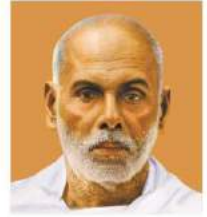
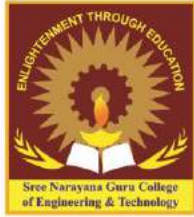


Sree Narayana Guru College of Engineering & Technology

CHALAKKODE P.O., KOROM, PAYYANUR, KANNUR-670 307

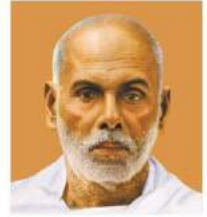


DETAILS OF TUTORIAL CLASSES



Sree Narayana Guru College of Engineering & Technology

CHALAKKODE P.O., KOROM, PAYYANUR, KANNUR-670 307



DEPARTMENT OF CIVIL ENGINEERING

DEGREE / BRANCH.....CIVIL / B.TECH.....

SEMESTER.....3.....SUBJECT CODE CET201.....

SUBJECT.....MECHANICS OF SOLIDS.....

CLASSES

COMMENCING DATE 12-9-2022 ENDING DATE.....

ACADEMIC YEAR.....2022-2023.....



SREE NARAYANA GURU COLLEGE OF ENGINEERING & TECHNOLOGY

P.O. CHALAKKODE - PAYYANUR.

Approved by AICTE, New Delhi, Affiliated to APJ Abdul Kalam Technological University, and Managed by Sree Bhakti Samvardhini Yogam, Talap, Kannur

ATTENDANCE AND ASSESSMENT RECORD

Dr. LEENA A. V.
PRINCIPAL
SREE NARAYANA GURU COLLEGE OF
ENGINEERING & TECHNOLOGY, PAYYANUR
KANNUR

May 14
HOD



SREE NARAYANA GURU COLLEGE OF ENGINEERING & TECHNOLOGY

P.O. CHALAKKODE - PAYYANUR.

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ATTENDANCE AND ASSESSMENT RECORD

NAME OF STAFF ... B. MARY SONIA GEORGE

DESIGNATION ... ASST. PROFESSOR (Sr. Gr.)

DEPARTMENT ... CIVIL

May 24
HOD

Leena
**Dr. LEENA A. V.
PRINCIPAL**

**SREE NARAYANA GURU COLLEGE OF
ENGINEERING & TECHNOLOGY, PAYYANUR
KANNUR**

[illegible]

May 14
HOD

M. LEENA A. V
PRINCIPAL

SHREE NARAYANA GURU COLLEGE OF
ENGINEERING & TECHNOLOGY, PAYYANUR
KANNUR

Degree / Branch : B. Tech / Cui

[illegible][illegible]

May 14
HOD

Leve

Dr. LEENA A. V.
PRINCIPAL
SREE NARAYANA GURU COLLEGE OF
ENGINEERING & TECHNOLOGY, PAYYANUR
KANNUR

B.Tech / Cui

[illegible][illegible]

Leena

M. LEENA A. V.
PRINCIPAL

SRILE NARAYANA GURU COLLEGE OF
ENGINEERING & TECHNOLOGY, PAYYANUR
KANNUR

May 14
HOD

[illegible]

URS ENGAGED

	ATTEN DANCE %	ATTEN DANCE MARK	SESS MARK OUT OF	ROLL NO.
	88	9	85	1
	84	89	35	2
	93	10	35	3
	82	9	36	4
	94	10	40	5
	84	9	35	6
	91	10	36	7
	94	10	36	8
	93	10	35	9
	94	10	39	10
	88	9	35	11
	90	10	36	12
	91	10	35	13
	96	10	35	14

May 14
HOD


Module Co-ordinator

J. LEENA A. V.
PRINCIPAL
SREE NARAYANA GURU COLLEGE OF
ENGINEERING & TECHNOLOGY, PAYYANUR
KANNUR

Degree / Branch : B.Tech / Cui

CLASS ROLL NO.	NAME	
1.	ADITHYA . K. SURESH	0
2.	ARJUN MUKUNDAN	3
3.	ARSHAD K.P.	0
4.	ASLAHA . B.	0
5.	BASILA . K . V	0
6.	DHANUSH GOPINATH	1
7.	FATHMATHUL NAFIYA	2
8.	FATHINATHUL SHAHAM	0
9.	HARSHITHA SATJITH	1
10.	NANDANA . K .	0
11.	NEELHARA SATJITH	0
12.	NUHA NIZAR	0
13.	SANOOP HANOSH . M	0
14.	VISHNU SUDHEER	0

May 14
HOD

Leena

DR. LEENA A. V.
PRINCIPAL
SRILEKSHMAYANA GURU COLLEGE OF
ENGINEERING & TECHNOLOGY, PAYYANUR
KANNUR

Degree / Branch : B.Tech / Civi

CLASS ROLL NO.	NAME
1.	ADITHYA . K. SURESH
2.	ARJUN MUKUNDAN
3.	ARSHAD K.P.
4.	ASLAHA . B.
5.	BASILA . K.V
6.	DHANUSH GOPINATH
7.	FATHMATHUL NAFIYA
8.	FATHINATHUL SHAHAN
9.	MARSHITHA SATITH
10.	NANDANA . K.
11.	NEELHARA SATITH
12.	NUHA NIZAR
13.	SANDOP MANOJ . M
14.	VISHNU SUDHEER.

ASSIGNMENT / RECORDS / PRESENTATION

1	2	3	4	5	6	7	8	9	10
10	10	10	10	10	10	10	10	10	
10	10	10	10	10	8	9	9		
8	8	8	8	9	8	9	9		
10	10	10	10	10	10	10	10		
10	10	9	9	9	8	9	9		
10	10	10	10	10	8	9	9		
10	10	10	10	10	10	9	9		
10	10	10	9	9	8	9	9		
8	6	7	9	9	8	9	9		
10	9	9	9	9	8	9	9		
10	10	10	10	10	10	10	10		
10	9	9	9	9	8	9	9		
10	10	10	10	10	10	10	10		
9	8	9	9	9	8	9	9		

Maya
HOD

Leena

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PRINCIPAL
SREE NARAYANA GURU COLLEGE OF
ENGINEERING & TECHNOLOGY, PATTANUR
KANNUR

TOTAL HOURS ENGAGED

ROLL NO.	68 AWARDING OF MARKS								ATTEN DANCE %	ATTEN DANCE MARK	SESS MARK OUT OF	ROLL NO.
	Hours Present	Test 1	Test 2	R (SD)								
1.	60	A	9	34					88	9	35	1
2.	57	20	3	25					84	09	35	2
3.	63	12	7	36					93	10	35	3
4.	56	20	26						82	9	36	4
5.	64	35	29						94	10	40	5
6.	57	25	14	20					84	9	35	6
7.	62	22	22						91	10	36	7
8.	64	21	26						94	10	36	8
9.	63	14	24	29					93	10	35	9
10.	64	28	32						94	10	39	10
11.	60	20	26	20					88	9	35	11
12.	61	26	22						90	10	36	12
13.	62	3	3	36					91	10	35	13
14.	65	15	15	15					96	10	35	14

