classroom.

- Group Study System is also encouraged with the help of the advanced learners. Academic and personal counselling is given to the slow learners by mentor. Provision of simple and standard lecture notes/course materials will enable them to perform even better in their academic performance.

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The College provides freedom and facilities to the faculty to develop student-specific, contextual and innovative teaching methodologies using ICT that can maximize the learning outcome. Seminars, problem solving sessions, power point presentations, net based assignments, group discussions, group assignments, quizzes and mini projects are some of methodologies and exercises used to enhance their learning.

Experiential Learning:

Learning by doing is considered one of the best means of arousing intellectual process among the rural, first-generation learners. From 2016 onwards, internship is introduced for all UG programmes. All UG programme students are learning by doing practical in their respective Labs for theory and laboratory concepts. Experiential learning is the process of learning through experience by doing and reflecting. We encourage students to practice various technical and non-technical skills through project development, student seminars, student development programs, workshops, internships, industrial visits and Science day celebration. These activities are planned, conducted and monitored regularly by the faculty to ensure that students are practicing the required skills, reflecting on their experiences and improving their skills.

Participative learning:

In this type of learning, students participate in various activities such as seminar, group discussion, wall papers, projects, and the skill based add on courses. Students are encouraged to participate in activities where they can use their specialized technical or management skills, such as

Regular Quizzes – Quizzes are organized for student participation at intra or inter college level. Seminar Presentation – Students develop technical skills while presenting papers in seminars.

We always strive to enhance the learning experience of learners in class through various interactive and participatory approaches apart from traditional teaching. These approaches aid in creating a feeling of responsibility in learners and makes learning a process of construction of knowledge. In this type of learning, students participate in various activities such as seminar, group discussion, poster presentations, projects, and the skill based add on courses. Students are encouraged to participate in these activities where they can use their specialized technical or management skills. Students actively participate in a myriad of

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academic activities like class room seminars on chosen/ assigned topics, home assignments, power point presentations, model preparation. Our institute consists of various club activities like NSS club, Start up and innovation cell Energy club, Fit India club, English Proficiency club, Robotics Club, Renewable Energy Club, Science club to exhibit their team work in communicating the needs and responsibilities to society in an ethical means

Problem-solving methods

Departments encourage students to acquire and develop problem-solving skills. For this, college organizes expert lectures on various topics, motivate students to join certificate courses, participate in various inter-college and intra-college technical fests and other competitions such as:

- Regular Assignments based on problems
- Mini Project development
- Regular Quizzes
- Case studies Discussion
- Class presentations
- Debates
- Participation in Inter college events
- Faculty handling Tutorial classes
- Students handling Tutorial classes
- Aptitude Training and Internship Program

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ADVANCED

LEARNER

COURSES

ADVANCED LEARNER COURSE

TECALC005 - ADVANCED REINFORCED CONCRETE DESIGN

TECALC005 - ADVANCED REINFORCED CONCRETE DESIGN

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B+

CIRCULAR

Ref:TEC/CIVIL/2022-23/ODD/ALC/05

Date: 04.01.2023

In order to make the student industry ready engineers and to provide advanced quality training to the advanced learners of third and final year of civil engineering department, the course on "**TECALC005 - ADVANCED REINFORCED CONCRETE DESIGN**" by Mr. S. Rajamuniasamy, AP /Civil is being offered to enhance employability of the students, technical skills and make them more competitive. Course commences from 01.02.2023 to 03.03.2023. Students are instructed to make use of the opportunity. Advanced learners of third and final year of civil engineering are eligible for this course.

COURSE INSTRUCTOR

HOD/CE

PRINCIPAL

To be read

All civil class room

S. No	Class	Sign
1	II year	
2	III year	
3	IV year	

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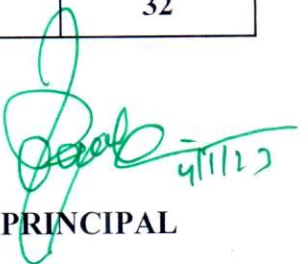Thatchanallur, Tirunelveli 627 358. Tamil Nadu.

TECALC005 - ADVANCED REINFORCED CONCRETE DESIGN
SYLLABUS

OBJECTIVE

To make the students be familiar with the limit state design of RCC beams and columns and to design special structures such as Deep beams, Corbels, Deep beams, and Grid floors.

DESIGN OF SPECIAL RC ELEMENTS

Design of slender columns - Design of RC walls. Strut and tie method of analysis for corbels and deep beams, Design of corbels, Deep-beams and grid floors.

FLAT SLABS AND YIELD LINE BASED DESIGN

Design of flat slabs and flat plates according to IS method – Check for shear - Design of spandrel beams - Yield line theory and Hillerborg's strip method of design of slabs.

OUTCOME

On completion of this course the students will have the confidence to design various concrete structures and structural elements by limit state design and detail the same for ductility as per codal requirements.

THEORY: 30 PERIODS
ASSESSMENT: 2 PERIODS
TOTAL: 32 PERIODS

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TECALC005 - ADVANCED REINFORCED CONCRETE DESIGN

LESSON PLAN & SCHEDULE

S.NO	DATE	TOPIC	No. of Hours
1.	01.02.2023	Design of special RC elements - Introduction	2
2.	02.02.2023	Design of slender columns	2
3.	03.02.2023	Design of RC walls	2
4.	06.02.2023	Strut and tie method of analysis for corbels and deep beams	2
5.	14.02.2023	Design of corbels	2
6.	16.02.2023	Design of corbels	2
7.	17.02.2023	Deep-beams	2
8.	20.02.2023	Grid floors.	4
9.	22.02.2023	Flat slabs and yield line based design- Introduction	2
10.	23.02.2023	Design of flat slabs and flat plates according to IS method	2
11.	24.02.2023	Check for shear	2
12.	27.02.2023	Design of spandrel beams	2
13.	28.02.2023	Design of spandrel beams	2
14.	01.03.2023	Yield line theory and Hillerborg's strip method of design of slabs	2
15.	03.03.2023	Assessment	2
		Total Hours	32

COURSE INSTRUCTOR   HOD/CE   PRINCIPAL

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DEPARTMENT OF CIVIL ENGINEERING
ATTENDANCE

Sl.No.	Register Number	Name	1.2.23	2.2.23	3.2.23	6.2.23	14.2.23	16.2.23	17.2.23	20.2.23	22.2.23	23.2.23	24.2.23	27.2.23	28.2.23	1.3.23	3.3.23	Signature
1	9531211030001	D AATHI LAKSHMI	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	D.Aathilaxmi
2	9531211030010	S. DHANALAKSMI	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	S.Dhanalaxmi
3	9531211030022	E. SILVA BHARATHI	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	E.Sil BA
4	9531201030094	CLARIN GNANA TRIZAH S	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	S. Clarin Gnana Trizah
5	9531201030005	ISAKKIMUTHU M	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Isakkimuthu
6	9531201030008	JEYALAKSHMI K	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	K.Jeyalakshmi.k
7	9531201030009	JEYALAKSHMI V	✓	✓	✓	✓	✓	✓	✓	✓	✓	D	✓	✓	✓	✓	✓	V.Jeyalakshmi
8	9531201030011	KARTHIKEYAN M	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	M.Karthikeyan
9	9531201030012	KIRUTHIKA S	✓	✓	D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	S.Kiruthika.
10	9531201030014	MAHAPRIYA M	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Mahapriya M
11	9531201030016	NARISH VI S	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	S.Naiseli
12	9531201030020	RAMALAKSHMI R	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	R.Ramalakshmi
13	9531201030301	ABHIRAMI M. S	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Abhirami
14	9531201030501	SIVA K	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	K.Siva
15	9531191030003	DEIVAKANI M	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Devakani M
16	9531191030006	KANAGARAJ J	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	J. Kanaraj
17	9531191030311	SUSMITHA P	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	P.Susmitha

COURSE INSTRUCTOR

Principal
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HoD

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CERTIFICATE COURSE FEEDBACK FORM

COURSE CODE & NAME : TECAL005-ADVANCED REINFORCED CONCRETE DESIGN

DEPARTMENT : CIVIL ENGINEERING

NAME OF THE STUDENT : DEIVAKANI. M

REG. NO. : 953119103003   ACADEMIC YEAR : 2022-2023

YEAR : IV year   SEM : 8th

THE DESIGN OF THE COURSE

A. Were objectives of the course clear to you?   Y ✓ / N ☐

B. The course contents met with your expectations
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree | 4 |

C. The lecture sequence was well planned
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree | 4 |

D. The level of the course was
   1. Too Low   2. Low   3. Moderate   4. High   5. Very high | 4 |

E. The course exposed you to new knowledge and practices
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree | 5 |

THE CONDUCT OF COURSE

A. The lectures were clear and easy to understand
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree | 5 |

B. The teaching aids were effectively used
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree | 5 |

C. The course material handed out was adequate
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree | 5 |

D. The instructors encouraged interaction and were helpful
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree | 5 |

E. Were objectives of the course realized? Y ✓ / N ☐

Please comment on the strengths of the course and the way it was conducted. (Optional)

Please comment on the weaknesses of the course and the way it was conducted. (Optional)

Please give suggestions for the improvement of the course. (Optional)

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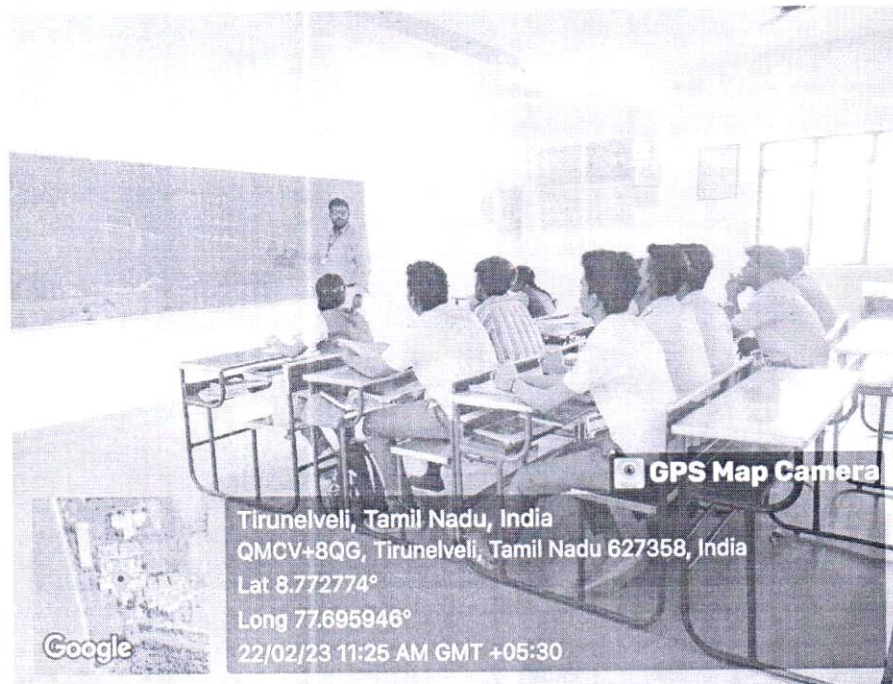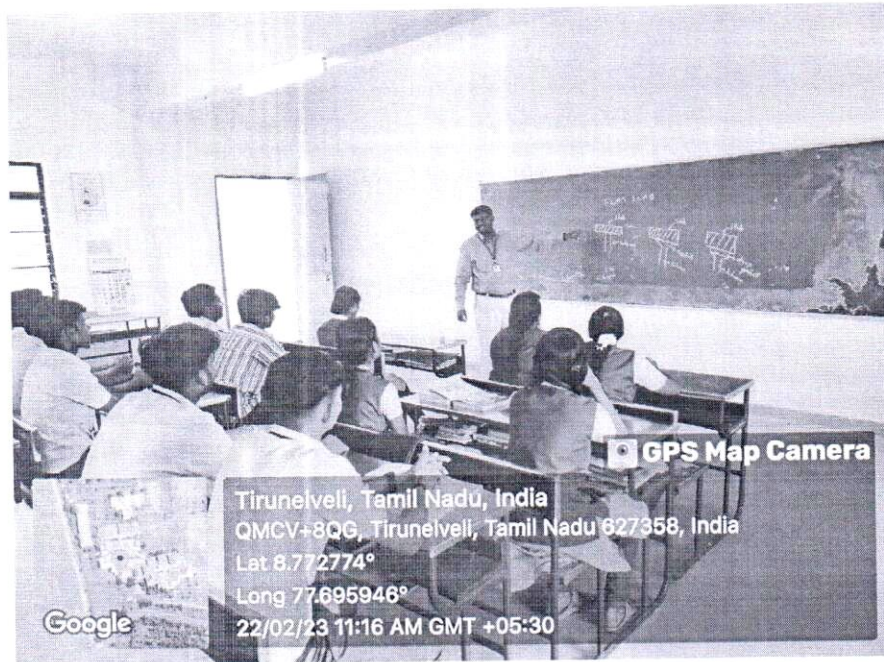Tirunelveli, Tamilnadu-627 358

SIGNATURE OF THE STUDENT

CERTIFICATE COURSE FEEDBACK FORM

COURSE CODE & NAME : TECANC 005 + Advanced Reinforced Concrete Design.

DEPARTMENT : Civil Engineering

NAME OF THE STUDENT : Selva Bharathi . L

REG. NO. : 953121103022   **ACADEMIC YEAR** : 2022-2023

YEAR : 2023 - II Year   **SEM** : IV

THE DESIGN OF THE COURSE

A. Were objectives of the course clear to you?   Y ✓ / N ☐

B. The course contents met with your expectations
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree | 5 |

C. The lecture sequence was well planned
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D. The level of the course was
   1. Too Low   2. Low   3. Moderate   4. High   5. Very high | 4 |

E. The course exposed you to new knowledge and practices
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree | 4 |

THE CONDUCT OF COURSE

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   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree | 4 |

E. Were objectives of the course realized? Y ✓ / N ☐

Please comment on the strengths of the course and the way it was conducted. (Optional)

_____

Please comment on the weaknesses of the course and the way it was conducted. (Optional)

_____

Please give suggestions for the improvement of the course. (Optional)

_____

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SIGNATURE OF THE STUDENT

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CERTIFICATE COURSE FEEDBACK FORM

COURSE CODE & NAME : TECALC005 – ADVANCED REINFORCED CONCRETE DESIGN

DEPARTMENT : CIVIL

NAME OF THE STUDENT : KANAGARAJ·J

REG. NO. : 953119103006   **ACADEMIC YEAR** : 2022 - 2023

YEAR : 2023 FINAL YEAR   **SEM** : VIII

THE DESIGN OF THE COURSE

A. Were objectives of the course clear to you?   Y ✓ / N ☐

B. The course contents met with your expectations
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree   **4**

C. The lecture sequence was well planned
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree   **4**

D. The level of the course was
   1. Too Low   2. Low   3. Moderate   4. High   5. Very high   **5**

E. The course exposed you to new knowledge and practices
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree   **5**

THE CONDUCT OF COURSE

A. The lectures were clear and easy to understand
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree   **4**

B. The teaching aids were effectively used
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree   **4**

C. The course material handed out was adequate
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree   **4**

D. The instructors encouraged interaction and were helpful
   1. Strongly disagree 2. Disagree 3. Neither agree nor disagree 4. Agree 5.Strongly agree   **4**

E. Were objectives of the course realized?   Y ✓ / N ☐

Please comment on the strengths of the course and the way it was conducted. (Optional)

Please comment on the weaknesses of the course and the way it was conducted. (Optional)

Please give suggestions for the improvement of the course. (Optional)

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J.

SIGNATURE OF THE STUDENT

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B+

Course delivery

Assignment

1. Explain in details the design procedure for slender column.
2. Explain in details the Hillerborg's strip method of design of slabs.