Dr. LEENA A. V.
PRINCIPAL

SREE NARAYANA GURU COLLEGE OF
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KANNUR

Signature of Staff Member

Module Co-ordinator

HOD

DETAILS OF ASSIGNMENT

Assignment No.	DETAILS
1.	Problems on stress and strain
2.	Stress strain diagram of MS rod
3.	Problems on Compound Stress
4.	Shear Force and Bending Moment
5.	Problems on temperature stress.
6.	Problems on Shear Force and Bending Moment
7.	Problems on bending and shear stress
8.	Problems on Principal stress

~~May 14~~

DETAILS OF TEST

Test No.	DETAILS
1.	Series test 1 including Module 1, 2, 3, 5
2.	Series test 2 including Module 2, 5, 4, 5
2.	Series test 3 including Module 2, 4, 5

~~May 14~~

Leena

Dr. LEENA A. V.
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ENGINEERING & TECHNOLOGY, PAYYANUR
KANNUR

Name of
faculty: Mrs. Mary Sonia George

39

CET 201 MECHANICS OF SOLIDS

Sl. No	Date	Tutorial Topic	Signature of faculty
1.	20/9/2022	Problems on Normal Stress	May 19 20/9/2022
2.	28/9/2022	Problems & Theory of Stress	May 19 28/9/2022
3.	12/10/2022	Problems on Compound Tubes	May 19 12/10/2022
4.	19/10/2022	Problems on Compound Tubes	May 19 19/10/2022

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**SREE NARAYANA GURU COLLEGE OF ENGINEERING
& TECHNOLOGY**

ASSIGNMENT FORMAT FOR IQAC APPROVAL

I. Details of Assignment [to be filled by the faculty setting the question paper]

[ATTACH ASSIGNMENT QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CEED01 MECHANICS OF SOLIDS
2	Name of the faculty and department	B. MARY SONIA GEORGE CE
3	Date of issue	28-9-2022
4	Date of submission	28-9-2022
5	Date of return	30-9-2022
6	Dated signature of the subject faculty	May 28/9/2022

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	YES	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	YES	
3	Whether questions are numbered correctly?	YES	
4	Whether marking scheme is attached?	YES	

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	May 28/9/2022
Name and dated Signature of the Head of the Department	May 28/9/2022

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**SREE NARAYANA GURU COLLEGE OF ENGINEERING &
TECHNOLOGY.**

<i>Tutorial</i>	1	<i>Academic Year / Semester</i>	2022- 23/ S3
<i>Subject name with code</i>	CET201 MECHANICS OF SOLIDS	<i>Branch</i>	Civil Engineering
<i>Date of Issue</i>	28-9-2022	<i>Date of submission</i>	28-9-2022

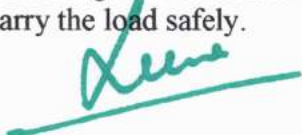
<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	A tensile test was conducted on a mild steel bar, the following data are obtained Diameter of the bar=3cm gauge length of the bar= 20cm Load at elastic limit=250 kN Extension at a load of 150kN = 0.21mm Maximum Load= 380kN Total extension= 60mm Diameter of rod at failure=2.25cm Determine Young's Modulus, Stress at elastic limit, percentage elongation and percentage decrease in area.	4	1	2
2.	Find the Young's Modulus of a brass rod of diameter 25mm and of length 250mm which is subjected to a tensile load of 50kN when the extension of rod is equal to 0.3mm.	3	1	2
3.	The safe stress for a hollow steel Column which contains an axial load of 2.1×10^3 kN is 125 MN/m^2 . If the external Diameter of the column is 30 cm. Determine the internal diameter.	3	1	2

CO - Course Outcome [CO]

CO 1: Apply the principles of solid mechanics to calculate internal stresses/strains, stress resultants in linear elastic deformable bodies. Analyze the given structural member to calculate the safe load or proportion the cross section to carry the load safely.

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding


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SREE NARAYANA GURU COLLEGE OF ENGINEERING

TECHNOLOGY

<i>Tutorial</i>	1(Scheme of Evaluation)	<i>Academic Year / Semester</i>	2022- 23/ S3
<i>Subject name with code</i>	CET201 MECHANICS OF SOLIDS	<i>Branch</i>	Civil Engineering
<i>Date of Issue</i>	28-9-2022	<i>Date of submission</i>	28-9-2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	A tensile test was conducted on a mild steel bar, the following data are obtained Diameter of the bar=3cm gauge length of the bar= 20cm Load at elastic limit=250 kN Extension at a load of 150kN = 0.21mm Maximum Load= 380kN Total extension= 60mm Diameter of rod at failure=2.25cm Determine Young's Modulus, Stress at elastic limit, percentage elongation and percentage decrease in area. Young's Modulus Stress at elastic limit, Percentage elongation Percentage decrease in area	4 1 1 1 1	2	2
2.	Find the Young's Modulus of a brass rod of diameter 25mm and of length 250mm which is subjected to a tensile load of 50kN when the extension of rod is equal to 0.3mm. Stress Strain Young's Modulus	3 1 1 1	2	2
3.	The safe stress for a hollow steel Column which contains an axial load of 2.1×10^3 kN is 125MN/m^2 . If the external Diameter of the column is 30 cm. Determine the internal diameter. External Diameter	 3	2	2

CO - Course Outcome [CO]

CO 1: Apply the principles of solid mechanics to calculate internal stresses/strains, stress resultants in linear elastic deformable bodies. Analyze the given structural member to calculate the safe load or proportion the cross section to carry the load safely.

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding

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SREE NARAYANA GURU COLLEGE OF ENGINEERING & TECHNOLOGY

ASSIGNMENT FORMAT FOR IQAC APPROVAL

I. Details of Assignment [to be filled by the faculty setting the question paper]

[ATTACH ASSIGNMENT QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CET 201 MECHANICS OF SOLIDS
2	Name of the faculty and department	B. MARY SONIA GEORGE
3	Date of issue	30-9-2022
4	Date of submission	30-10-2022
5	Date of return	1-10-2022
6	Dated signature of the subject faculty	May 19 30/9/2022

II. CHECK-LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	YES	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	YES	
3	Whether questions are numbered correctly?	YES	
4	Whether marking scheme is attached?	YES	

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	 30/9/22
Name and dated Signature of the Head of the Department	May 19 30/9/2022



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SREE NARAYANA GURU COLLEGE OF ENGINEERING &
TECHNOLOGY

<i>Tutorial</i>	2	<i>Academic Year / Semester</i>	2022- 23/ S3
<i>Subject name with code</i>	CET201 MECHANICS OF SOLIDS	<i>Branch</i>	Civil Engineering
<i>Date of Issue</i>	⁹ 30/10/2022	<i>Date of submission</i>	⁹ 30/10/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Define Stress and Strain	5	I	1
2.	Draw the stress strain curve of mild steel bar and explain all the important points on the graph.	5	I	1

CO - Course Outcome [CO]

CO I: Apply the principles of solid mechanics to calculate internal stresses/strains, stress resultants in linear elastic deformable bodies. Analyse the given structural member to calculate the safe load or proportion the cross section to carry the load safely.

LEVEL - Bloom's Taxonomy Level

Level 1: Remember


HOD


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SREE NARAYANA GURU COLLEGE OF ENGINEERING &

TECHNOLOGY

Tutorial	2	Academic Year / Semester	2021- 22/ S3
Subject name with code	CET201 MECHANICS OF SOLIDS	Branch	Civil Engineering
Date of Issue	30/10/2021	Date of submission	30/10/2021

Q.No	QUESTIONS	Marks	CO	Level
1	Define Stress and Strain	5	I	1
	Definition of Stress	2.5		
	Definition of Strain	2.5		
2.	Draw the stress strain curve of mild steel bar and explain all the important points on the graph.	5	I	1
	Stress Strain Curve	2.5		
	Limit of Proportionality	0.5		
	Elastic limit	0.5		
	Yield Point	0.5		
	Ultimate Point	0.5		
	Breaking Point	0.5		

CO - Course Outcome [CO]

CO I: Apply the principles of solid mechanics to calculate internal stresses/strains, stress resultants in linear elastic deformable bodies. Analyse the given structural member to calculate the safe load or proportion the cross section to carry the load safely.

LEVEL - Bloom's Taxonomy Level

Level 1: Remember

May 14
HOD

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KANNUR



SREE NARAYANA GURU COLLEGE OF ENGINEERING & TECHNOLOGY

ASSIGNMENT FORMAT FOR IQAC APPROVAL

I. Details of Assignment [to be filled by the faculty setting the question paper]

[ATTACH ASSIGNMENT QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CET 201 MECHANICS OF SOLIDS
2	Name of the faculty and department	B. MARY SONIA GEORGE
3	Date of issue	12-10-2022
4	Date of submission	14-10-2022
5	Date of return	18-10-2022
6	Dated signature of the subject faculty	Mary 19/12/10/2022

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	YES	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	YES	
3	Whether questions are numbered correctly?	YES	
4	Whether marking scheme is attached?	YES	

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	 12/10
Name and dated Signature of the Head of the Department	Mary 19/12/10/2022

New

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PRINCIPAL
SREE NARAYANA GURU COLLEGE OF
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KANNUR

SREE NARAYANA GURU COLLEGE OF ENGINEERING &

TECHNOLOGY

<i>Tutorial</i>	3	<i>Academic Year / Semester</i>	2021- 22/ S3
<i>Subject name with code</i>	CET201 MECHANICS OF SOLIDS	<i>Branch</i>	Civil Engineering
<i>Date of Issue</i>	12/10/2022	<i>Date of submission</i>	14/10/2022

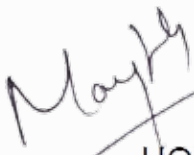
<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	A compound tube consist of steel tube 140mm internal diameter and 160mm external diameter and an outer brass tube of 160mm internal diameter and external diameter 180mm. The two tubes are of same length the compound tube carries an axial load of 900kN. Find the stresses and the load carried by each tube and the amount it shortens. The length of the tube is 140mm. Take $E_{\text{steel}} = 2 \times 10^5 \text{ N/mm}^2$ and $E_{\text{brass}} = 1 \times 10^5 \text{ N/mm}^2$	5	1	2
2.	Two vertical rods one of steel and other of copper are each rigidly fixed at top and 50cm apart. Diameter and length of each rod are 2cm and 4m. A cross sectional bar fixed to the rods at the lower end carries a load of 5000N such that the cross bar remains horizontal even after bending. Find the stress in each rod and position of the load on bar. Take $E_s = 2 \times 10^5$ and $E_{\text{cu}} = 1 \times 10^5$	5	1	2

CO - Course Outcome [CO]

CO 1: Apply the principles of solid mechanics to calculate internal stresses/strains, stress resultants in linear elastic deformable bodies. Analyse the given structural member to calculate the safe load or proportion the cross section to carry the load safely.

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding


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SREE NARAYANA GURU COLLEGE OF ENGINEERING

TECHNOLOGY

Tutorial	3	Academic Year / Semester	2021-22/ S3
Subject name with code	CET201 MECHANICS OF SOLIDS	Branch	Civil Engineering
Date of Issue	12/10/2022	Date of submission	14/10/2022

Q.No	QUESTIONS	Marks	CO	Level
1	A compound tube consist of steel tube 140mm internal diameter and 160mm external diameter and an outer brass tube of 160mm internal diameter and external diameter 180mm. The two tubes are of same length the compound tube carries an axial load of 900kN. Find the stresses and the load carried by each tube and the amount it shortens. The length of the tube is 140mm. Take $E_{\text{steel}} = 2 \times 10^5 \text{ N/mm}^2$ and $E_{\text{brass}} = 1 \times 10^5 \text{ N/mm}^2$ Stress of Steel Load Carried by Steel Stress of Brass Load Carried by Brass Shortened Length	5 1 1 1 1 1	1	2
2.	Two vertical rods one of steel and other of copper are each rigidly fixed at top and 50cm apart. Diameter and length of each rod are 2cm and 4m. A cross sectional bar fixed to the rods at the lowe end carries a load of 5000N such that the cross bar remains horizontal even after bending. Find the stress in each rod and position of the load on bar. Take $E_s = 2 \times 10^5$ and $E_{\text{cu}} = 1 \times 10^5$ Stress in Steel Stress in Copper Position of load	5 2 2 1	1	2

CO - Course Outcome [CO]

CO 1: Apply the principles of solid mechanics to calculate internal stresses/strains, stress resultants in linear elastic deformable bodies. Analyse the given structural member to calculate the safe load or proportion the cross section to carry the load safely.