Assessment   Total Marks: 50

Part- A (10*1= 10)

1. Failure of R.C.C beam due to shear can only occur on account of
   a) Diagonal Compression
   b) Diagonal Tension
   c) Web Compression
   d) None of above

2. Nominal Shear stress tv at section does not exceed permissible shear stress tc
   a) Minimum shear reinforcement is still provided
   b) Shear reinforcement is provided to resist nominal shear stress
   c) No shear reinforcement is provided
   d) Shear reinforcement is provided for different of two

3. The diameter of longitudinal bars of a column should never be less than _____
   a) 6 mm
   b) 8 mm
   c) 10 mm
   d) 12 mm

4. Thickened part of a flat slab over its supporting column, is technically known as
   _____
   a) drop panel
   b) capital
   c) column head
   d) cannot be determined

5. The minimum cube strength of concrete used for a prestressed member, is _____
   a) 50 kg/cm2
   b) 150 kg/cm2
   c) 350 kg/cm2
   d) 100 kg/cm2

6. The minimum cube strength of concrete used for a prestressed member, is _____
   a) 0.8%
   b) 0.12%

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c) 0.15%

d) 0.2%

7. The lap length of reinforcement in compression should not be less than

   a) 30 dia

   b) 24 dia

   c) 20 dia

   d) 02 dia

8. **Which of the following is correct criteria to be considered while designing?**

   a) Structure should be aesthetically pleasing but structurally unsafe

   b) Structure should be cheap in cost even though it may be structurally unsafe

   c) Structure should be structurally safe but less durable

   d) Structure should be adequately safe, should have adequate serviceability

9. **The structure is statically indeterminate when_____**

   a) static equilibrium equations are insufficient for determining internal forces and reactions on that structure

   b) static equilibrium equations are sufficient for determining internal forces and reactions on that structure

   c) structure is economically viable

   d) structure is environment friendly

10. **Which method is mainly adopted for design of steel structures as per IS code?**

    a) Limit State Method

    b) Working Stress Method

    c) Ultimate Load Method

    d) Earthquake Load Method

Part- B (20*2= 40)

11. The moisture content of the aggregate shall not exceed from _____

    a) .1% – .5%

    b) 1% – 55

    c) 10% – 50%

    d) 15%

12. Which one is not the polymeric resin?

    a) Polyester resin

    b) Epoxy resin

    c) Vinyl ester resin

    d) Sulphates

13. Higher resin dosage is recommended when using _____

    a) Coarse aggregate

    b) Fine aggregates

    c) All in one aggregates

    d) More cement

14. Steel fibers helps in the enhancement of its properties.

    a) True

    b) False

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10

15. The addition of glass fibers are in the range of _____

    a) 0-6%

    b) 10%

    c) 15-20%

    d) 20%-25%

16. Concrete is not recommended to be placed at a temperature below _____ ^{o}C.

    a) 2

    b) 3

    c) 4

    d) 5

17. IS: 7861 part-2 deals with _____

    a) Hot weathering concrete

    b) Cold weathering concrete

    c) Air entertained concrete

    d) OPC

18. Why the time period for removal of form work has to be increased.

    a) The development of strength of concrete is retarded compared with development at normal temperature

    b) The development of strength of concrete is accelerate compared with development at normal temperature

    c) The development of strength of concrete is advanced compared with development at normal temperature

    d) The development of strength of concrete is precocious compared with development at normal temperature

19. If concrete is exposed to repeated freezing and thawing after the final set, the final qualities of the concrete may also be _____

    a) Impair

    b) Aid

    c) Improve

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20. Large temperature differentials within the concrete member may promote _____

    a) Elastic shrinkage

    b) Cracking

    c) High workability

    d) Good strength

21. When the concrete in fresh stage is exposed to freeze before certain pre-hardening period, compressive strength may get _____

    a) Increased to 50%

    b) Decreased to 50%

    c) Increased to 25%

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22. . What could be the possible answer among the following for compressive strength of high strength concrete?
    a) 10MPa
    b) 20MPa
    c) 30MPa
    d) 40MPa

23. What could be the possible answer among the following for water cement ratio for high strength concrete?
    a) .5
    b) .45
    c) .4
    d) .35

24. Due to low w/c ratio _____
    a) It doesn't cause any problems
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25. Which type of aggregates are used to produce 70MPa compressive strength?
    a) All in one
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26. Maximum size of aggregates are used to produce 70MPa compressive strength is

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B+

Assessment   **Total Marks: 50**

Part- A (10*1= 10)

1. Failure of R.C.C beam due to shear can only occur on account of
   a) Diagonal Compression ✓
   b) Diagonal Tension
   c) Web Compression
   d) None of above

2. Nominal Shear stress tv at section does not exceed permissible shear stress tc
   a) Minimum shear reinforcement is still provided ✓
   b) Shear reinforcement is provided to resist nominal shear stress
   c) No shear reinforcement is provided
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3. The diameter of longitudinal bars of a column should never be less than _____
   a) 6 mm
   b) 8 mm
   c) 10 mm
   d) 12 mm ✓

4. Thickened part of a flat slab over its supporting column. is technically known as _____
   a) drop panel ✓
   b) capital
   c) column head
   d) cannot be determined

5. The minimum cube strength of concrete used for a prestressed member, is _____
   a) 50 kg/cm2
   b) 150 kg/cm2
   c) 350 kg/cm2 ✓
   d) 100 kg/cm2

6. The minimum cube strength of concrete used for a prestressed member, is _____
   a) 0.8%
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7. The lap length of reinforcement in compression should not be less than
   a) 30 dia
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8. Which of the following is correct criteria to be considered while designing?
   a) Structure should be aesthetically pleasing but structurally unsafe
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13

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B+

9. The structure is statically indeterminate when_____
   - a) static equilibrium equations are insufficient for determining internal forces and reactions on that structure ✓
   - b) static equilibrium equations are sufficient for determining internal forces and reactions on that structure
   - c) structure is economically viable
   - d) structure is environment friendly

10. Which method is mainly adopted for design of steel structures as per IS code?
    - a) Limit State Method ✓
    - b) Working Stress Method
    - c) Ultimate Load Method
    - d) Earthquake Load Method

Part- B (20*2= 40)

11. The moisture content of the aggregate shall not exceed from _____
    - a) .1% – .5% ✓
    - b) 1% – 55
    - c) 10% – 50%
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12. Which one is not the polymeric resin?
    - a) Polyester resin
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Assessment   **Total Marks: 50**

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Part- B (20*2= 40)

11. The moisture content of the aggregate shall not exceed from _____
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    c) 10% – 50% ✓
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12. Which one is not the polymeric resin?
    a) Polyester resin
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Assessment   Total Marks: 50

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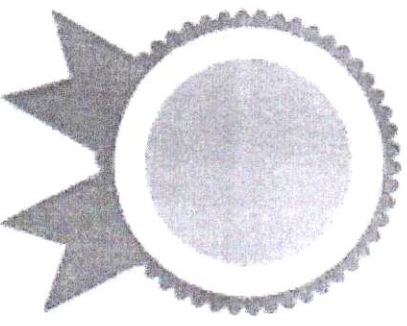Thatchanallur, Tirunelveli 627 358, Tamil Nadu.

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Part- B (20*2= 40)

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    c) 10% – 50%
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CERTIFICATE OF COMPLETION

This is to certify that Mr. /Mrs. /Ms. __M. Devakani__

of _____ has completed the certificate course entitled "__TECALC005-__

__Advanced Reinforced Concrete Design__" conducted by the Department

of Civil Engineering, Thamirabharani Engineering College, Tirunelveli from

__01.02.2023__ to __05.03.2023__ .

HoD/CE

PRINCIPAL

B+

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	REPORT OF THE COURSE	
1	Program name	TECALC005 - ADVANCED REINFORCED CONCRETE DESIGN
2	Date of program duration	01.02.2023 to 03.03.2023
3	Resource person	Mr. M. A. Raja, AP /Civil/ TEC
4	Participants	17
5	Objective of program	The main objective of this program is to inculcate the advanced knowledge to the advanced learning students of civil engineering department and to make the students be familiar with the limit state design of RCC beams and columns and to design special structures such as Deep beams, Corbels, Deep beams, and Grid floors.
6	Program description	In this course the following key design elements are explained and their designing methodology is explained. A column is said to be slender if its cross-sectional dimensions are small compared to its length. If the slenderness ratio of a column is high, it will collapse under a smaller compression load in contrast to a short column with the same cross-sectional dimensions. A corbel is a very short structural cantilever member projecting from a wall or a column for the purpose of carrying loads. In reinforced concrete structures, corbels are cast monolithically with the walls or columns supporting them. Beams with large depths in relation to spans are called deep beams.
7	Outcome of this program	On completion of this course the students will have the confidence to design various concrete structures and structural elements by limit state design and detail the same for ductility as per codal requirements.

COURSE INSTRUCTOR　　　　**HOD/CE**　　　　**PRINCIPAL**

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COURSE SUMMARY

COURSE NAME	COURSE INSTRUCTOR	NO. OF HOURS	COURSE PERIOD	TOTAL NO. OF REGISTERED STUDENTS	TOTAL NO. OF ATTENDED STUDENTS
TECALC005 - ADVANCED REINFORCED CONCRETE DESIGN	Mr. M. A. Raja, AP /Civil/ TEC	32	01.02.2023 to 03.03.2023	17	17

COURSE INSTRUCTOR   HOD/CE   PRINCIPAL

Principal
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Tirunelveli,Tamilnadu-627 358

R. Ramalakshmi

1. Explain in details the design procedure for slender column.

The majority A Compression member may be Considered as Slender or long when the Slenderness ratio l_{ex}/D and l_{ey}/b are more then 12.

Thus if $l_{ex}/D > 12$ the Column is Considered to be slender for bending about x-x axis while if $l_{ey}/b > 12$ the Column is Considered to be slender for bending about y-y axis

when a short Column is loaded even with an axial load the lateral deflection is either zero or very Small

Similarly when a slender Column is loaded even with axial load the lateral deflection Δ measured from the original Centre line along its length becomes appreciable.

The design of a slender column can be carried out by following Simplified method.

The Strength Reduction Coefficient method

The Additional moment method.

The moment magnification method.

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The reduction coefficient method given by IS 456-2000 is recommended for working stress design for service load and is based on allowable stresses in steel and concrete.

The additional moment method is recommended by Indian and British codes

The ACI code recommends the use of moment magnification method.

Slender Compression members.

The design of slender compression members shall be based on the forces and the moments determined from an analysis of the structure including the effect of deflections are not taken forces when the effect of deflections on moment in to account in the analysis additional moment given in 39.7.1 shall be taken into account in the appropriate direction

The additional moment M_a & M_a shall be calculated by the following formulae.

$$M_{ax} = \frac{P_g D}{2000} \left\{ \frac{l_{ex}}{D} \right\}^2$$

$$M_{ay} = \frac{P_g D}{2000} \left\{ \frac{l_{ey}}{b} \right\}^2$$

where:

P_g = axial load on the member

l_{ex} = Effective length in respect of the major axis

l_{ey} = Effective length in respect of the minor axis

D = depth of the cross-section at right angles to the major axis and

b = width of the member.
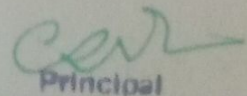
Notes:

A column may be conscidered braced in a given plane if lateral stability to be as a whole is provided by walls or bracing or butterssing designed to resist all lateral forces in that

plane It should otherwise be considered as unbraced

In the case of a braced column without any transverse loads occurring in its height the additional moment shall be added to an initial moment equal to sum of $0.4 M$ and $0.6 M_{ac}$ where M_{ac} is the larger end moment and m_{ac} is the smaller end moment In no case shall the initial moment be less than $0.4 M_{ac}$ nor the total moment including the initial moment be less than Column the additional moment shall be added to the end moments Unbraced compression member at any given level or storey subject to lateral load are usually constrained to deflect equally in such cases slenderness ratio for each column may be taken as the average for all column acting in the same direction

D. Athilakshmi

1. Explain in details the design procedure for slender column.

The majority of reinforced concrete columns in practice are subjected to very little secondary stresses associated with column deformations. These columns are designed as short columns using the column interaction diagrams presented in chapter-3. Rarely, when the column height is longer than typical strong height and/or the column section is small relative to column height, secondary stresses become significant, especially if end restraints are small and/or columns are not braced against side sway. These columns are designed as "slender columns". Fig 1. adoquently illustrates the secondary moments generated in a slender column by $P-\Delta$ effects. Slender columns resist lower axial loads than short colums having the same cross-section. Therfore, the slenderness effect must be considered in design, over and above the sectional capacity considerations incorporated in the interaction diagrams. The significance of slenderness effect is expressed through slenderness station.

Slenderness Ratio

The degree of slenderness in a column is expressed in terms of "slenderness ratio" defined

below

slenderness Ratio : kl_u/r

where l_u is unsupported column length, k is effective length factor reflecting in end restraint and lateral bracing conditions of a column, and r is radius of gyration, reflecting the size and shape of a column cross-section.

Unsupported Length l_u

The supported length l_u of a column is measured as the clear distance between the underside of the beam, slab or column capital above, and the top of the beam or slab below. The unsupported length of a column may be different in two orthogonal directions depending on the supporting elements in respective directions. provides examples of different support conditions are corresponding unsupported length (l_u). Each coordinate and subscript "x" and "y" in the figure indicates the plane of the frame in which the stability of columns is investigated.

2. Explain in details the Hillerborg's strip method of design of slabs

This method requires you to define plate strips at a critical locations across the slab. It is usual to locate strips along lines of support. and along lines in between the supports for the the longitudinal and transverse directions. You can also define strips in other directions such as across reentrant corners, next to voids, along angled edges, etc. strips in different directions can across over without affecting each other. You can define the width of each strip to match the area of the slab that you want it to represent.

The reinforced concrete slab module can then design each strip, taking into account flexure, shear and deflection. Torsion can be allowed for by a adjusting the design moments using the wood-armer method

or by applying the code specific torsion checks that involve T^* (AS3600) or T_u (IS456).

Punching shear is a ~~stress~~ separate check that is fully explained in the "Punching Shear" Section.

Hillerborg's strip method of design (1, 2) is a powerfull and versatile technique for designing two-way reinforced concrete slabs and plates the method is based on the lower bound theorem of plasticity, meaning that a design based on the strip method is always safe.

The purpose of this paper is to provide an overview of the strip method including design example. The strip method is usually divided into two parts. The simple strip method is used to design edge supported slabs. Many designers will recognise this is an application of the strong-band concept.

CASE STUDY
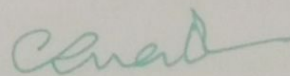
CASE STUDY

Testing of E-Commerce Website
www.flipkart.com

Submitted by:

953121104041
SAKTHI S
III CSE

Principal
THAMIRABHARANI ENGG. COLLEGE,
Tirunelveli, Tamilnadu-627 358

Plan:

To create a comprehensive test plan for testing an e-commerce web application www.flipkart.com requires careful consideration of different testing aspects.

1. Introduction:
- Overview of the application (www.flipkart.com)
- Purpose and objectives of the test plan
- Scope of testing (devices, browsers, operating systems, etc.)

2. Test Strategy:
- Testing approach (manual, automation, or a combination)
- Test levels (unit, integration, system, regression, etc.)
- Test types (functional, performance, security, usability, etc.)

3. Test Environment:
- Hardware and software requirements
- Supported browsers and devices
- Test data setup and management

4. Test Cases:
- Detailed test cases covering various scenarios and functionalities
- Test case identification and prioritization
- Test case execution schedule and dependencies

5. Functional Testing:
- Verification of core e-commerce functionalities (e.g., search, product listing, add to cart, checkout, payment, order history, etc.)
- Testing various product categories and attributes
- Testing user registration and account management
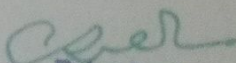
6. Usability Testing:
- Evaluation of the user interface (UI) and user experience (UX)
- Ensuring responsiveness across different devices and screen sizes
- Checking accessibility compliance

7. Security Testing:
- Validation of secure data transmission (HTTPS)

- Authentication and authorization testing
- Protection against common security vulnerabilities (e.g., SQL injection, cross-site scripting)

8. Performance Testing:

- Load testing to assess website/mobile app performance under various user loads
- Stress testing to determine system limits and responsiveness during peak traffic
- Response time, resource utilization, and server performance analysis

9. Compatibility Testing:

- Verification of application behavior across different browsers (Chrome, Firefox, Safari, etc.)
- Testing on various operating systems (Windows, macOS, Android, iOS)
- Testing on different devices (desktop, tablets, smartphones)

10. Mobile App Testing:

- App installation and uninstallation testing
- App compatibility with different device configurations
- Testing of app-specific features (push notifications, location services, etc.)

11. Payment Gateway Testing:

- Testing different payment methods (credit card, debit card, net banking, etc.)
- Verification of secure payment transactions

12. Order Fulfillment Testing:

- Testing order processing and shipment tracking
- Validation of order cancellation and refund processes

13. Error Handling and Recovery Testing:

- Validation of error messages and user guidance
- Recovery testing to check the application's behavior after failure scenarios

14. Regression Testing:
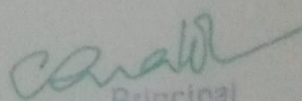
- Testing after each update or change to ensure existing functionality remains intact

15. User Acceptance Testing (UAT):

- Involving real users to validate the application's suitability for their needs
- Gathering feedback and making necessary improvements

16. Test Reporting:

- Defect reporting, tracking, and resolution process

- Test execution status and progress reporting
- Test summary report with overall findings and recommendations

17. Risk Assessment:

- Identifying potential risks and their mitigation strategies
- Prioritizing testing efforts based on risk impact

18. Test Deliverables:

- List of documents and artifacts to be produced during testing
- Test data and environment setup documentation

19. Test Exit Criteria:

- Conditions that must be met before concluding testing
- Criteria for approving the application for production release

20. Test Schedule:

- Timeframe and milestones for each testing phase
- Resource allocation and responsibilities

1.Inspection of Search convenience

1.a) Searched on Google chrome browser.
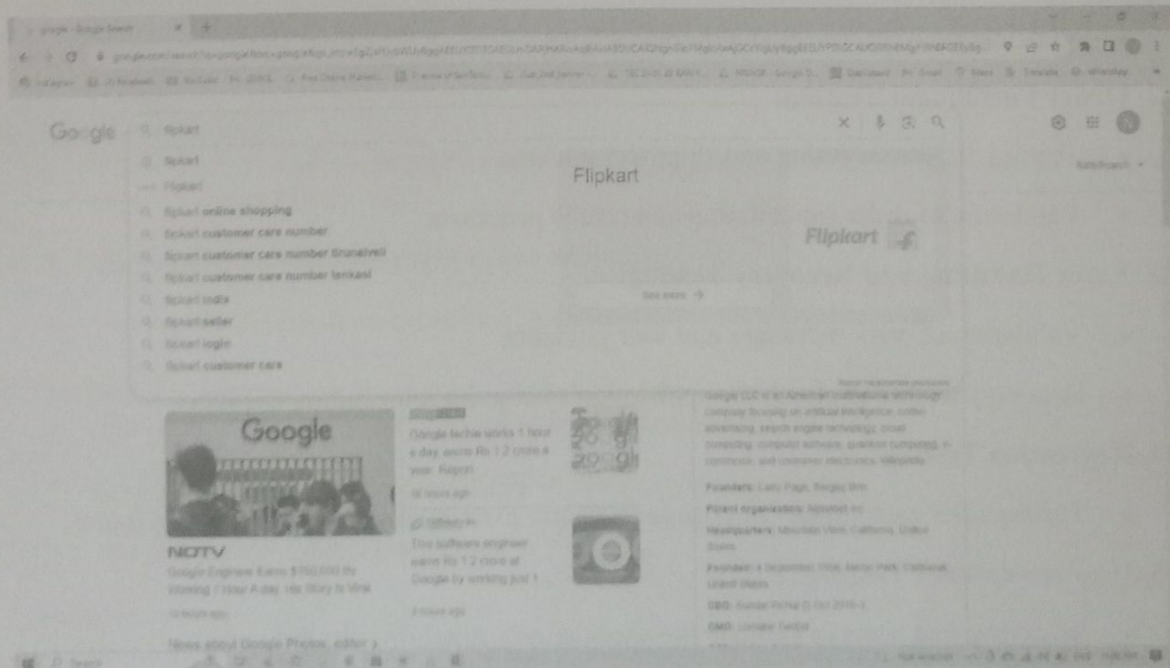
1.b) Searched on Mozilla Firefox browser.
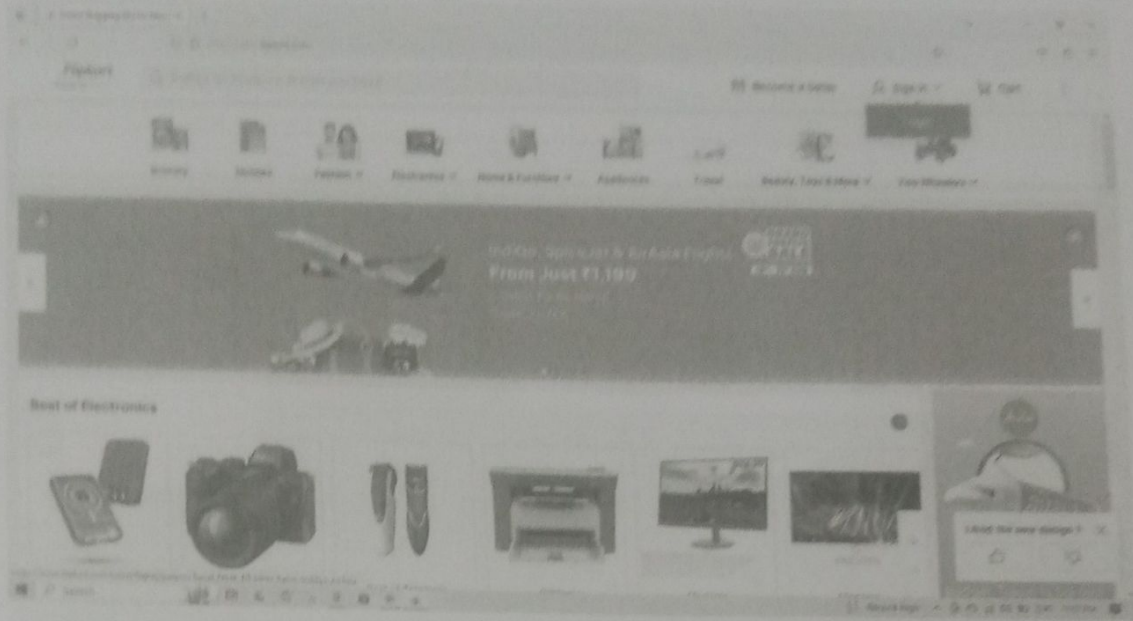
Search convenience was inspected