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding

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SREE NARAYANA GURU COLLEGE OF ENGINEERING & TECHNOLOGY

ASSIGNMENT FORMAT FOR IQAC APPROVAL

I. Details of Assignment [to be filled by the faculty setting the question paper]

[ATTACH ASSIGNMENT QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CET201 MECHANICS OF SOLIDS
2	Name of the faculty and department	B. MARY SONIA GEORGE
3	Date of issue	28-10-2022
4	Date of submission	4-11-2022
5	Date of return	9-11-2022
6	Dated signature of the subject faculty	<i>Mary</i>

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	YES	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	YES	
3	Whether questions are numbered correctly?	YES	
4	Whether marking scheme is attached?	YES	

Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	<i>[Signature]</i>
Name and dated Signature of the Head of the Department	<i>Mary</i>

Dr. LEENA A. V.
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SREE NARAYANA GURU COLLEGE OF ENGINEERING &

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<i>Tutorial</i>	4	<i>Academic Year / Semester</i>	2021- 22/ S3
<i>Subject name with code</i>	CET201 MECHANICS OF SOLIDS	<i>Branch</i>	Civil Engineering
<i>Date of Issue</i>	28-10-2022	<i>Date of submission</i>	4-11-2022

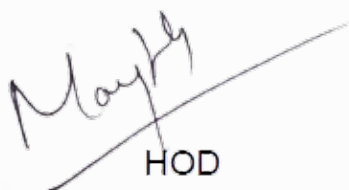
<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Infer the relation between intensity of loading, shear force and bending moment	5	3	2
2.	Interpret the BMD and SFD for a cantilever beam subjected to central concentrated load.	5	3	2

CO - Course Outcome [CO]

CO 3: Apply the principles of solid mechanics to calculate Bending Moment and Shear Force in various types of beams

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding


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TECHNOLOGY

<i>Tutorial</i>	4(Scheme of Evaluation)	<i>Academic Year / Semester</i>	2021- 22/ S3
<i>Subject name with code</i>	CET201 MECHANICS OF SOLIDS	<i>Branch</i>	Civil Engineering
<i>Date of Issue</i>	28-10-2022	<i>Date of submission</i>	4-11-2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Infer the relation between intensity of loading, shear force and bending moment Relation between Bending Moment and Shear Force Relation between Shear force and Loading	5 2.5 2.5	3	2
2.	Interpret the BMD and SFD for a cantilever beam subjected to central concentrated load. BMD diagram SFD diagram	5 2.5 2.5	3	2

CO - Course Outcome [CO]

CO 3: Apply the principles of solid mechanics to calculate Bending Moment and Shear Force in various types of beams

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding

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ASSIGNMENT FORMAT FOR IQAC APPROVAL

I. Details of Assignment [to be filled by the faculty setting the question paper]

[ATTACH ASSIGNMENT QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CET 201 MECHANICS OF SOLIDS
2	Name of the faculty and department	B. MARY SONIA GEORGE
3	Date of issue	15-11-2022
4	Date of submission	25-11-2022
5	Date of return	29-11-2022
6	Dated signature of the subject faculty	May 14

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	YES	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	YES	
3	Whether questions are numbered correctly?	YES	
4	Whether marking scheme is attached?	YES	

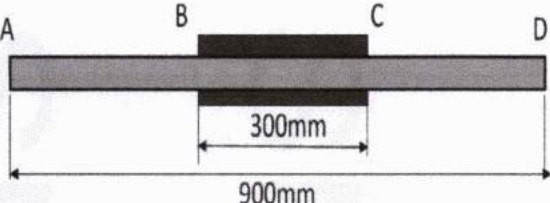
Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	May 14
Name and dated Signature of the Head of the Department	May 14

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Tutorial	5	Academic Year / Semester	2021- 22/ S3
Subject name with code	CET201 MECHANICS OF SOLIDS	Branch	Civil Engineering
Date of Issue	25-11-2022	Date of submission	29-11-2022

Q.No	QUESTIONS	Marks	CO	Level
1	A steel rod AB of length 900mm and diameter 25 mm has a bronze sleeve BC of length 300mm and external diameter 30 mm securely bonded to it as shown in fig:3. For a rise in temperature of 200 degree Celsius, Solve : i) Stresses in steel rod and bronze sleeve respectively. ii) Compressive force developed in bronze sleeve. iii) Elongation of bronze sleeve iv) Total elongation of steel rod Take $E_S=200\text{GPa}$, $E_B=100\text{GPa}$ & $\alpha_S=1.2 \times 10^{-5}$ per $^{\circ}\text{C}$, $\alpha_B=2.03 \times 10^{-5}$ per $^{\circ}\text{C}$  Figure 3	5	2	3
2.	A steel tube of 35 mm outer diameter and 30 mm inner diameter encloses a gunmetal rod of 25mm diameter and is rigidly joined at each end. If at a temperature of 40°C there is no longitudinal stress, model the stresses developed in the rod and the tube when the temperature of the assembly is raised to 240°C. $A_s=11 \times 10^{-6}/^{\circ}\text{C}$ $\alpha_g=18 \times 10^{-6}/^{\circ}\text{C}$ $E_s=205\text{GPa}$ $E_g=91.5\text{GPa}$ Also find the increase in length if the original length of the assembly is 1m	5	2	3

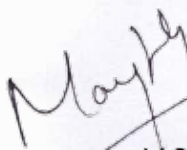

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CO - Course Outcome [CO]

CO 2: Explain the behaviour and response of various structural elements under loading conditions with and without temperature changes and calculate strain energies in structural elements. Choose appropriate principles or formula to find the elastic constants of materials making use of the information available

LEVEL - Bloom's Taxonomy Level

Level 3: Applying



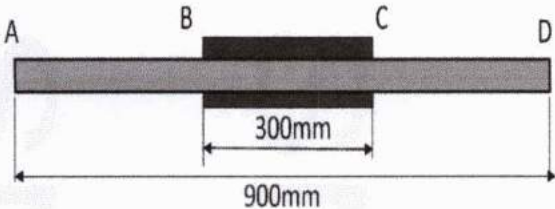
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**SREE NARAYANA GURU COLLEGE OF ENGINEERING &
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<i>Tutorial</i>	5(Scheme of Evaluation)	<i>Academic Year / Semester</i>	2021- 22/ S3
<i>Subject name with code</i>	CET201 MECHANICS OF SOLIDS	<i>Branch</i>	Civil Engineering
<i>Date of Issue</i>	25-11-2022	<i>Date of submission</i>	29-11-2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	A steel rod AB of length 900mm and diameter 25 mm has a bronze sleeve BC of length 300mm and external diameter 30 mm securely bonded to it as shown in fig:3. For a rise in temperature of 200 degree Celsius, Solve : i) Stresses in steel rod and bronze sleeve respectively. ii) Compressive force developed in bronze sleeve. iii) Elongation of bronze sleeve iv) Total elongation of steel rod Take $E_s=200\text{GPa}$, $E_B=100\text{GPa}$ & $\alpha_s=1.2 \times 10^{-5}$ per $^{\circ}\text{C}$, $\alpha_B=2.03 \times 10^{-5}$ per $^{\circ}\text{C}$  Figure 3 Stresses in steel rod and bronze sleeve respectively. Compressive force developed in bronze sleeve. Elongation of bronze sleeve Total elongation of steel rod	5	2	3
		3		
		3		
		4		
		4		
2.	A steel tube of 35 mm outer diameter and 30 mm inner diameter encloses a gunmetal rod of 25mm diameter and is rigidly joined at each end. If at a temperature of 40°C there is no longitudinal stress, model the stresses developed in the rod and the tube when the temperature of the assembly is raised to 240°C. $\alpha_s=11 \times 10^{-6}/^{\circ}\text{C}$	5	2	3