2.Interface of the e-commerce Website – Flipkart
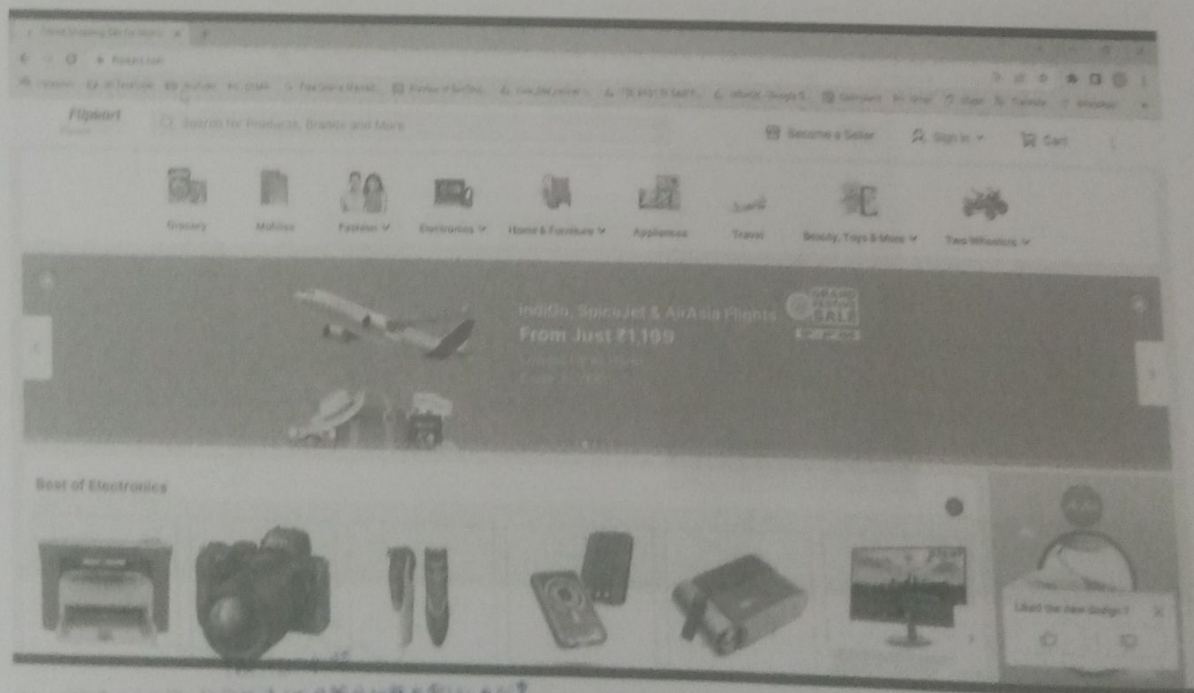
The Interface of the e-commerce website was displaying the products list and categories and It is more convenient for the users.

3. User Sign in for new and already signed up user

3.a)
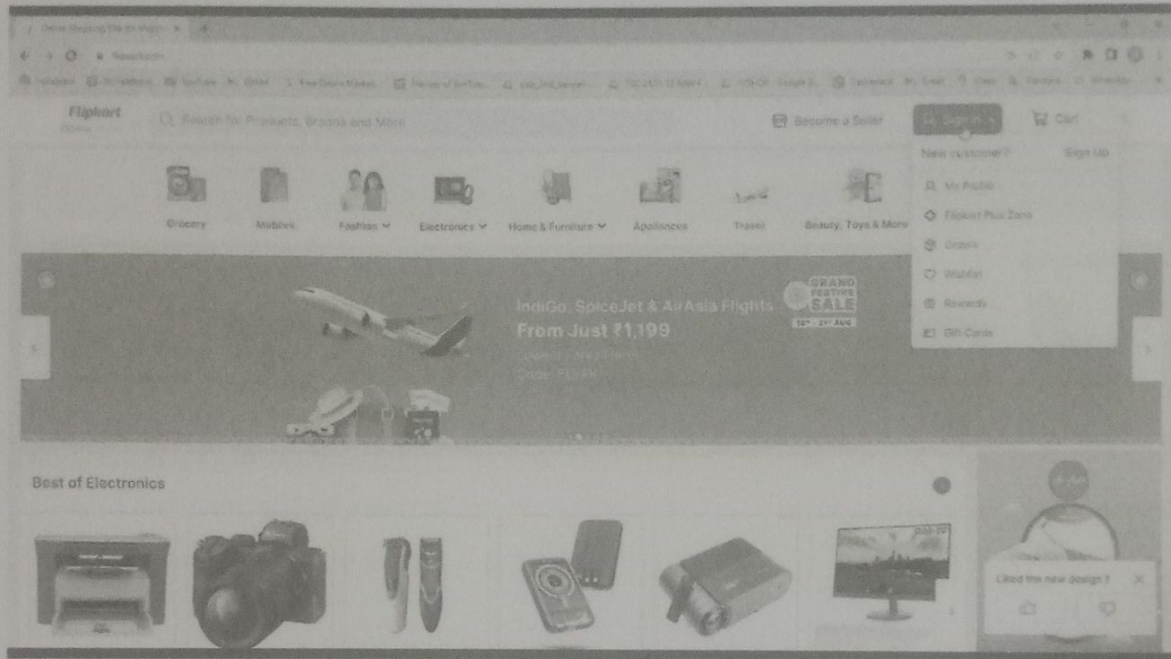
3.b)
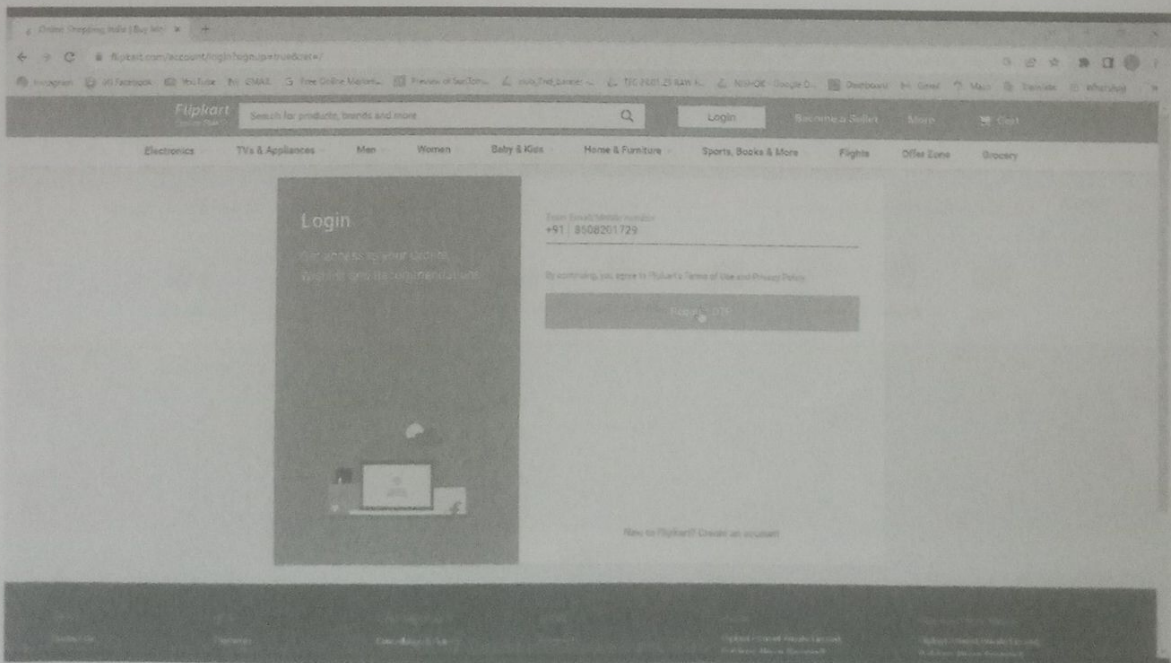
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Tirunelveli Tamilnadu-627 358

3.c)

3.d)
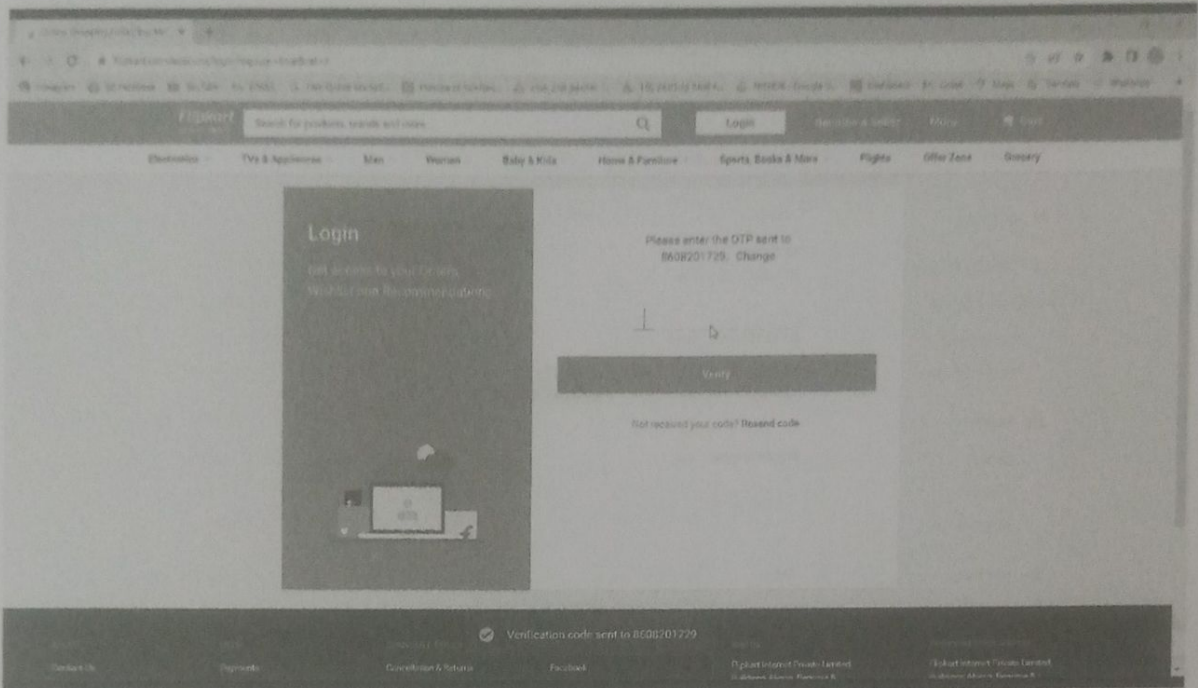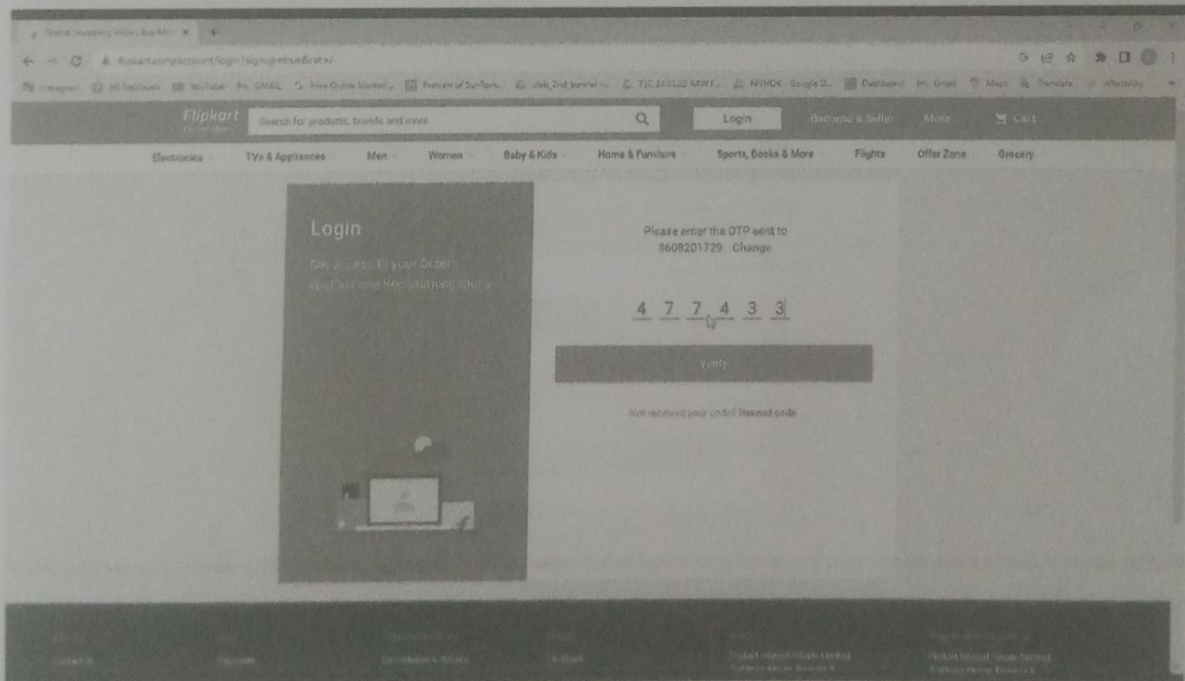
3.e)
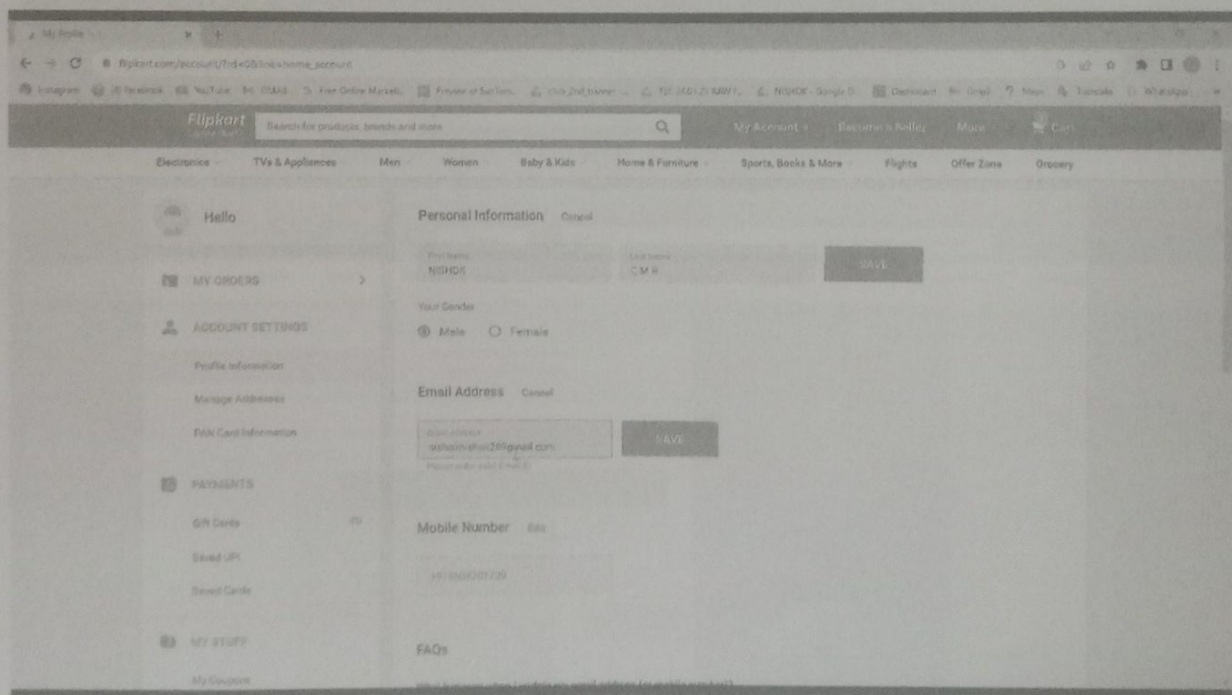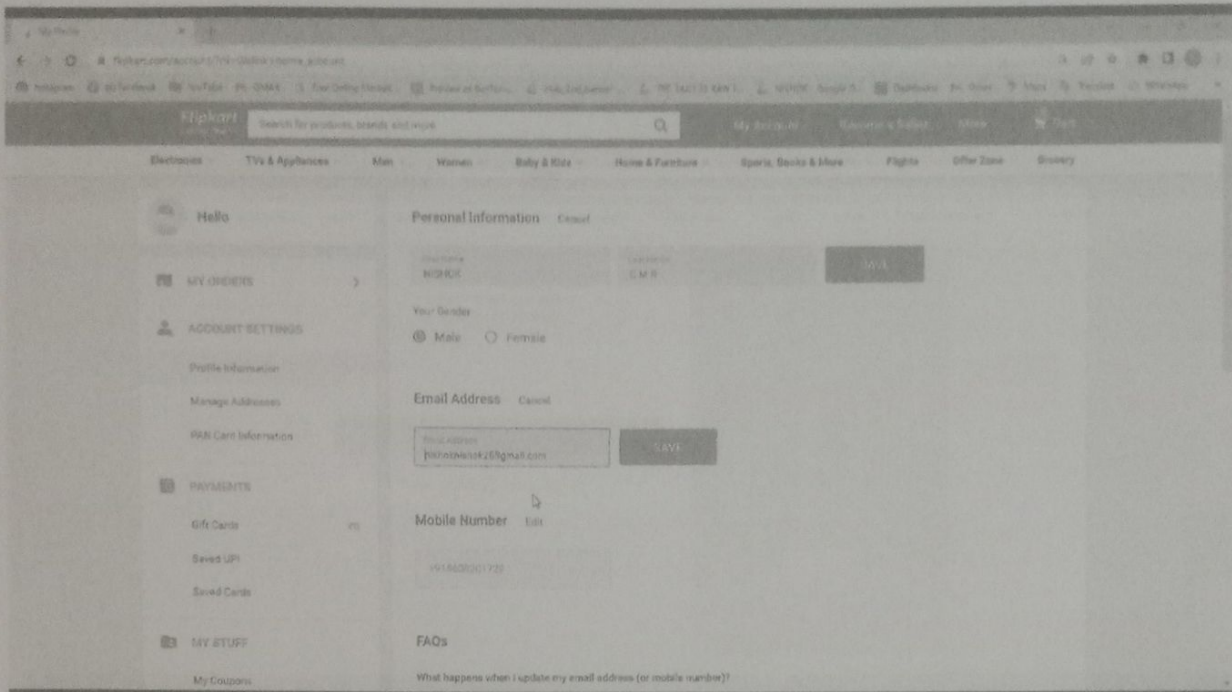
The web application responded to the exception that is my mail id. I had intentionally missed the @ symbol. It thrown an exception as" Please enter an valid Email id".

3.f)
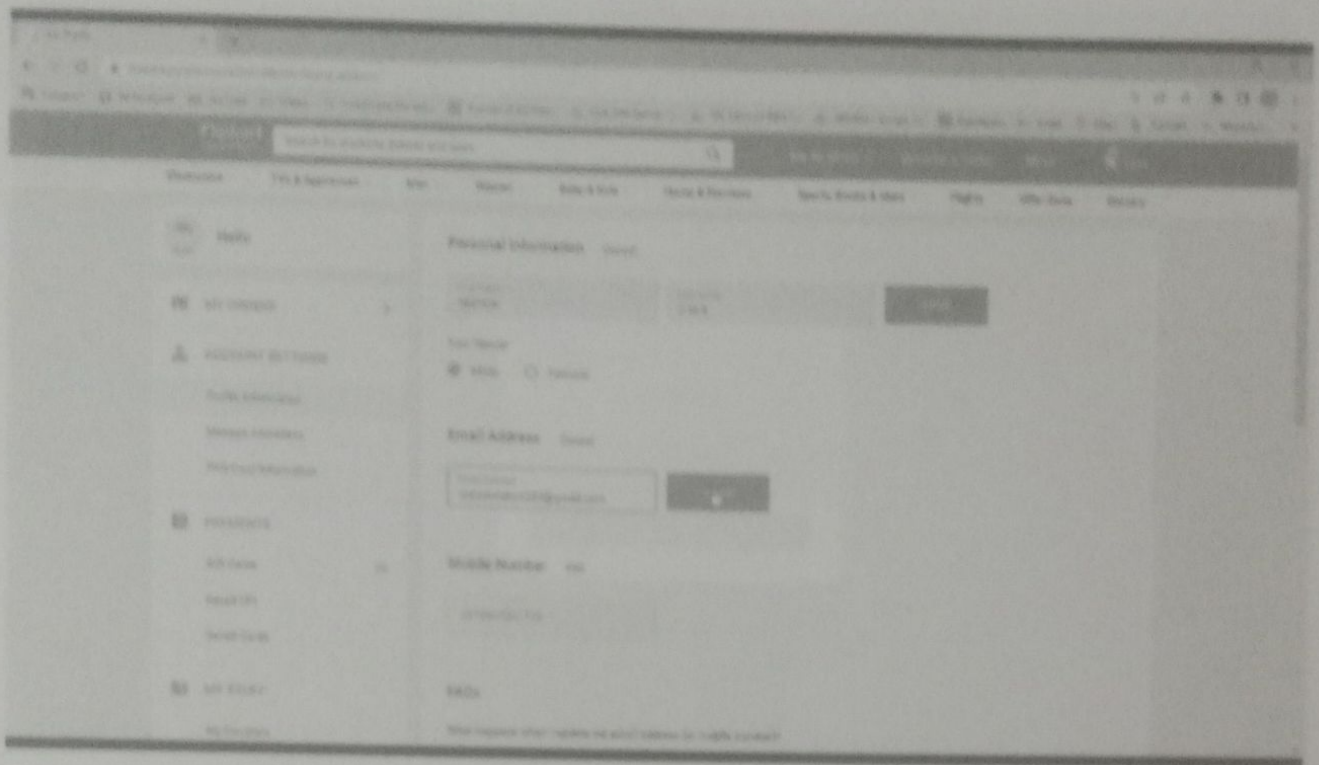
3.g)

OTP verification for the secure connection between user and server.
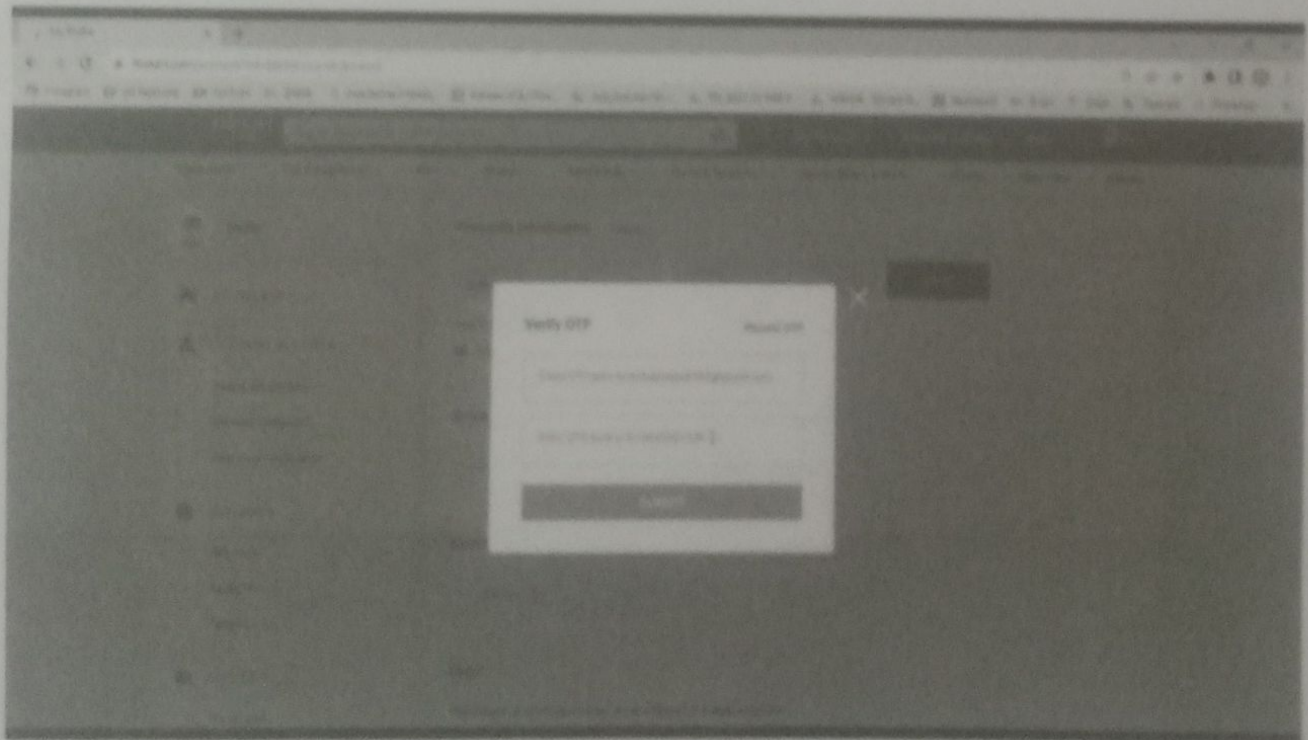
3.h)
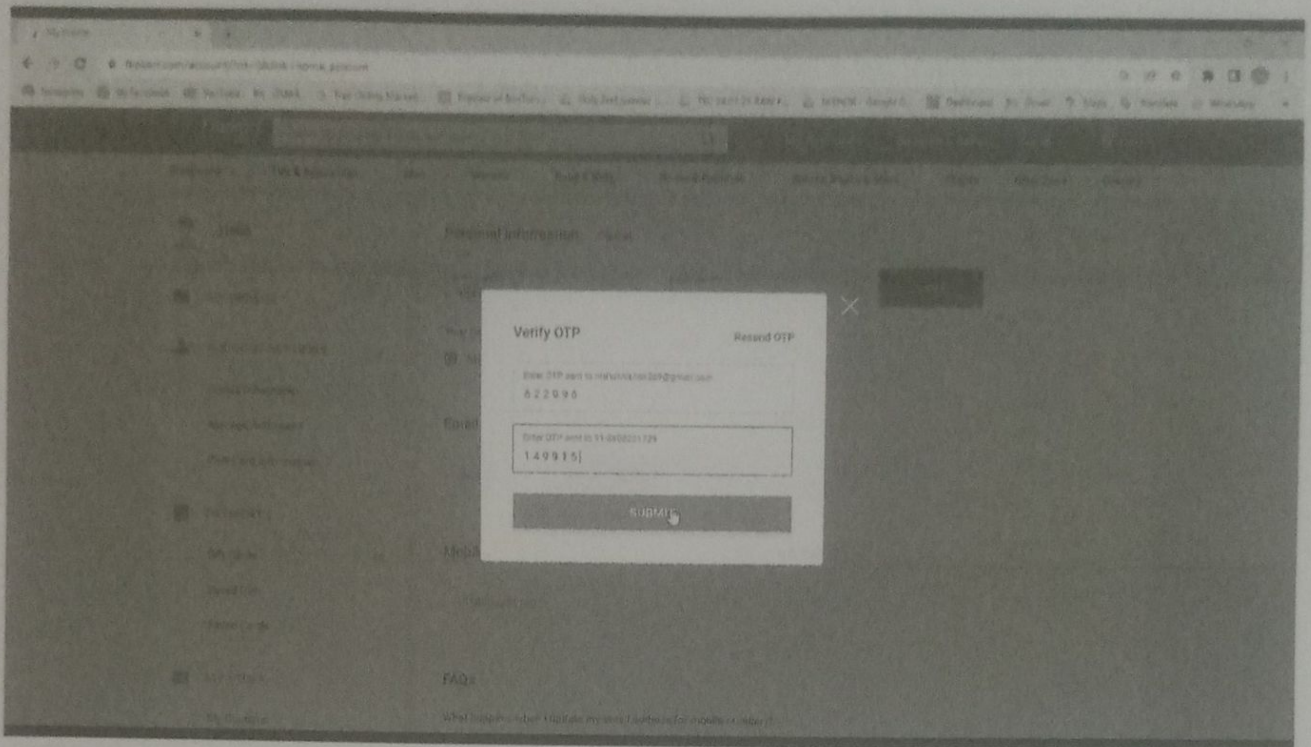
OTP received and it is verified by the Web application.

3.i)
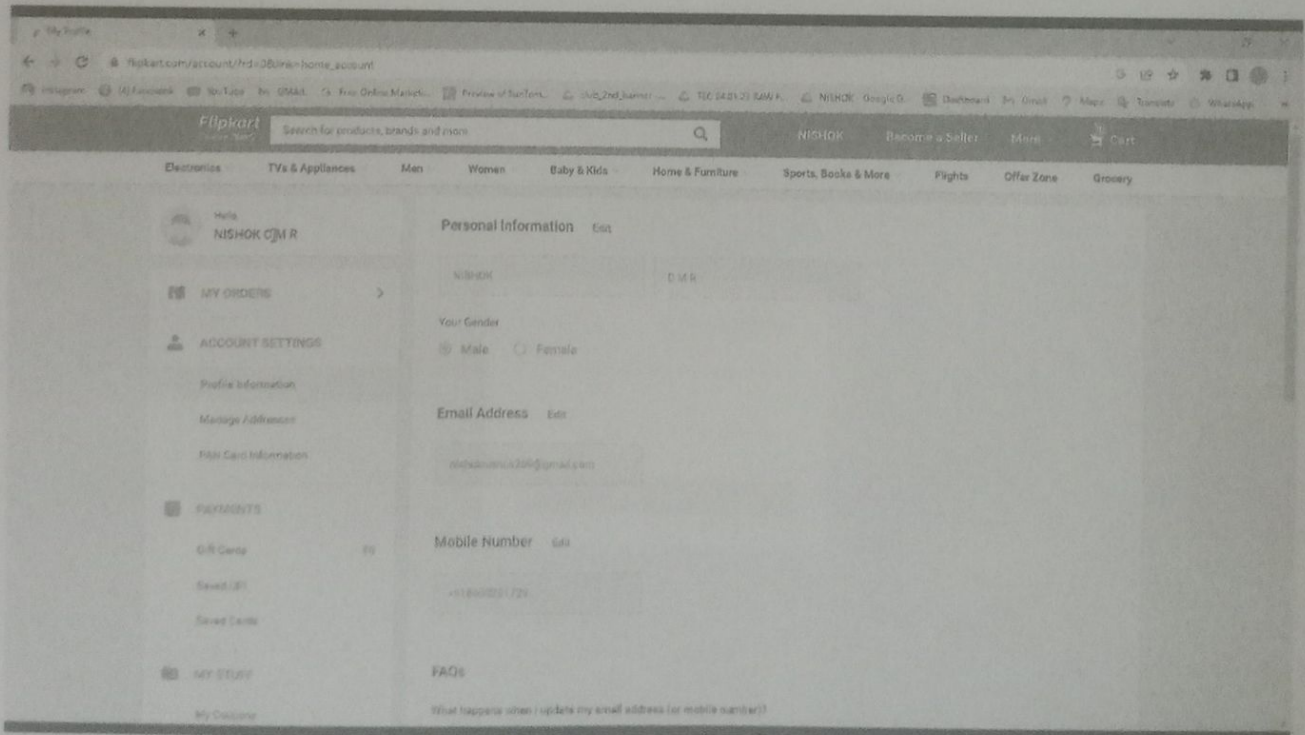
All the information that are provided by the user was Updated in the application and saved successfully.

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3.j)
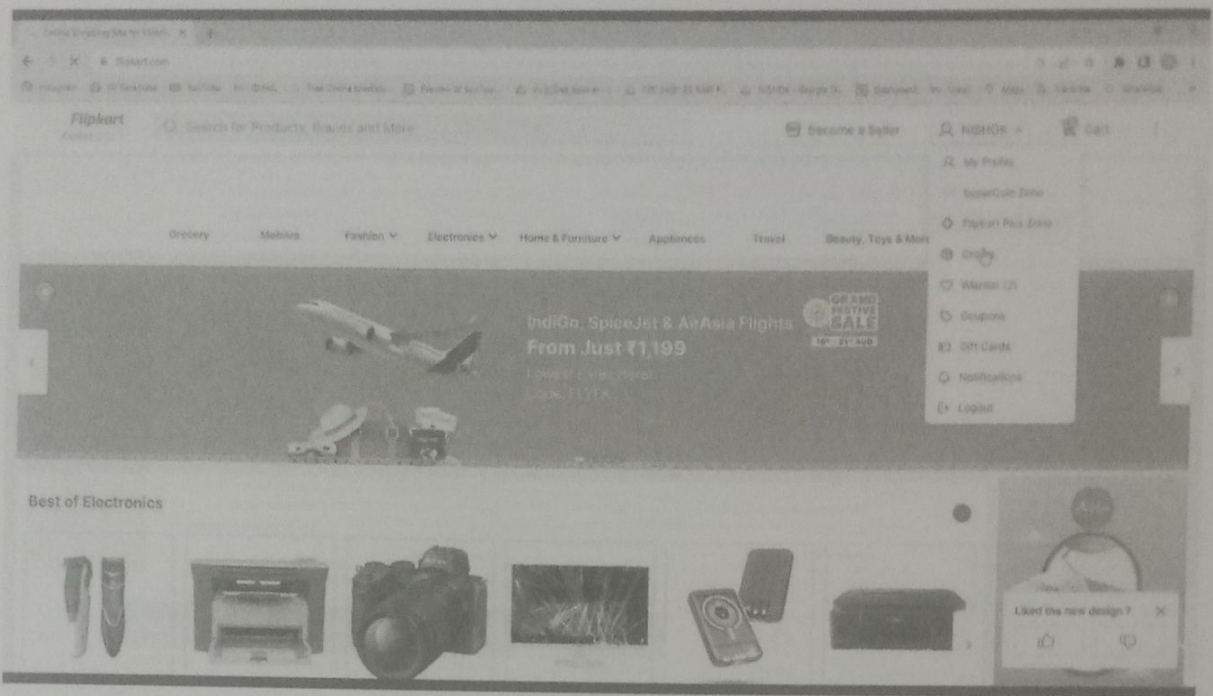
The application displays the user name on the Navigation bar.