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$\alpha_g = 18 \times 10^{-6}/^{\circ}\text{C}$ $E_s = 205 \text{ GPa}$ $E_g = 91.5 \text{ GPa}$ Also find the increase in length if the original length of the assembly is 1 m Stresses in the rod Stresses in the tube Increase in length	3		
	3		
	3		

CO - Course Outcome [CO]

CO 2: Explain the behaviour and response of various structural elements under loading conditions with and without temperature changes and calculate strain energies in structural elements. Choose appropriate principles or formula to find the elastic constants of materials making use of the information available

LEVEL - Bloom's Taxonomy Level

Level 3: Applying

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ASSIGNMENT FORMAT FOR IQAC APPROVAL

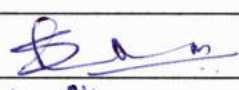
I. Details of Assignment [to be filled by the faculty setting the question paper]

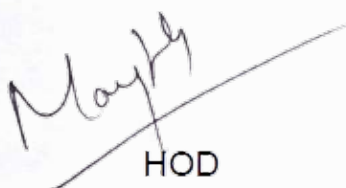
[ATTACH ASSIGNMENT QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CET201 MECHANICS OF SOLIDS
2	Name of the faculty and department	B. MARY SONIA GEORGE
3	Date of issue	5-12-2022
4	Date of submission	14-12-2022
5	Date of return	19-12-2022
6	Dated signature of the subject faculty	Mary

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	YES	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	YES	
3	Whether questions are numbered correctly?	YES	
4	Whether marking scheme is attached?	YES	

Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	
Name and dated Signature of the Head of the Department	Mary

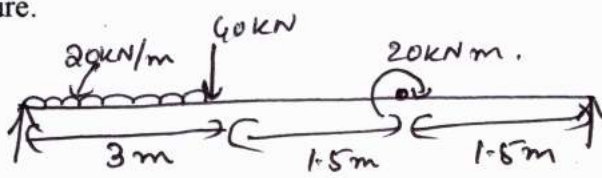

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<i>Tutorial</i>	6	<i>Academic Year / Semester</i>	2021- 22/ S3
<i>Subject name with code</i>	CET201 MECHANICS OF SOLIDS	<i>Branch</i>	Civil Engineering
<i>Date of Issue</i>	5-12-2022	<i>Date of submission</i>	14-12-2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Draw the Shear Force and Bending Moment Diagram of the given figure. 	10	3	3

CO - Course Outcome [CO]

CO 3: Apply the principles of solid mechanics to calculate Bending Moment and Shear Force in various types of beams

LEVEL - Bloom's Taxonomy Level

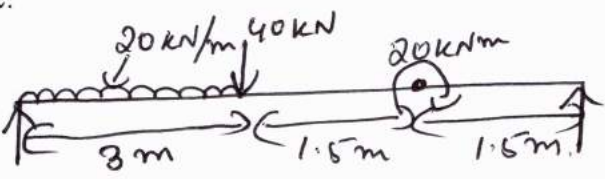
Level 3: Applying

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**SREE NARAYANA GURU COLLEGE OF ENGINEERING &
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<i>Tutorial</i>	6(Scheme of valuation)	<i>Academic Year / Semester</i>	2021- 22/ S3
<i>Subject name with code</i>	CET201 MECHANICS OF SOLIDS	<i>Branch</i>	Civil Engineering
<i>Date of Issue</i>		<i>Date of submission</i>	

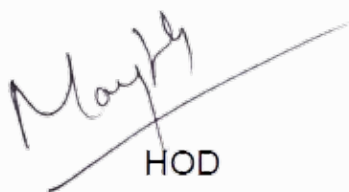
<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Draw the Shear Force and Bending Moment Diagram of the given figure.  Shear Force Diagram Bending Moment diagram	10	3	3
		5		
		5		

CO - Course Outcome [CO]

CO 3: Apply the principles of solid mechanics to calculate Bending Moment and Shear Force in various types of beams

LEVEL - Bloom's Taxonomy Level

Level 3: Applying


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ASSIGNMENT FORMAT FOR IQAC APPROVAL

I. Details of Assignment [to be filled by the faculty setting the question paper]

[ATTACH ASSIGNMENT QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CET 201 MECHANICS OF SOLIDS
2	Name of the faculty and department	B. MARY SONIA GEORGE
3	Date of issue	19-12-2022
4	Date of submission	3-1-2023
5	Date of return	7-1-2023
6	Dated signature of the subject faculty	May 19

II. CHECK-LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	YES	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	YES	
3	Whether questions are numbered correctly?	YES	
4	Whether marking scheme is attached?	YES	

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	May 19
Name and dated Signature of the Head of the Department	May 19

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**SREE NARAYANA GURU COLLEGE OF ENGINEERING &
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<i>Tutorial</i>	7	<i>Academic Year / Semester</i>	2021- 22/ S3
<i>Subject name with code</i>	CET201 MECHANICS OF SOLIDS	<i>Branch</i>	Civil Engineering
<i>Date of Issue</i>	19-12-2022	<i>Date of submission</i>	3-1-2023

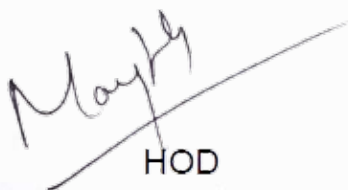
<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	A simply supported beam AB of 5m span is carrying a uniformly distributed load of 20kN/m. The beam is made up of rectangular cross section of dimensions 300mm x 450 mm. i) Draw the bending stress distribution at the critical section for bending. ii) Draw the shear stress distribution considering the critical section for shear. iii) Also calculate bending stress and shear stress on layer located 50mm above the neutral axis on the cross section at the mid-point of the beam.	5	4	3
2.	A simply supported wooden beam of span 1.3 m having a cross-section 150 mm wide and 250 mm deep carries a point load W at the centre. The permissible stresses are 7 N/mm ² in bending and 1 N/mm ² in shear. Calculate the safe load W.	5	4	3