4. Product listing features of the e-commerce application

4.a)
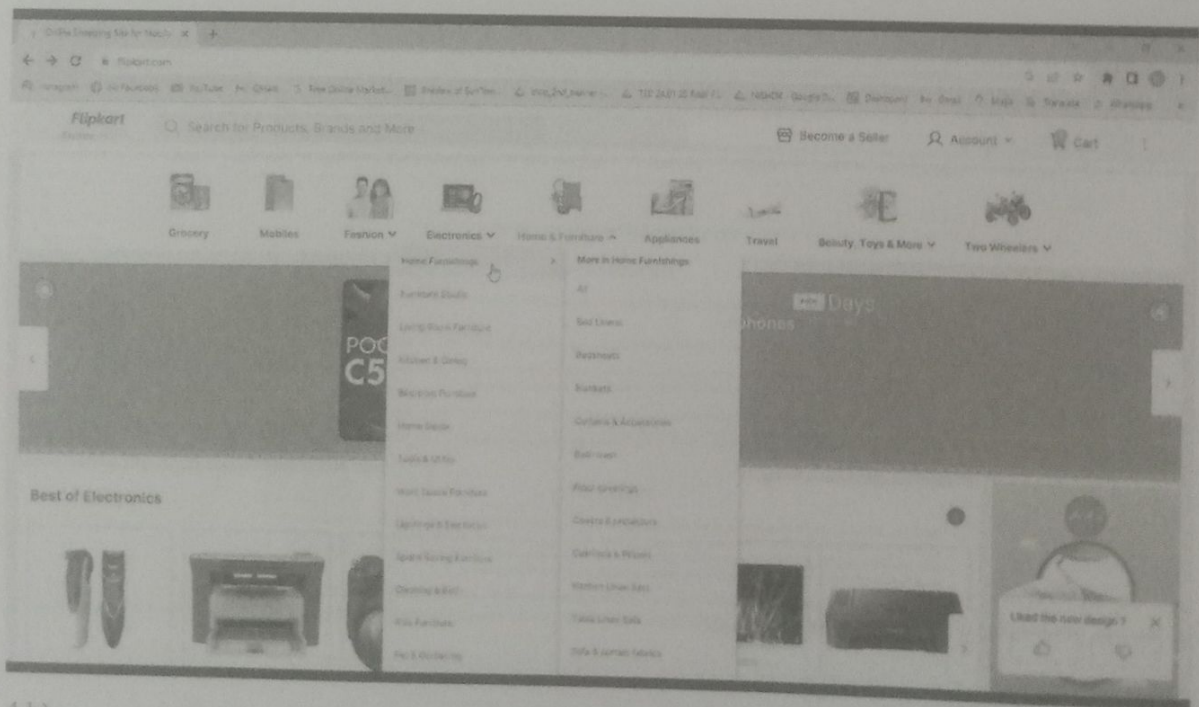
4.b)
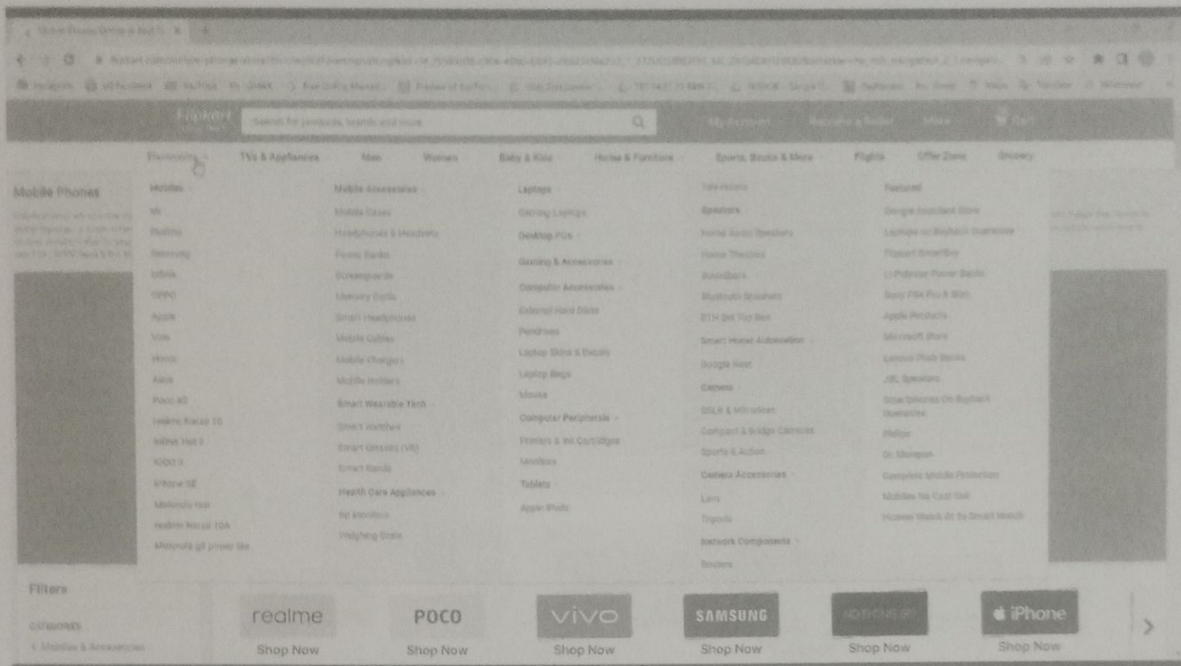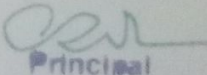
The application displays the relevant products according to the product category.

5.Cancellation , Returns and Privacy policy of the application

5.a)
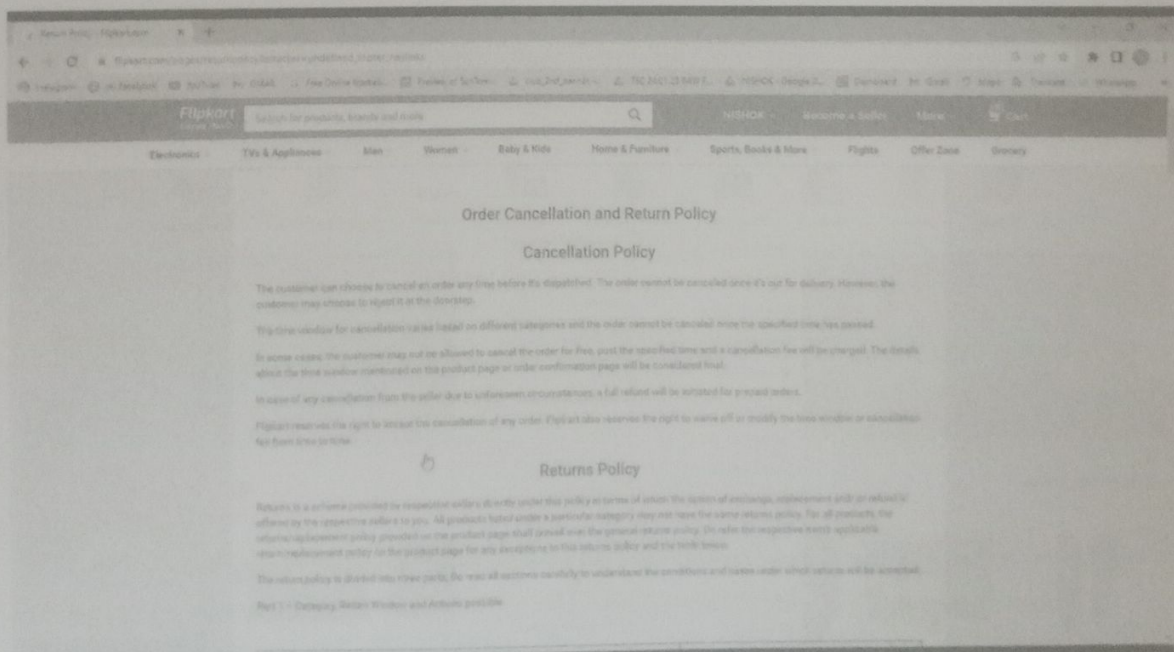
5.b)
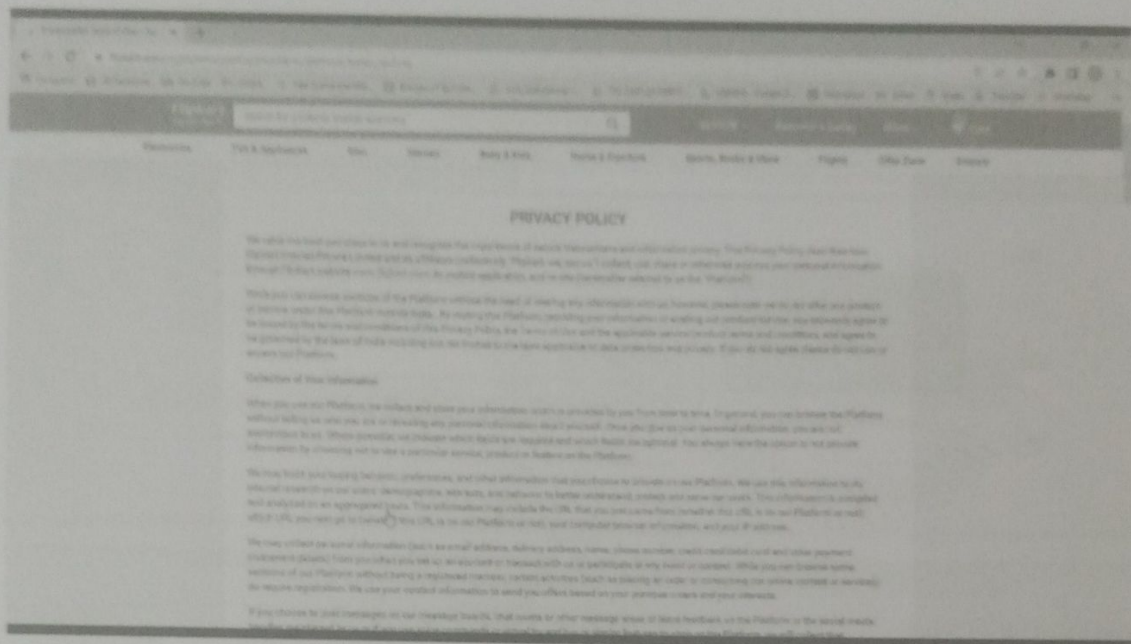
6.Search Testing
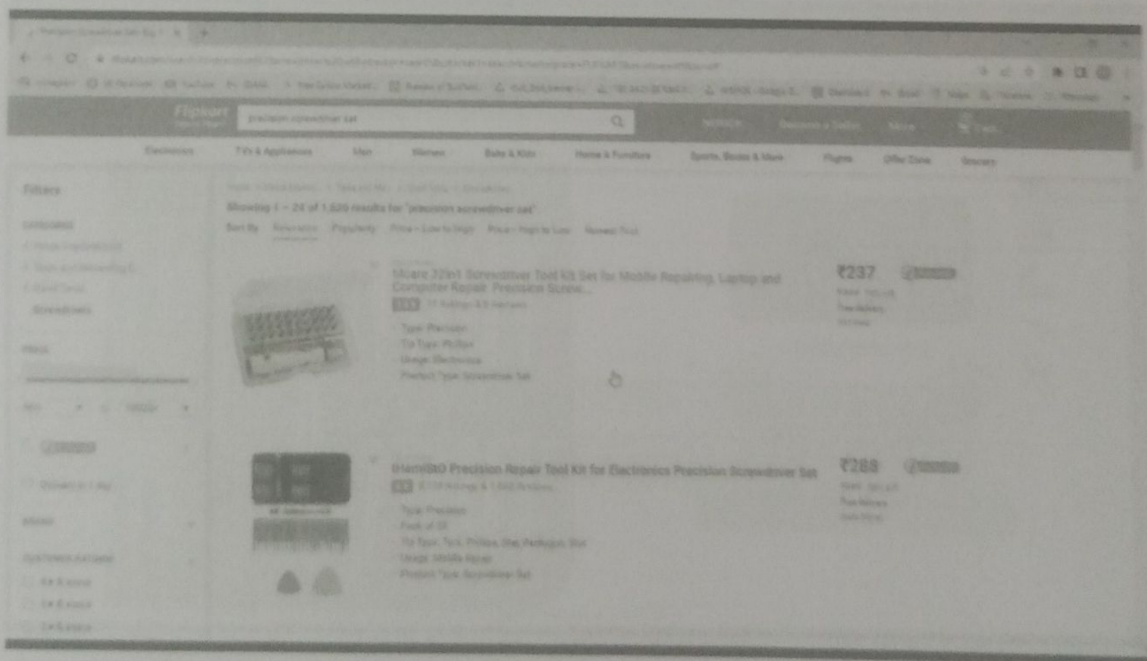
The Application displays the exact destination product that was searched.

7.Product Details and Cost of the product

7.a)

7.b)

7.c)Product Reviews

8.Add to Cart Functionalities

8.a)
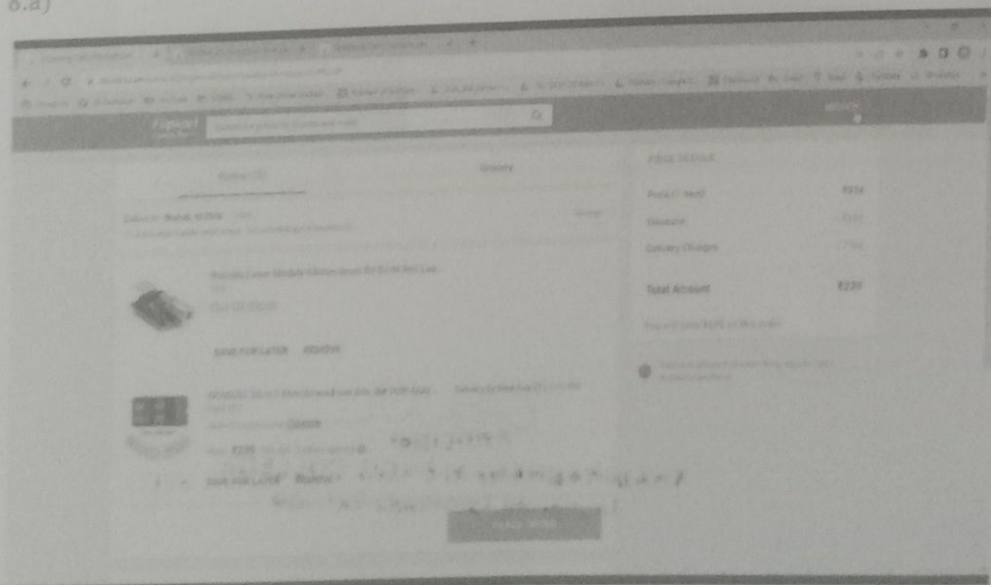
8.b)

8.c)
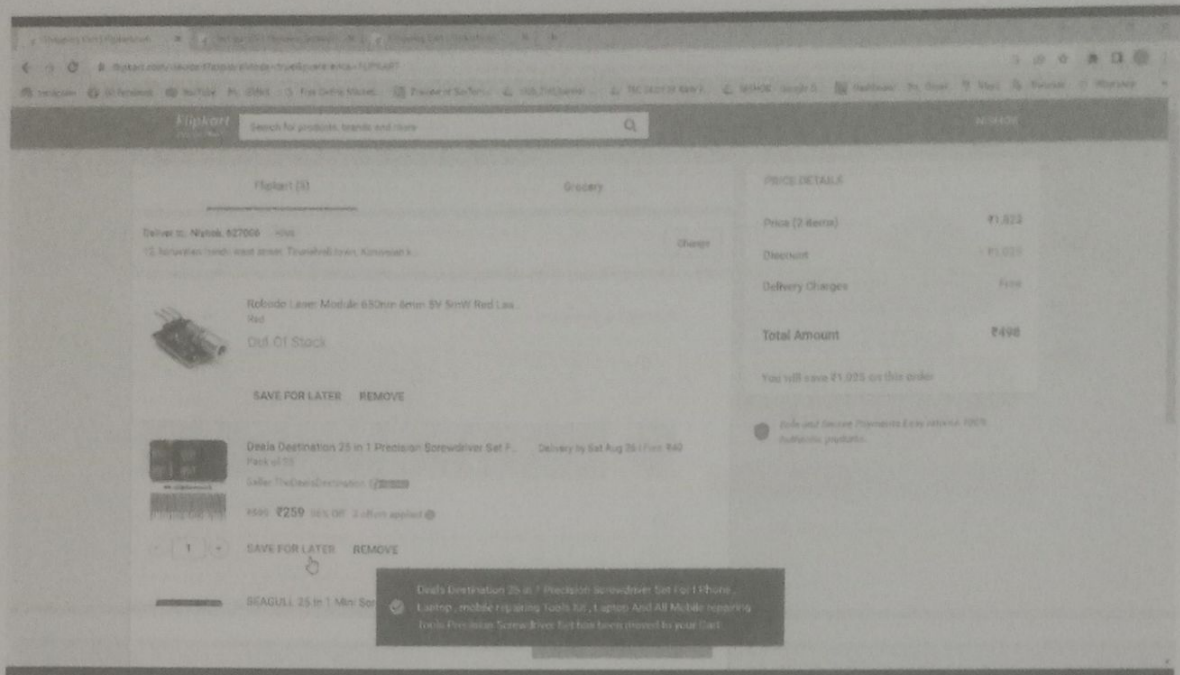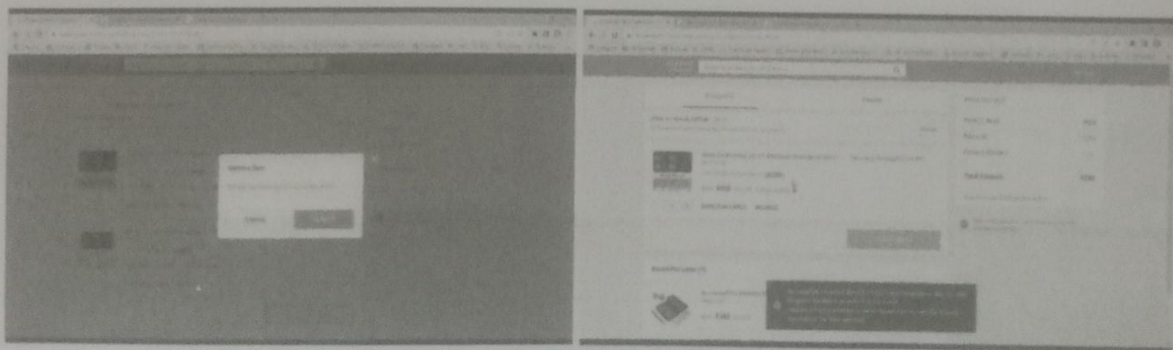
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9.Order placing

9.a)
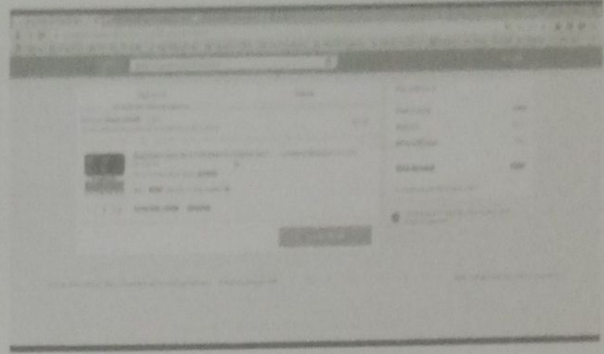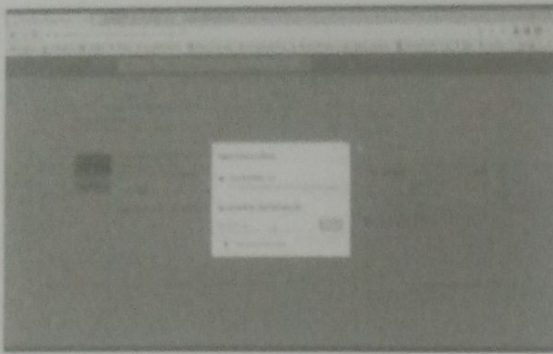
9.b)
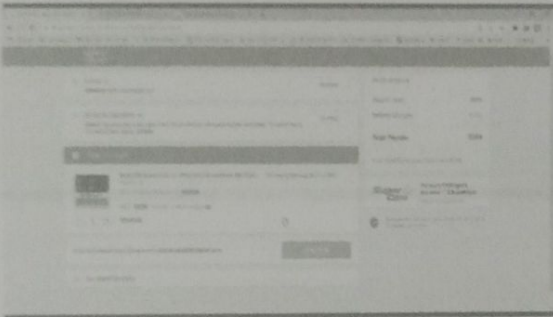
10. Payments of the Application
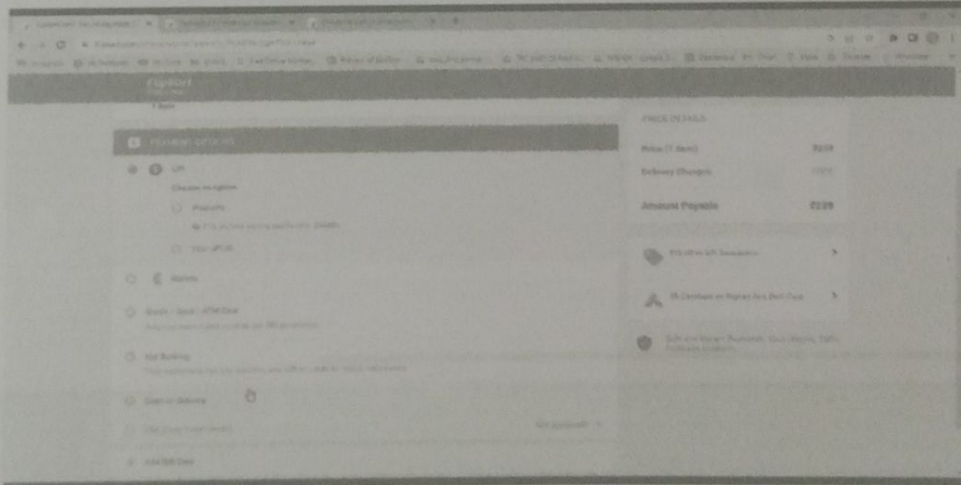
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10.a) Debit card payment method
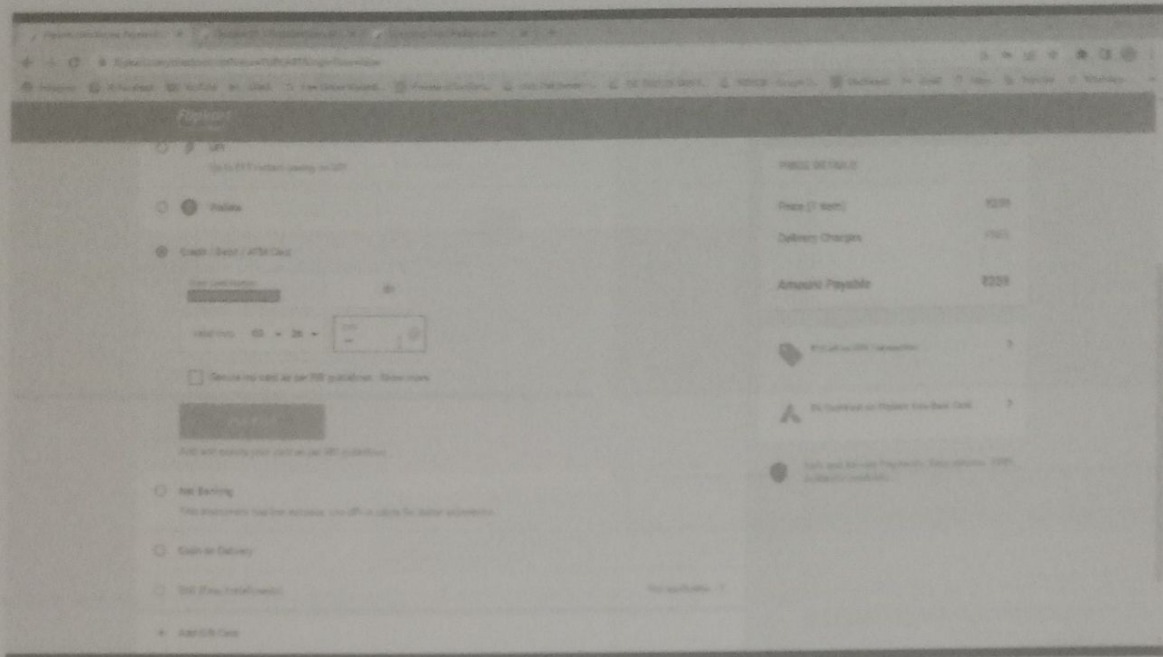
10.b)
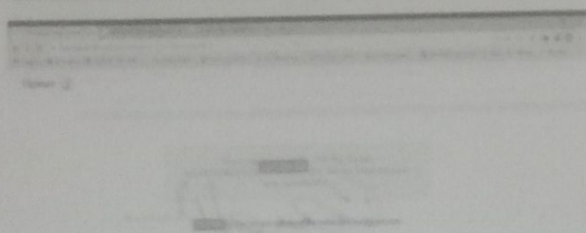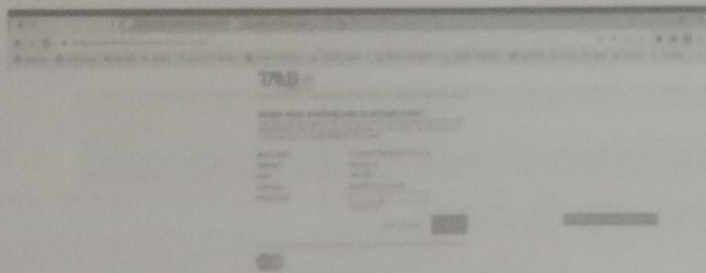
The payment was seccesfull and it was verified by the application.

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11.Order status verification
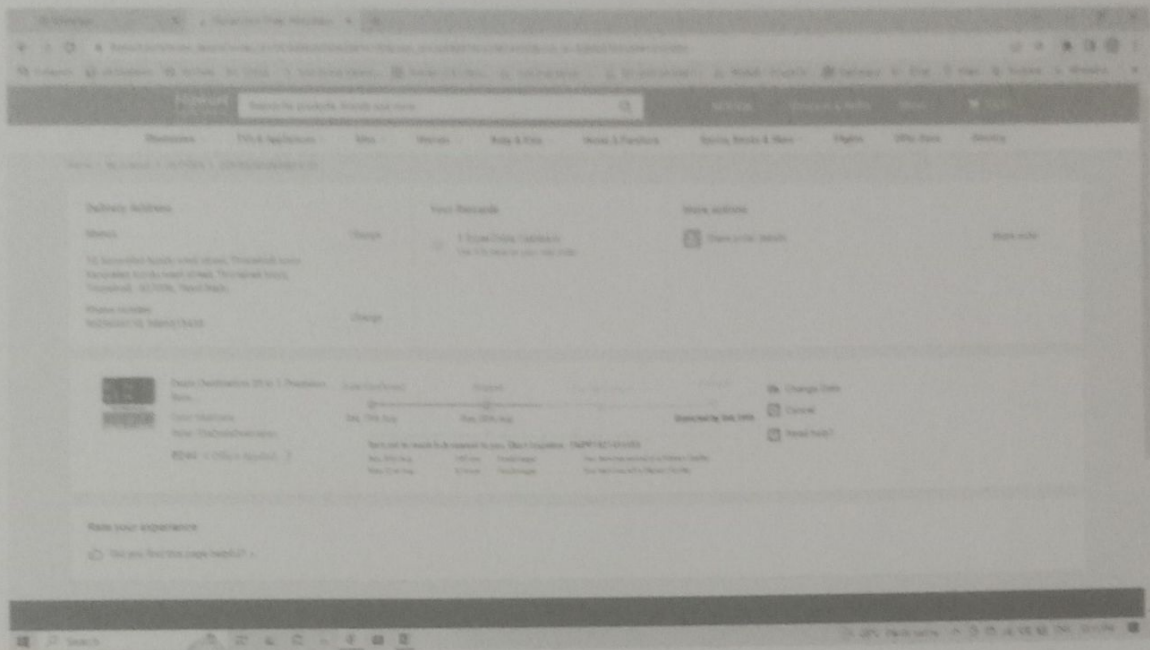
The delivery of the order is expected to be on 26th Aug 2023.
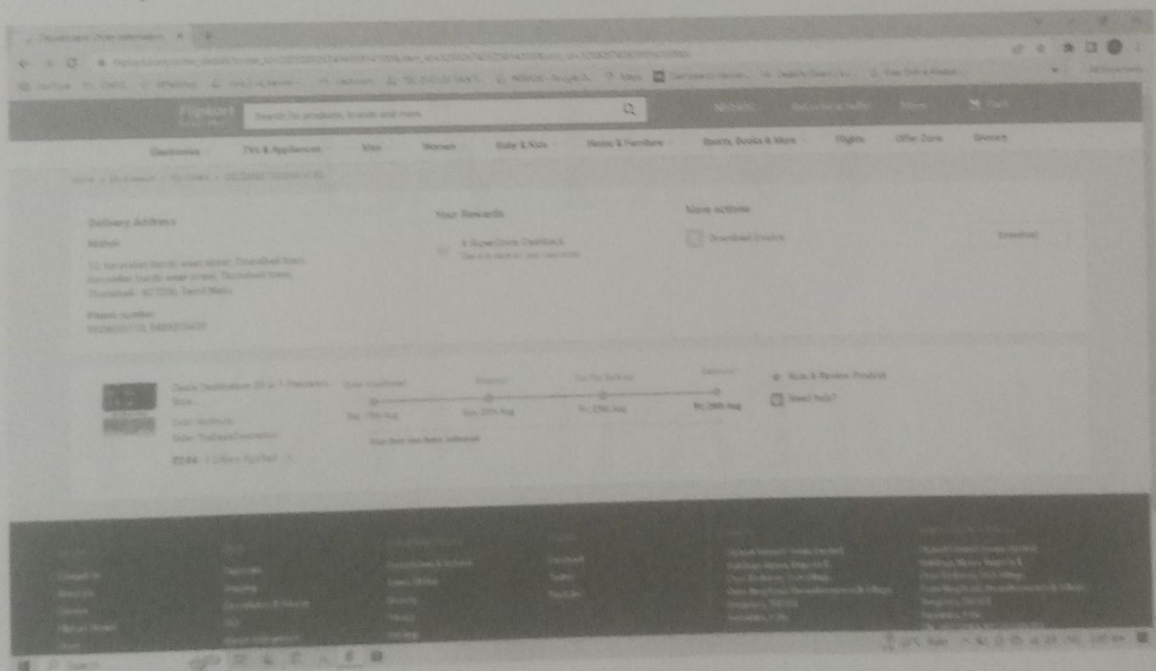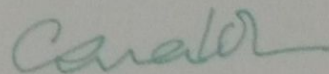
Actually the Order was delivered a day before the Guaranteed delivery date.

Result:

    Thus the e-commerce web application and the Functionalities of the web application was successfully tested and report was made

EVENT

PARTICIPATIONS
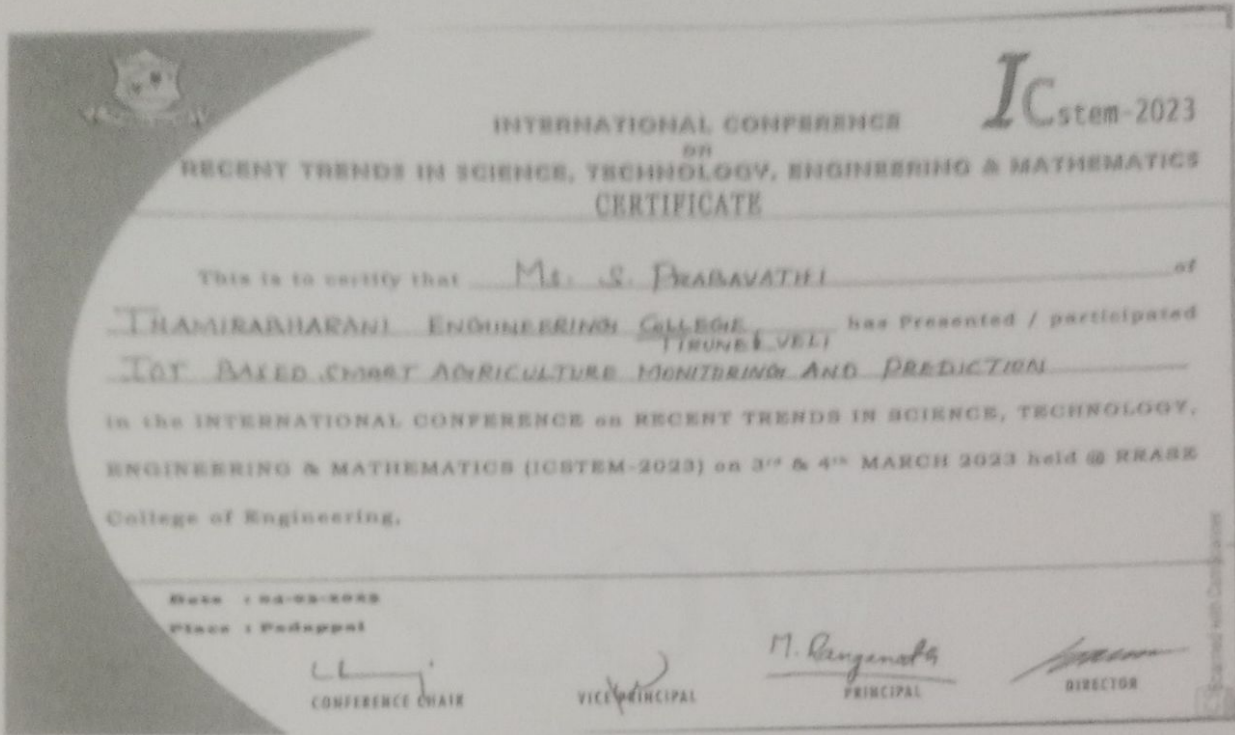
Fig. 1: Students Awarded Certificate

Fig. 2: Students Awarded Certificate

SLOW

LEARNER

COACHING CLASS

S.NO	SUBJECT CODE/NAME	DATE OF EXAM	DATE OF COACHING	STAFF NAME	No of students asked to attend	No of students attended
YEAR : III

S.NO	SUBJECT CODE/NAME	DATE OF EXAM	DATE OF COACHING	STAFF NAME	No of students asked to attend	No of students attended
			YEAR : III			
1.	Computer Architecture And Organization	16.12.2022	12.12.2022 & 13.12.2022	Mrs. G. Twinkle Geojini , AP/CSE	38	30 & 27
2.	Communication Networks	21.12.2022	19.12.2022	Mrs G. Shunmuga Priya, AP/ECE	38	28
3.	Discrete-Time Signal Processing	24.12.2022	22.12.2022	Mrs. P Saravanaselvi , AP/ECE	38	27
4.	Total Quality Management	27.12.2022	17.12.2022	Mr. S. R. Sam Kingsley AP/ECE	38	29
5.	Renewable Energy Sources	29.12.2022	27.12.2022 (AN)	Mrs. R.S. Bini, AP/ECE	38	30
6.	Digital Communication	03.01.2023	29.12.2022 AN & 30.12.2022	Mr. A. Niyas Ahamed , AP/ECE	38	26 & 26
			YEAR : IV			
1.	Ad Hoc And Wireless Sensor Networks	15.12.2022	12.12.2022	Mrs. G. Shunmuga Priya, AP/ECE	41	32
2.	Antennas And Microwave Engineering	21.12.2022	16.12.2022 & 19.12.2022	Mr. V. Arunachalam, AP/ECE	41	30 & 29
3.	Hospital Management	30.12.2022	26.12.2022 & 27.12.2022	Mr. A. Niyas Ahamed , AP/ECE	41	29 & 29
4.	Embedded And Real Time Systems	03.01.2023	21.12.2022 AN & 30.12.2022 AN	Mrs. R.S. Bini , AP/ECE	41	32 + 32
5.	Optical Communication	05.01.2023	22.12.2023 & 23.12.2022	Mr. R. Alexsander, AP/ECE	41	30 & 30

HOD/ECE

Principal
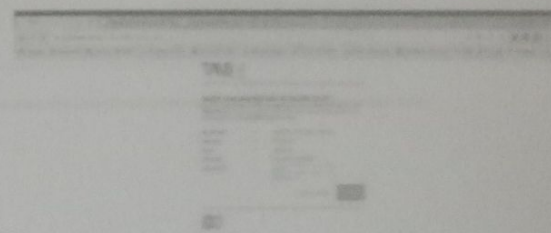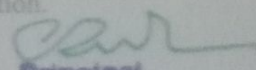THAMIRABHARANI ENGG. COLLEGE,
Tirunelveli,Tamilnadu-627 358