CO - Course Outcome |CO|

CO 4: Choose the appropriate principles or formula to find the Bending Stresses and Shear stresses in various types of beams

LEVEL - Bloom's Taxonomy Level

Level 3: Applying


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**SREE NARAYANA GURU COLLEGE OF ENGINEERING &
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<i>Tutorial</i>	7	<i>Academic Year / Semester</i>	2021- 22/ S3
<i>Subject name with code</i>	CET201 MECHANICS OF SOLIDS	<i>Branch</i>	Civil Engineering
<i>Date of Issue</i>	19-12-2022	<i>Date of submission</i>	3-1-2023

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	A simply supported beam AB of 5m span is carrying a uniformly distributed load of 20kN/m. The beam is made up of rectangular cross section of dimensions 300mm x 450 mm. i) Draw the bending stress distribution at the critical section for bending. ii) Draw the shear stress distribution considering the critical section for shear. iii) Also calculate bending stress and shear stress on layer located 50mm above the neutral axis on the cross section at the mid-point of the beam. Bending Stress Distribution Shear stress Distribution Bending Stress and shear stress at 50mm above NA	5 2 2 1	4	3
2.	A simply supported wooden beam of span 1.3 m having a cross-section 150 mm wide and 250 mm deep carries a point load W at the centre. The permissible stresses are 7 N/mm² in bending and 1 N/mm² in shear. Calculate the safe load W. Moment Safe Load	5 2.5 2.5	4	3

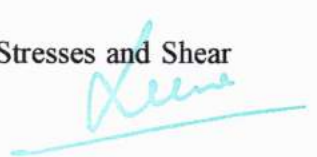
CO - Course Outcome [CO]

CO 4: Choose the appropriate principles or formula to find the Bending Stresses and Shear stresses in various types of beams

LEVEL - Bloom's Taxonomy Level

Level 3: Applying

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ASSIGNMENT FORMAT FOR IQAC APPROVAL

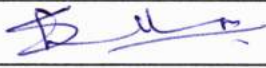
I. Details of Assignment [to be filled by the faculty setting the question paper]

[ATTACH ASSIGNMENT QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CET 201 MECHANICS OF SOLIDS
2	Name of the faculty and department	B. MARY SONIA GEORGE
3	Date of issue	21-12-2022
4	Date of submission	5-1-2023
5	Date of return	7-1-2023
6	Dated signature of the subject faculty	May 19

II. CHECK -LIST [to be filled by the module coordinator]

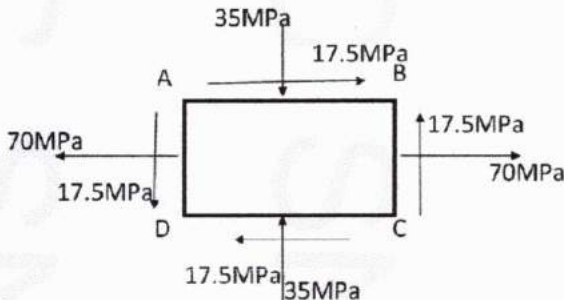
Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	YES	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	YES	
3	Whether questions are numbered correctly?	YES	
4	Whether marking scheme is attached?	YES.	

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications —
Name and dated signature of the module coordinator	
Name and dated Signature of the Head of the Department	May 19


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Tutorial	8	Academic Year / Semester	2021- 22/ S3
Subject name with code	CET201 MECHANICS OF SOLIDS	Branch	Civil Engineering
Date of Issue	21-12-20 22	Date of submission	5-1-2023

Q.No	QUESTIONS	Marks	CO	Level
1	A rectangular element ABCD of an elastic material is subjected to a shear stress of 17.5 MPa. The planes at right angles carry tensile stress of 70 MPa and compressive stress of 35 MPa respectively. Determine: i) The magnitude of the principal stresses. ii) The direction of the principal planes. iii) The magnitude of maximum shear stress. iv) The orientation of the plane of maximum shear stress. 	5	5	3
2.	An elemental cube is subjected to tensile stresses of 30N/mm² and 15N/mm² acting on two mutually perpendicular planes and a shear stress of 25N/mm² on these planes. Determine magnitude and directions of principal stresses. Also calculate greatest shear stress and its planes.	5	5	3

CO - Course Outcome [CO]

CO 5: Perform stress transformations identify principal planes/stresses and maximum shear stress at a point in a structural member subjected to Torsion and calculates the buckling load in Columns.

LEVEL - Bloom's Taxonomy Level

Level 3: Applying

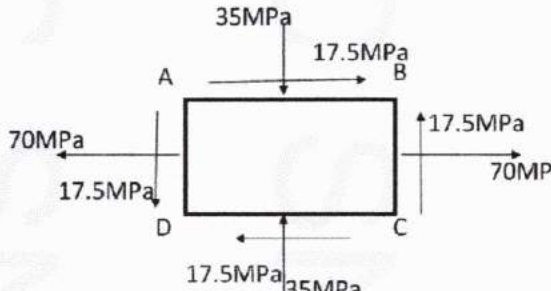
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TECHNOLOGY

Tutorial	8	Academic Year / Semester	2021- 22/ S3
Subject name with code	CET201 MECHANICS OF SOLIDS	Branch	Civil Engineering
Date of Issue	21-12-2022	Date of submission	5-1-2023

Q.No	QUESTIONS	Marks	CO	Level
1	A rectangular element ABCD of an elastic material is subjected to a shear stress of 17.5 MPa. The planes at right angles carry tensile stress of 70 MPa and compressive stress of 35 MPa respectively. Determine: i) The magnitude of the principal stresses. ii) The direction of the principal planes. iii) The magnitude of maximum shear stress. iv) The orientation of the plane of maximum shear stress.  Major Principal Stress Minor Principal Stress Direction of Principal Planes Magnitude of Maximum Shear Stress Direction of Maximum Shear Stress	5	5	3
2.	An elemental cube is subjected to tensile stresses of 30 N/mm² and 15 N/mm² acting on two mutually perpendicular planes and a shear stress of 25 N/mm² on these planes. Determine magnitude and directions of principal stresses. Also calculate greatest shear stress and its planes. Major Principal Stress Minor Principal Stress Direction of Principal Planes Magnitude of Maximum Shear Stress Direction of Maximum Shear Stress	5	5	3


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CO - Course Outcome [CO]

CO 5: Perform stress transformations identify principal planes/stresses and maximum shear stress at a point in a structural member subjected to Torsion and calculates the buckling load in Columns.

LEVEL - Bloom's Taxonomy Level

Level 3: Applying

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I N D E X

NAME: Aslaha.B ROLL NO.: 4

STD.: civil DIV./SEC.: _____ SUBJECT: MOS-T

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Tutorial - 1

- 1- Find the young's modulus of brass rod of dia. 25mm & of length 250mm. Which is subjected to a tensile load of 50kN. When the extension of the rod is 0.3mm.
- 2- A tensile test was conducted on a mild steel bar. The following data obtained where the dia. of steel bar is 3cm. gauge length of the bar 20cm, load at the elastic limit 250kN, extension at a load of 150kN = 0.21mm, max^m load 880kN. Total extension 60mm, dia of rod at failure 2.25cm. Determine Young's modulus, stress at elastic limit, % elongation & % rise in area.
- 3) The same safe stress for a hollow steel column carries an axial load of 2.1×10^3 kN is 125 MN/m^2 . If the external dia. of the column is 80cm determine the internal diameter.

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1) Diameter = 25 mm
 length = 250 mm
~~Force~~ = 50 kN
 extension of length $\Delta L = 0.3$ mm

$$\text{Area} = \frac{\pi D^2}{4} = \frac{3.14 \times (25)^2}{4} = 490.625 \text{ mm}^2$$

$$\text{Young's modulus} = \frac{FL}{A \Delta L} = \frac{50 \times 250 \times 1000}{490.625 \times 0.3} = 84925.690 \text{ N/mm}^2$$

$$= 84883.33 \times 10^6 \text{ N/m}^2$$

2) Diameter = 3 cm
 = 30 mm
 length = 20 cm
 = 200 mm

2) Diameter = 3 cm = 30 mm
 length = 20 cm = 200 mm

Elastic limit = 250 kN

$$\text{Area at elastic limit} = \frac{\pi}{4} \times (30)^2 = 706.5$$

$$\text{Stress at elastic limit} = \frac{F}{A} = \frac{250}{706.5} = 0.3538 \text{ kN/mm}^2$$

$$= 353.68 \text{ MN/m}^2$$

$$\text{Young's modulus} = \frac{FL}{A \Delta L} = \frac{250 \times 1000 \times 30}{706.5 \times 0.21} = 3033.060 \text{ N/mm}^2$$

$$= 3.033 \times 10^6 \text{ N/m}^2$$

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$$\begin{aligned} \% \text{ elongation} &= \frac{\text{total extension}}{\text{original length}} \times 100 \\ &= \frac{60}{30} \times 100 = 200\% \\ \text{Dra} &= 2.25 \text{ cm} = 22.5 \text{ mm} \\ \text{Area decreased} &= \frac{\pi}{4} \times (22.5)^2 \\ &= 397.40625 \text{ mm}^2 \\ \% \text{ decrease in area} &= \frac{708.5 - 397.4}{708.5} \times 100 \\ &= 43.75\% \\ F &= 2.1 \times 10^3 \text{ kN} \\ &= 2.1 \times 10^6 \text{ N} \end{aligned}$$

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$$\begin{aligned} \text{Stress} &= 125 \text{ MN/m}^2 \\ &= 125 \times 10^6 \text{ N/m}^2 \\ &= 125 \text{ N/mm}^2 \\ \text{external dia} &= 30 \text{ mm} \\ \text{Area} &= \frac{\pi}{4} (D^2 - d^2) \\ &= \frac{\pi}{4} (30^2 - 22.5^2) \\ &= 397.40625 \text{ mm}^2 \\ \text{Stress} &= F/A \\ A &= F/s \\ \frac{\pi}{4} (D^2 - d^2) &= \frac{2.1 \times 10^6}{125} \\ \frac{\pi D^2}{4} - \frac{\pi d^2}{4} &= \frac{2.1 \times 10^6}{125} \end{aligned}$$

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$$\frac{\pi D^2}{4} = \frac{2.1 \times 10^6}{125} = \frac{\pi d^2}{4}$$

$$D^2 - d^2 = \frac{2.1 \times 10^6 \times 4}{125 \times \pi}$$

$$D^2 - d^2 = 21401.27329$$

$$21401.27329 - (300)^2$$

$$d = 261.9135 \text{ mm}$$

1- Given: Dia of rod, $D = 25 \text{ mm}$

$$\text{Area of rod, } A = \frac{\pi (25)^2}{4} = 490.87 \text{ mm}^2$$

$$P = 50 \text{ kN} = 50 \times 1000 = 50,000 \text{ N}$$

$$d = 0.3 \text{ mm}$$

$$L = 250 \text{ mm}$$

$$\sigma = \frac{P}{A} = \frac{50,000}{490.87} = 101.86 \text{ N/mm}^2$$

$$e = \frac{\Delta L}{L} = \frac{0.3}{250} = 0.0012 \text{ m}$$

$$\text{Young's modulus } Y = \frac{\sigma}{e} = \frac{101.86}{0.0012} = 84883.33 \text{ N/mm}^2$$

$$= 84883.33 \times 10^6 \text{ N/m}^2 = 84.883 \times 10^9 \text{ N/m}^2$$

$$\text{Area of the rod, } A = \frac{\pi}{4} D^2 = \frac{\pi}{4} (30)^2 \text{ cm}^2$$

$$= 7.0685 \text{ cm}^2 = 7.0685 \times 10^{-4} \text{ m}^2$$

$$3) \sigma = 125 \text{ MN/m}^2 = 125 \times 10^6 \text{ N/m}^2$$

$$P = 2.1 \times 10^3 \text{ kN} = 2.1 \times 10^6 \text{ N}$$

$$D = 30 \text{ cm} = 0.30 \text{ m}, \quad d = \text{internal diameter}$$

$$\text{Area of cross-section, } A = \frac{\pi}{4} (D^2 - d^2) = \frac{\pi}{4} (30^2 - d^2) \text{ m}^2$$

$$\sigma = \frac{P}{A}$$

$$125 \times 10^6 = \frac{2.1 \times 10^6}{\frac{\pi}{4} (30^2 - d^2)}$$

$$(30^2 - d^2) = \frac{4 \times 2.1 \times 10^6}{\pi \times 125 \times 10^6}$$

$$0.09 - d^2 = 213.9$$

$$d = \sqrt{0.09 - 0.02139}$$

$$= 0.2619 \text{ m}$$

$$= 26.19 \text{ cm}$$


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2) Area of rod, $A = \pi/4 b^2 = \pi/4 3^2 \text{ cm}^2$
 $= 7.0685 \text{ cm}^2 = 7.0685 \times 10^{-6} \text{ m}^2$

3) stress = $\frac{\text{load}}{\text{Area}} = \frac{150 \times 1000}{7.0685 \times 10^{-6}} = 21220.9 \times 10^4 \text{ N/m}^2$

Strain = $\frac{\text{Increase in length}}{\text{original length}} = \frac{0.21}{20 \times 10} = 0.00105$