PRINCIPAL

THAMIRABHARANI ENGINEERING COLLEGE
THATCHANALLUR-627358
TIME TABLE FOR EVEN SEMESTER (2022-2023)
DEPARTMENT OF SCIENCE & HUMANITIES
Coaching Timetable

DATE	SECTION	STAFF NAME	SUB CODE	SUB NAME	FA/AN
08.08.2023	A-CSE	Mr. M. Rajasekaran, AP/MECH	GE3251	Engineering Graphs	FN
		Mr. P. Arriyamuthu, AP/MATH	MA3251	Statistics and Numerical methods	AN
	B-CSE	Ms. D. Chella Priya, AP/PHY	PH3256	Physics for Information science	FN
		Mr. S. K. Sri ram kalyan, AP/MATH	MA3251	Statistics and Numerical methods	AN
	C-ECE	Ms. P. Kanagavalli, AP/MATHS	MA3251	Statistics and Numerical methods	FN
		Dr. S. Selva kumar, AP/PHY	PH3254	Physics for Electronics Engineering	AN
	D-MECH/CIVIL/EEE	Mr. K. Veluraj, AP/MATHS	MA3251	Statistics and Numerical methods	FN
	D-MECH	Mr. S. Sundar Raj , AP/EEE	BE3251	Basic Electrical and Electronics Engineering	AN
	D-CIVIL	Ms. S. Anusha, AP/EEE	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	AN
	D-EEE	Ms. D. Chella Priya, AP PHY	PH3202	Physics for Electrical engineering	AN
09.09.2023	A-CSE	Dr. J. Armstrong Joseph, AP/CSE	CS3251	Programming in C	FN
		Dr. J. Alphas Jeba Singh, AP/EEE	GE3251	Basic Electrical and Electronics Engineering	AN
		Mr. M. A. Raja, AP CIVIL	GE3251	Engineering Graphs	FN
	B-CSE	Mr. M. A. Raja, AP CIVIL	GE3251	Engineering Graphs	AN
		Mr. M. Mari kannan, AP/EEE	EC3251	Circuit Analysis	FN
	C-ECE	Ms. S. Anusha, AP/EEE	BE3254	Basic Electrical and Instrumentation Engineering	AN
	D-MECH	Dr. S. Selva kumar, AP/PHY	PH3251	Materials Science	FN
	D-CIVIL	Mrs. S. Thirithuva Smily, AP/PHY	PH3201	Physics for civil engineering	FN
	D-EEE	Ms. D. Chella Priya, AP/PHY	PH3202	Physics for Electrical engineering	FN
	D-MECH/CIVIL/EEE	Mr. M. Rajasekaran, AP/MECH	GE3251	Engineering Graphs	AN
10.09.2023	A-CSE	Mr. M. Rajasekaran, AP/MECH	GE3251	Engineering Graphs	FN
		Mr. P. Arriyamuthu, AP/MATH	MA3251	Statistics and Numerical methods	AN
	B-CSE	Dr. J. Alphas Jeba Singh, AP/EEE	GE3251	Basic Electrical and Electronics Engineering	FN
		Ms. D. Chella Priya, AP/PHY	PH3256	Physics for Information science	AN
		Mr. M. A. Raja, AP/CIVIL	GE3251	Engineering Graphs	FN
	C-ECE	Dr. S. Selva kumar, AP/PHY	PH3254	Physics for Electronics Engineering	AN
	D-MECH	Mr. S. Sundar Raj , AP/EEE	BE3251	Basic Electrical and Electronics Engineering	FN
	D-CIVIL	Ms. S. Anusha, AP EEE	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	FN
	D-EEE	Ms. S. Nazrin Salma, AP EEE	EE3251	Electric Circuit Analysis	FN
	D-MECH/CIVIL/EEE	Mr. M. Rajasekaran, AP MECH	GE3251	Engineering Graphs	AN
11.09.2023	A-CSE	Ms. S. Thirithuva Smily, AP PHY	PH3256	Physics for Information science	FN
		Mr. M. Rajasekaran, AP/MECH	GE3251	Engineering Graphs	AN
	B-CSE	Ms. D. Chella Priya, AP/PHY	PH3256	Physics for Information science	FN
		Dr. R. Rajakumari, HOD S&H	HS3252	Professional English -II	AN
	C-ECE	Ms. P. Kanagavalli, AP/MATHS	MA3251	Statistics and Numerical methods	FN
	D-MECH	Mr. M. A. Raja, AP/CIVIL	GE3251	Engineering Graphs	AN
	D-MECH	Dr. S. Selva kumar, AP/PHY	PH3251	Materials Science	FN
		Mr. S. Sundar Raj , AP/EEE	BE3251	Basic Electrical and Electronics Engineering	AN
	D-CIVIL	Ms. S. Anusha, AP/EEE	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	FN
		Mrs. S. Thirithuva Smily, AP/PHY	PH3201	Physics for civil engineering	AN
	D-EEE	Ms. S. Nazrin Salma, AP/EEE	EE3251	Electric Circuit Analysis	FN
		Mr. R. Radha Krishnan, AP/MECH	BE3255	Basic Civil and Mechanical Engineering	AN
	A-CSE	Dr. J. Alphas Jeba Singh, AP/EEE	GE3251	Basic Electrical and Electronics Engineering	FN
		Dr. J. Armstrong Joseph, AP/CSE	CS3251	Programming in C	AN
		Mr. M. A. Raja, AP/CIVIL	GE3251	Engineering Graphs	FN

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Date	Dept	Faculty	Code	Subject	Session
12.08.2023	B-CSE				
	C-ECE				
	D-MECH/CIVIL/EEE				
	D-MECH				
	D-CIVIL				
	D-EEE				
14.08.2023	A-CSE				
	B-CSE				Basic Electrical and Electronics Engineering	
	C-ECE				Engineering Graphs	
	D-MECH/CIVIL				
	A-CSE			HS3252	Professional English -II	
16.08.2023	B-CSE	Dr. T. Mohan Jeba Singh, AP/EEE	BE3251	Basic Electrical and Electronics Engineering	FN
		Mr. M. A. Raja, AP/CIVIL	GE3251	Engineering Graphs	AN
		Dr. T. Mohan Jeba Singh, AP/EEE	BE3251	Basic Electrical and Electronics Engineering	AN
	C-ECE	Dr. S. Selva kumar, AP/PHY	PH3254	Physics for Electronics Engineering	FN
		Mr. M. A. Raja, AP/CIVIL	GE3251	Engineering Graphs	AN
	D-MECH	Mr. S. Sundar Raj, AP/EEE	BE3251	Basic Electrical and Electronics Engineering	
	D-CIVIL	Ms. S. Thirithuva Smily, AP/PHY	PH3201	Physics for civil engineering	FN
	D-EEE	Mr. R. Radha Krishnan, AP/MECH	BE3255	Basic Civil and Mechanical Engineering	FN
	D-MECH/CIVIL/EEE	Mr. K. Veliraj, AP/MATHS	MA3251	Statistics and Numerical methods	AN
17.08.2023	A-CSE	Ms. S. Thirithuva Smily, AP/PHY	PH3256	Physics for Information science	FN
		Mr. M. Rajasekaran, AP/MECH	GE3251	Engineering Graphs	AN
	B-CSE	Ms. D. Chella Priya, AP/PHY	PH3256	Physics for Information science	FN
		Ms. G.T. Twinkle Geojini, AP CSE	CS3251	Programming in C	AN
	C-ECE	Dr. R. Rajakumari, HOD/S&H	HS3252	Professional English -II	FN
	D-MECH/CIVIL/EEE	Mr. M. Mari kannan, AP/EEE	EC3251	Circuit Analysis	AN
	D-MECH	Mr. M. Rajasekaran, AP/MECH	GE3251	Engineering Graphs	FN
		Dr. S. Selva kumar, AP PHY	PH3251	Materials Science	AN
	D-CIVIL	Ms. S. Anusha, AP EEE	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	AN
	D-EEE	Mr. R. Radha Krishnan, AP/MECH	BE3255	Basic Civil and Mechanical Engineering	AN
18.08.2023	A-CSE	Mr. P. Ariyamuthu, AP/MATH	MA3251	Statistics and Numerical methods	FN&AN
	B-CSE	Mr. C. L. Sriram Kalyan, AP/MATH	MA3251	Statistics and Numerical methods	FN&AN
	C-ECE	Mr. P. Janagavathi, AP/MATHS	MA3251	Statistics and Numerical methods	FN&AN
	D-MECH/CIVIL/EEE	Mr. K. Veliraj, AP/MATHS	MA3251	Statistics and Numerical methods	FN&AN
19.08.2023	A-CSE	Mr. P. Ariyamuthu, AP/MATH	MA3251	Statistics and Numerical methods	FN&AN
	B-CSE	Mr. N. K. Sriram Kalyan, AP/MATH	MA3251	Statistics and Numerical methods	FN&AN
	C-ECE	Mr. P. Janagavathi, AP/MATHS	MA3251	Statistics and Numerical methods	FN&AN

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Date	Branch	Faculty	Code	Subject	Session
	D MECH/CIVIL/ EEE	Mr. K. Velraj. AP/MATHS	MA3251	Statistics and Numerical methods	FN& AN
	A-CSE	ANNA UNIVERSITY EXAM Mr. P. Aravananthu. AP/MATH	MA3251	Statistics and Numerical methods	FN
			MA3251	Matrices and Calculus	AN
	B-CSE	ANNA UNIVERSITY EXAM Mr. S. K. Sriram Kalyan. AP/MATH	MA3251	Statistics and Numerical methods	FN
			MA3251	Matrices and Calculus	AN
21.08.2023	C-ECE	ANNA UNIVERSITY EXAM Mr. P. Kanagavalli. AP/MATHS	MA3251	Statistics and Numerical methods	FN
			MA3251	Matrices and Calculus	AN
	D MECH/CIVIL/ EEE	ANNA UNIVERSITY EXAM	MA3251	Statistics and Numerical methods	FN
	D MECH/CIVIL/ EEE	Mr. K. Velraj. AP/MATHS	MA3251	Matrices and Calculus	AN
	A-CSE				AN
		Dr. J. Armstrong Joseph. AP/CSI	CS3251	Programming in C	
22.08.2023	B-CSE	Ms. G.T. Twinkle Georin. AP/CSE	CS3251	Programming in C	AN
	C-ECE	Mr. M. Mari Kannan. AP/EEE	EC3251	Circuit Analysis	AN
	D- MECH	Dr. S. Selva kumar. AP/PHY	PH3251	Materials Science	AN
	D- CIVIL	Mrs. S. Thirithuva Smily. AP/PHY	PH3201	Physics for civil engineering	AN
	D- EEE	Ms. R. Ambika. AP/CIVIL	BE3255	Basic Civil and Mechanical Engineering	AN
	A-CSE	ANNA UNIVERSITY EXAM Ms. S. Thirithuva Smily. AP/PHY	CS3251	Programming in C	FN
			PH3256	Physics for Information science	AN
		ANNA UNIVERSITY EXAM	CS3251	Programming in C	FN
23.08.2023	B-CSE	Ms. D. Chella Priya. AP/PHY	PH3256	Physics for Information science	AN
		ANNA UNIVERSITY EXAM	EC3251	Circuit Analysis	FN
	C-ECE	Dr. S. Selva kumar. AP/PHY	PH3254	Physics For Electronics Engineering	AN
	D- EEE	ANNA UNIVERSITY EXAM	BE3255	Basic Civil and Mechanical Engineering	FN
	A- CSE	ANNA UNIVERSITY EXAM	PH3256	Physics for Information science	FN
	B-CSE	ANNA UNIVERSITY EXAM	PH3256	Physics for Information science	FN
	C-ECE	ANNA UNIVERSITY EXAM	PH3254	Physics for Electronics Engineering	FN
25.08.2023	D- MECH	ANNA UNIVERSITY EXAM	PH3251	Materials Science	FN
	D- CIVIL	ANNA UNIVERSITY EXAM	PH3201	Physics for civil engineering	FN
	D- EEE	ANNA UNIVERSITY EXAM	PH3202	Physics for Electrical engineering	FN
	ALL I YEARS	ANNA UNIVERSITY EXAM	GE3252	Tamils and Technology	AN
	A- CSE	Dr. J. Alaphas Jeba Singh. AP EEE	BE3251	Basic Electrical and Electronics Engineering	AN
	B-CSE	Dr. J. Alphas Jeba Singh. AP EEE	BE3251	Basic Electrical and Electronics Engineering	AN
28.08.2023	C-ECE	Ms. S. Anusha. AP/EEE	BE3254	Basic Electrical and Instrumentation Engineering	AN
	D- MECH	Mr. S. Sundar Raj . AP/EEE	BE3251	Basic Electrical and Electronics Engineering	AN
	D- CIVIL	Ms. S. Anusha. AP/EEE	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	AN
	D- EEE	Ms. S. Nazrin Salma. AP/EEE	BE3251	Electric Circuit Analysis	FN
	A- CSE	ANNA UNIVERSITY EXAM	BE3251	Basic Electrical and Electronics Engineering	AN
		Mr. M. Rajasekaran. AP/MECH	GE3251	Engineering Graphs	FN
		ANNA UNIVERSITY EXAM	BE3251	Basic Electrical and Electronics Engineering	AN
	B-CSE	Mr. M. A. Raja. AP/CIVIL	GE3251	Engineering Graphs	FN
		ANNA UNIVERSITY EXAM	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	AN
01.09.2023	C-ECE	Mr. M. A. Raja. AP/CIVIL	GE3251	Engineering Graphs	FN
		ANNA UNIVERSITY EXAM	BE3252	Basic Electrical and Electronics Engineering	AN
	D-MECH	Mr. M. Rajasekaran. AP/MECH	GE3251	Engineering Graphs	FN
		ANNA UNIVERSITY EXAM	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	AN
	D- CIVIL	Mr. M. Rajasekaran. AP/MECH	GE3251	Engineering Graphs	FN
		ANNA UNIVERSITY EXAM	EE3251	Electric Circuit Analysis	AN
	D- EEE	Mr. M. Rajasekaran. AP/MECH	GE3251	Engineering Graphs	FN& AN
04.09.2023	ALL I YEARS	ANNA UNIVERSITY EXAM	GE3251	Engineering Graphs	FN& AN
07.09.2023	ALL I YEARS	ANNA UNIVERSITY EXAM	HS3252	Professional English-II	FN

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HOME TEST

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SLOW LEARNERS NOTES

P. Kanagavalli
Staff Incharge

R. Anjali 5/12/28
HOD

Characteristic equation. and characteristic polynomial.

$$[A - \lambda I] = 0]$$ $$[|A - \lambda I|]$$

Example : ①

Find the characteristic equation of the matrix

$$\begin{pmatrix} 1 & 2 \\ 0 & 2 \end{pmatrix}.$$

Solution :-

Let, $A = \begin{pmatrix} 1 & 2 \\ 0 & 2 \end{pmatrix}$

The characteristic equation of A is $\lambda^2 - S_1\lambda + S_2 = 0$.

S_1 = Sum of the main diagonal elements

$S_2 = |A| = \begin{vmatrix} 1 & 2 \\ 0 & 2 \end{vmatrix} = 2 - 0 = 2$

Hence, the equation is $\lambda^2 - (3)\lambda + 2 = 0$

ie) $\lambda^2 - 3\lambda + 2 = 0$.

Example : ②

find the characteristic equation $\begin{pmatrix} 2 & -3 & 1 \\ 3 & 1 & 3 \\ -5 & 2 & -4 \end{pmatrix}$

Solution :-

Let $A = \begin{bmatrix} 2 & -3 & 1 \\ 3 & 1 & 3 \\ -5 & 2 & -4 \end{bmatrix}$

The characteristic equation is $\lambda^3 - S_1\lambda^2 + S_2\lambda - S_3 = 0$.

S_1 = Sum of the diagonal elements

S_2 = Sum of the minors of main diagonal elements

$S_3 = |A|$.

$S_1 = 2 + (1) + (-4) = -1$

$$S_2 = \begin{vmatrix} 1 & 3 \\ 2 & -4 \end{vmatrix} + \begin{vmatrix} 2 & 1 \\ -5 & -4 \end{vmatrix} + \begin{vmatrix} 2 & -3 \\ 3 & 1 \end{vmatrix}$$

$$= (-4 - 6) + (-8 + 5) + (2 + 9)$$

$$= -10 + 2 - 3 + 11 = \boxed{-2}$$

$$|A| = S_3 = \begin{vmatrix} 2 & -3 & 1 \\ 3 & 1 & 3 \\ -5 & 2 & -4 \end{vmatrix}$$

$$= 2(-4 - 6) - (-3)(-12 + 15) + 1(6 + 5)$$

$$= 2(-10) + 3(3) + 1(11) = -20 + 9 + 11 = 0.$$

$$\therefore \quad \lambda^3 - (-1)\lambda^2 + (-2)\lambda + (0) = 0.$$

$$\lambda^3 + \lambda^2 - 2\lambda = 0.$$

Example : ③

Find the characteristic polynomial of

$$\begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}.$$

Solution :-

Let, $A = \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$

The characteristic polynomial of A is $|A - \lambda I|$

$$= \left[\begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix} - \lambda \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \right] = \begin{vmatrix} 1-\lambda & 4 \\ 2 & 3-\lambda \end{vmatrix}.$$

$$= (1-\lambda)(3-\lambda) - 8 = 3 - \lambda - 3\lambda + \lambda^2 - 8$$

$$= \lambda^2 - 4\lambda - 5$$

Hence, the characteristic polynomial is $\lambda^2 - 4\lambda - 5$.

Eigen Values and Eigen Vectors of the Non-Symmetric Matrix.

Example : ① find the Eigen values and Eigen vectors of the matrix, $A = \begin{bmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{bmatrix}$

Solution :-

Given, $A = \begin{bmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{bmatrix}$

Step : ① To find characteristic equation.

The characteristic equation of A is $|A - \lambda I| = 0$.

(i) $\lambda^3 - S_1 \lambda^2 + S_2 \lambda - S_3 = 0$

S_1 = Sum of the main diagonal elements

$= 11 + (-2) + (-6) = 11 - 8 = 3$

S_2 = Sum of the minors of main diagonal elements

$= \begin{vmatrix} -2 & -5 \\ -4 & -6 \end{vmatrix} + \begin{vmatrix} 11 & -7 \\ 10 & -6 \end{vmatrix} + \begin{vmatrix} 11 & -4 \\ 7 & -2 \end{vmatrix}$

$= (12 - 20) + (-66 + 70) + (-22 + 28)$

$= -8 + 4 + 6 = 2$

$S_3 = |A| = \begin{vmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{vmatrix}$

$= 11 (12 - 20) - (-4)(-42 + 50) - 7(-28 + 20)$

$= 11(-8) + 4(8) - 7(8) = -88 + 32 + 56 = 0$

$\therefore ① \Rightarrow \lambda^3 - 3\lambda^2 + 2\lambda - 0 = 0.$

Step: ② To find the eigen Values.

$$\lambda(\lambda^2 - 3\lambda + 2) = 0$$

$$\Rightarrow \lambda = 0, \quad \lambda^2 - 3\lambda + 2 = 0$$

$$(\lambda - 1)(\lambda - 2) = 0$$

$$\Rightarrow \lambda = 0, \quad \lambda = 1, \quad \lambda = 2$$

Hence, the Eigen values of the given matrix are $0, 1, 2$.

Step: ③ To find the eigen vectors

Solve, $(A - \lambda I) X = 0$.

(i) $$\left[\begin{pmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & 0 \end{pmatrix} - \lambda \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \right] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

(ii) $$\begin{bmatrix} 11 - \lambda & -4 & -7 \\ 7 & -2 - \lambda & -5 \\ 10 & -4 & -6 - \lambda \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$
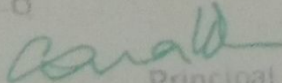
Case (i) put, $\lambda = 0$

$$\begin{bmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$11x_1 - 4x_2 - 7x_3 = 0$$

$$7x_1 - 2x_2 - 5x_3 = 0$$

$$10x_1 - 4x_2 - 6x_3 = 0$$

Solving ① and ③, by Cross multiplication method,

we get.

$$\frac{x_1}{20-14} = \frac{x_2}{-49+55} + \frac{x_3}{-22+28}$$

$$\frac{x_1}{6} = \frac{x_2}{6} = \frac{x_3}{6}$$

$x_1 = 1, \; x_2 = 1, \; x_3 = 1$

Hence, the corresponding eigen vectors is $X_1 \equiv \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$

Case (ii) If $\lambda = 1$,

$$\begin{bmatrix} 10 & -4 & -7 \\ 7 & -3 & -5 \\ 10 & -4 & -7 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$10x_1 - 4x_2 - 7x_3 = 0$ ——— ④

$7x_1 - 3x_2 - 5x_3 = 0$ ——— ⑤

$10x_1 - 4x_2 - 7x_3 = 0.$ ——— ⑥

Solve ④ and ⑤ by Cross multiplication method.

$$\frac{x_1}{20-21} = \frac{x_2}{-49+50} = \frac{x_3}{-30+28}$$

$$\frac{x_1}{-1} = \frac{x_2}{1} = \frac{x_3}{-2}$$

(ie) $\frac{x_1}{1} = \frac{x_2}{-1} = \frac{x_3}{2}$

Hence, the corresponding eigen vectors is $X_2 = \begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix}$

Case (iii) If $\lambda = 2$, then the equation,

$$\begin{bmatrix} 9 & -4 & -7 \\ 7 & -4 & -5 \\ 10 & -4 & -8 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$9x_1 - 4x_2 - 7x_3 = 0 \quad\text{———}\;⑦$$

$$7x_1 - 4x_2 - 5x_3 = 0 \quad\text{———}\;⑧$$

$$10x_1 - 4x_2 - 8x_3 = 0 \quad\text{———}\;⑨$$

Solving ⑦ and ⑧ by cross-multiplication, we get

$$\frac{x_1}{20-28} = \frac{x_2}{-49+45} = \frac{x_3}{-36+28}$$

$$\frac{x_1}{-8} = \frac{x_2}{-4} = \frac{x_3}{-8}$$

✳ (-2)

$$\frac{x_2}{2} = \frac{x_2}{1} = \frac{x_3}{2}$$

Hence, the corresponding Eigenvectors is $x_3 = \begin{bmatrix} 2 \\ 1 \\ 2 \end{bmatrix}$

H.W

① Find the Eigen values and Eigen vectors of

$$\begin{bmatrix} 6 & -6 & 5 \\ 14 & -13 & 10 \\ 7 & -6 & 4 \end{bmatrix}$$

⑤

nd the Eigen values and Figen vectors of $\begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 2 \end{bmatrix}$

Also, determine the algebric and geometric multiplicity.

Solution:-

Let $A = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 2 \end{bmatrix}$.

Given the matrix is upper triangular matrix. Hence the properties of eigen values,

Eigen values are diagonal elements.

∴ The eigen values are 2, 2, 2.

$\lambda = 2, 2, 2$ is an eigen values of algebric multiplicity 3.

To find the Eigen vectors.

Solve, $(A - \lambda I) X = 0$.

$$\left[\begin{pmatrix} 2 & 1 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 2 \end{pmatrix} - \lambda \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \right] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

(e) $\begin{bmatrix} 2-\lambda & 1 & 0 \\ 0 & 2-\lambda & 1 \\ 0 & 0 & 2-\lambda \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

when, $\lambda = 2$

(e) $0x_1 + 0x_2 + 0x_3 = 0$ —————— ①

$0x_1 + 0x_2 + x_3 = 0$ —————— ②

$0x_1 + 0x_2 + 0x_3 = 0$ —————— ③

$\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

Solve, ① and ② by cross multiplication

we get,

$$\frac{x_1}{1-0} = \frac{x_2}{0-0} = \frac{x_3}{0-0}$$

$$\frac{x_1}{1} = \frac{x_2}{0} = \frac{x_3}{0}$$

Hence, the corresponding Eigen vector is $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$

We get one eigen vector corresponding to repeated eigen values. and not linearly independent.

$$\lambda_1 = \lambda_2 = \lambda_3 = 2.$$

So, Geometric multiplicity is one.

————————— x —————————

Matrices and calculus.
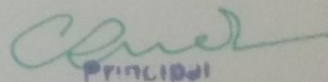
Unit - iii - Functions of several variables.

1. State any two Properties of Jacobian. [2018/2019].

Solution:-

① If u and v are the functions of x and y, then

$$\frac{\partial(u,v)}{\partial(x,y)} \times \frac{\partial(x,y)}{\partial(u,v)} = 1.$$

② If u and v are functions of (x,y) and x, y are themselves functions of r, s then $\frac{\partial(u,v)}{\partial(x,y)} \cdot \frac{\partial(x,y)}{\partial(r,s)} = \frac{\partial(u,v)}{\partial(r,s)}$

Matrices and calculus

Unit-iii - Functions of Several variables

Example:

If $x = uv$, $y = \dfrac{u}{v}$, find $\dfrac{\partial(x,y)}{\partial(u,v)}$

Solution:-

$$J = \frac{\partial(x,y)}{\partial(u,v)} = \begin{vmatrix} \dfrac{\partial x}{\partial u} & \dfrac{\partial x}{\partial v} \\[2mm] \dfrac{\partial y}{\partial u} & \dfrac{\partial y}{\partial v} \end{vmatrix} \quad \text{——①}$$

Given,

$$x = uv \qquad\qquad y = \frac{u}{v}$$

$$\frac{\partial x}{\partial u} = \boxed{v} \qquad\qquad \frac{\partial y}{\partial u} = \boxed{\frac{1}{v}}$$

$$\frac{\partial x}{\partial v} = \boxed{u} \qquad\qquad \frac{\partial y}{\partial v} = u\left(\frac{-1}{v^2}\right) = \boxed{\frac{-u}{v^2}}$$

From ①

$$J = \begin{vmatrix} v & u \\[3mm] \dfrac{1}{v} & \dfrac{-u}{v^2} \end{vmatrix}$$

$$= v\left(\frac{-u}{v^2}\right) - \frac{u}{v}$$

$$= \frac{-u}{v} - \frac{u}{v} = \boxed{\frac{-2u}{v}}$$

Matrices and Calculus

Unit - IV Integral calculus

Example :-

Evaluate $\int \theta \cos\theta \, d\theta$ using integration by parts

Solution :-

Let, $I = \int \theta \cos\theta \, d\theta$. $\boxed{\int u \, dv = uv - \int v \, du}$

Let, $\boxed{u = \theta}$ $\boxed{dv = \cos\theta \, d\theta}$

$\dfrac{du}{d\theta} = 1$ $\int dv = \int \cos\theta \, d\theta$

$\boxed{du = d\theta}$ $\boxed{v = \sin\theta}$

$\displaystyle\int \theta \cos\theta \, d\theta = \overset{u}{\theta} \cdot \overset{v}{\sin\theta} - \int \overset{v}{\sin\theta} \cdot \overset{du}{d\theta}$

$\qquad\qquad = \theta \cdot \sin\theta - \left[-\cos\theta\right] + c$

$\displaystyle\int \theta \cos\theta \, d\theta = \boxed{\theta \cdot \sin\theta + \cos\theta} + c$

Matrices and calculus (unit-iv)

$$\boxed{\text{Integral calculus}}$$

Example:

Find the value of $\displaystyle\int_{0}^{\pi/2} \sin^{6}x \, . \, dx$

$$\boxed{\text{APR/MAY} - 2023}$$

Solution:-

Given, $\displaystyle I = \int_{0}^{\pi/2} \sin^{6}x \, . \, dx$

Here, $\boxed{n = 6}$ (is even)

$$I_{6} = \left[\frac{6-1}{6}\right]\left[\frac{6-3}{6-2}\right]\left[\frac{6-5}{6-4}\right] . \frac{\pi}{2}$$

$$\left. \begin{array}{l} I_{n} = \left(\frac{n-1}{n}\right)\left(\frac{n-3}{n-2}\right)\left(\frac{n-5}{n-4}\right) \\ \qquad \cdots \cdots \frac{\pi}{2}. \end{array} \right.$$

$$I_{6} = \left(\frac{5}{6}\right)\left(\frac{3}{4}\right)\left(\frac{1}{2}\right)\left(\frac{\pi}{2}\right)$$

Matrices and calculus.

Unit - IV [Integral calculus]

Example:

Given that $\int_{0}^{10} f(x) \cdot dx = 17$ and $\int_{0}^{8} f(x) \, dx = 12$

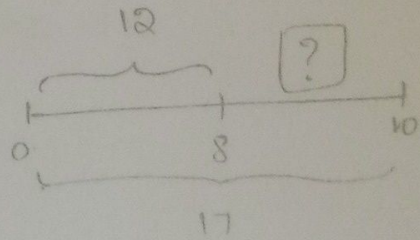then find $\int_{8}^{10} f(x) \cdot dx$.

[Jan - 2022]

Solution:-

Given, $\int_{0}^{10} f(x) \, dx = \int_{0}^{8} f(x) \, dx + \int_{8}^{10} f(x) \cdot dx$.

By property, $\int_{a}^{c} f(x) \cdot dx + \int_{c}^{b} f(x) \cdot dx = \int_{a}^{b} f(x) \cdot dx, \quad a < c < b$

$\therefore \int_{8}^{10} f(x) \cdot dx = 17 - 12 = \boxed{5}$
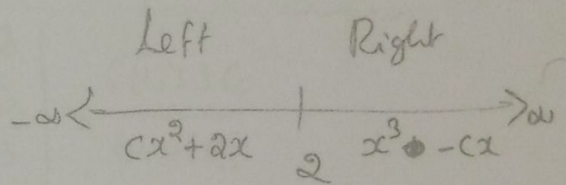
Unit - II - Differential calculus

Example: For what value of the constant 'c' is the

function f continuous at $(-\infty, \infty)$.

$$f(x) = \begin{cases} cx^2 + 2x & , \quad x < 2 \\ x^3 - cx & , \quad x \geq 2. \end{cases}$$

Solution:-

    Given : f is continuous.

      ie) $\underline{f(2^-) = f(2) = f(2^+)}$

Left   Right

$-\infty \overset{}{\longleftarrow} \underset{cx^2+2x \quad 2 \quad x^3 - cx}{} \overset{}{\longrightarrow} \infty$

① $f(2) = \lim\limits_{x \to 2} f(x) = \lim\limits_{x \to 2} [x^3 - cx]$.

                            $= 8 - 2c$ ——①

② $f(2^-) = \lim\limits_{x \to 2^-} f(x) = \lim\limits_{x \to 2^-} [cx^2 + 2x]$

                            $= 4c + 4$ ——②

        $8 - 2c = 4c + 4$

           $6c = 4$

        $\boxed{c = \dfrac{2}{3}}$

Jacobians

Example:

If $x = u^2 - v^2$ and $y = 2uv$, then find the Jacobian of x and y with respect to u and v.
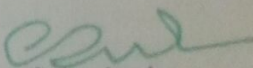
Solution:-

$$\frac{\partial(x,y)}{\partial(u,v)} = \begin{vmatrix} \dfrac{\partial x}{\partial u} & \dfrac{\partial x}{\partial v} \\[2mm] \dfrac{\partial y}{\partial u} & \dfrac{\partial y}{\partial v} \end{vmatrix} \qquad —————①$$

Given,

$\underline{x = u^2 - v^2}$

$\dfrac{\partial x}{\partial u} = 2u$

$\dfrac{\partial x}{\partial v} = -2v$

$\underline{y = 2uv.}$

$\dfrac{\partial y}{\partial u} = 2v.$

$\dfrac{\partial y}{\partial v} = 2u.$

From ①,

$$\frac{\partial(x,y)}{\partial(u,v)} = \begin{vmatrix} 2u & -2v \\[2mm] 2v & 2u \end{vmatrix}$$
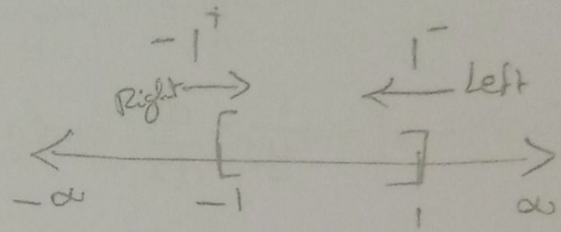
$$= 4u^2 + 4v^2 = 4(u^2 + v^2).$$

Matrices and calculus

Examples:

Show that the function $f(x) = 1 - \sqrt{1-x^2}$ is continuous on the interval $[-1, 1]$.

Solution:-

WKT,

$$\lim_{x \to -1^+} f(x) = \lim_{x \to 1^-} f(x)$$

$$= \lim_{x \to -1^+} 1 - \sqrt{1-x^2}$$

$$= 1 - \sqrt{1-(-1)^2}$$

$$= 1 - \sqrt{0} =$$

$$= \boxed{0} \qquad \text{①}$$

$$= \lim_{x \to 1^-} f(x)$$

$$= \lim_{x \to 1^-} 1 - \sqrt{1-x^2}$$

$$= 1 - \sqrt{1-1} = \boxed{0} \qquad \text{②}$$

$$\therefore \text{①} = \text{②}$$

Given, the function $f(x)$ is continuous on $[-1, 1]$.

Matrices and calculus [MA3151]

Find the derivatives of $y = [\sin x]^{\cos x}$

Solution:-

Given, $y = [\sin x]^{\cos x}$ _____ (i)

$\log y = \underbrace{\cos x}_{u} [\underbrace{\log \sin x}_{v}]$

$\boxed{uv' = uv^{1} + vu^{1}}$

$\dfrac{1}{y} \cdot \dfrac{dy}{dx} = \cos x \left[\dfrac{1}{\sin x} \cos x \right] + \log \sin x [-\sin x]$

$\dfrac{1}{y} \cdot \dfrac{dy}{dx} = \cos^{2} x [\csc x] - \sin x \log \sin x$

$\therefore \dfrac{dy}{dx} = y \left[\cos^{2} x \cdot \csc x - \sin x \log \sin x \right]$

$\boxed{\dfrac{dy}{dx} = [\sin x]^{\cos x} \left[\cos^{2} x \cdot \csc x - \sin x \log \sin x \right]}$

Matrices and Calculus [MA3151]

Example:

Find the derivatives of $y = [\sin x]^{\cos x}$

Solution:-

Given, $y = [\sin x]^{\cos x}$ ————①

$$\log y = \underbrace{\cos x}_{u} \underbrace{[\log \sin x]}_{v} \qquad \boxed{uv' = uv' + vu'}$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \cos x \left[\frac{1}{\sin x} \cos x\right] + \log \sin x \left[- \sin x\right]$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \cos^2 x \left[\cosec x\right] - \sin x \log \sin x$$

$$\therefore \frac{dy}{dx} = y \left[\cos^2 x \cdot \cosec x - \sin x \log \sin x\right]$$

$$\boxed{\frac{dy}{dx} = [\sin x]^{\cos x} \left[\cos^2 x \cdot \cosec x - \sin x \log \sin x\right]}$$

Matrices and calculus

Example:

Find the derivative of $y = (x^3 - 1)^{100}$.

Solution:-

Given, $y = (x^3 - 1)^{100}$

Let, $u = (x^3 - 1)^{100}$.

$\Rightarrow y = u^{100}$

$\dfrac{dy}{du} = 100 u^{99}$

$\dfrac{dy}{du} = 100 (x^3 - 1)^{99}$ — ①

Formula

$$\boxed{\dfrac{dy}{dx} = \dfrac{dy}{du} \cdot \dfrac{du}{dx}}$$

$u = x^3 - 1$

$\dfrac{du}{dx} = 3x^2$ — ②

$\dfrac{dy}{dx} = 100 (x^3 - 1)^{99} (3x^2)$

$$\boxed{\dfrac{dy}{dx} = 300 (x^3 - 1)^{99} \cdot x^2}$$

Matrices and calculus [MA3151]

Example:

Find the critical value of the function

$$f(x) = 5x^3 - 6x.$$

Solution:-

Given, $f(x) = 5x^3 - 6x$

$$f'(x) = 15x^2 - 6$$

$$f'(x) = 0 \implies 15x^2 - 6 = 0$$

$$15x^2 = 6$$

$$x^2 = \frac{\cancel{6}^2}{\cancel{15}_5}$$

$$x^2 = \frac{2}{5}$$

$$\boxed{x = \pm \sqrt{\frac{2}{5}}}$$