Young's modulus, $E = \frac{\text{Stress}}{\text{Strain}} = \frac{21220.9 \times 10^4}{0.00105} = 20209523.8 \text{ N/m}^2$
 $= 202.095 \times 10^9 \text{ N/m}^2$
 $= 202.095 \text{ GN/m}^2$

4) The % elongation is obtained as,
 $\% \text{ elongation} = \frac{\text{total } \Delta \text{ in length}}{\text{original length}} \times 100$
 $= \frac{60 \text{ mm}}{20 \times 10 \text{ mm}} \times 100 = 30\%$

5) The stress at the elastic limit
 $\text{Stress} = \frac{\text{load at elastic limit}}{\text{Area}}$
 $= \frac{250 \times 1000}{7.0685 \times 10^{-6}} = 35362 \times 10^4$

$= 353.62 \times 10^4$

$= 353.62 \text{ MN/m}^2$

6) The percentage decrease in area is obtained as,
 $\% \text{ decrease in area} = \frac{\text{original area} - \text{area at the elastic limit}}{\text{original area}} \times 100$

$= \frac{\pi/4 \times 3^2 - \pi/4 \times 2.25^2}{\pi/4 \times 3^2} \times 100$

$= \frac{3^2 - 2.25^2}{3^2} \times 100$
 $= \frac{9 - 5.0625}{9} \times 100$

$= 43.75\%$

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1) Define stress & strain.

2) Draw the stress strain graph & explain all the important points on the graph.

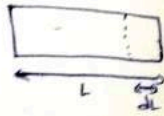
1) Stress

Strain

It is the ratio of changing dimension to the original dimension.

$$\text{Strain } \epsilon = \frac{\Delta L}{L}$$

It is a unit less quantity.



Stress

When a body is subjected to a force per unit area. When the body against the deforming force.

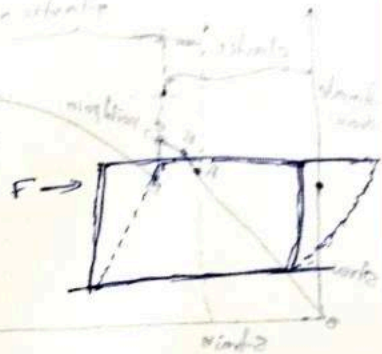
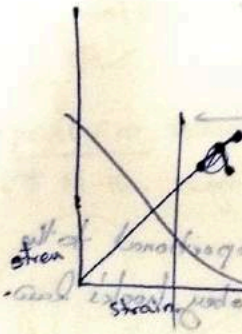
$$\text{Stress, } \sigma = \frac{\text{Force}}{\text{Area of cross-section}}$$

unit is N/m^2

unit is N/m^2 .

$$\sigma = \frac{F}{A}$$

2) Stress strain graph



Final situation $\leftarrow A \rightarrow$

Initial situation $\leftarrow A \rightarrow$

Final situation $\leftarrow A \rightarrow$

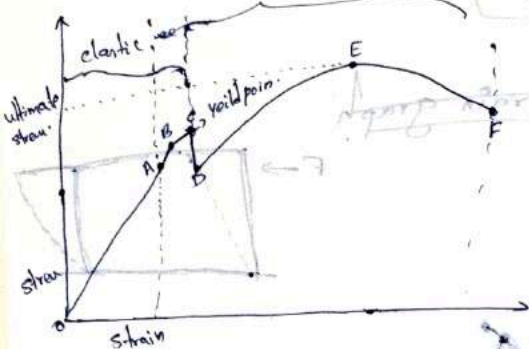
Initial situation $\leftarrow A \rightarrow$

Final situation $\leftarrow A \rightarrow$

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2) stress-strain graph



- ⇒ 0-A → proportionality limit.
- In this point stress is directly proportional to the strain. In this region graph obey Hooke's Law.
- ⇒ A-B → elastic limit.
- In this region the body regain its original shape after the removal of deforming force.
- After the elastic limit body doesn't regain its original shape. This body is called plastic.

⇒ point C-D → yield point.

• the body

- C is minimum yield point.
- D is max^m yield point.

• The body doesn't regain its original shape after the removal of deforming force.

⇒ Point E → ultimate stress.

• point F → ~~break~~ ~~break~~

• At this region the steel break.

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d

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Tutorial-3

1) A compound tube consist of steel tube 140mm internal diameter and 160mm external diameter and outer to brass tube 160mm internal diameter and external diameter 180mm. The tubes are of same length. The compound tube carries an axial load of 900 kN. Find the stresses and load carry by each tube and the amount shortens. Length of each tube is 140mm. Take $E_{\text{steel}} = 2 \times 10^5 \text{ N/mm}^2$ and $E_{\text{brass}} = 1 \times 10^5 \text{ N/mm}^2$.

2) 2 vertical rods one of steel and other of copper are each rigidly fixed at top 50cm apart. Diameter and lengths of each rod are 2cm, and 4m. A cross sectional bar fix to the rods at lower end carries a load of 5000N such that the cross bar remains horizontal even after bending. Find the stresses in each rod & position of the load on bar. Take $E_s = 2 \times 10^5 \text{ N/mm}^2$ & $E_c = 1 \times 10^5 \text{ N/mm}^2$.

3) A load of 2MN is applied on a short concrete column 500x500mm. The column is reinforced by 4 steel bars of 10mm dia. one in each column. Find the stress in concrete & steel bar. $E_s = 2 \times 10^5 \text{ N/mm}^2$ & $E_c = 1 \times 10^5 \text{ N/mm}^2$.

Answer

Internal Diameter of steel

rod = 140mm

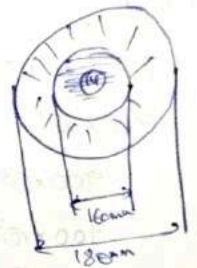
External dia of steel rod = 160mm

Area of steel rod,

$$A = \frac{\pi}{4} (160^2 - 140^2)$$

$$= \frac{\pi}{4} \times 6000$$

$$= 4710 \text{ mm}^2$$



$$\frac{\sigma_{\text{brass}}}{E_{\text{brass}}} = \frac{\sigma_{\text{steel}}}{E_{\text{steel}}}$$

$$\sigma_b = \frac{E_b}{E_s} \times \sigma_s$$

$$= \frac{1 \times 10^5}{2 \times 10^5} \times \sigma_s$$

$$\text{Area of brass rod} = \frac{\pi}{4} (180^2 - 160^2)$$

$$= \frac{\pi}{4} (32400 - 25600)$$

$$= 5338 \text{ mm}^2$$

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Total load = load on steel + load on brass

$$P = \sigma_s A_s + \sigma_b A_b$$

$$900 \times 10^3 = \sigma_s \times 4710 + 0.5 \sigma_s \times 5338$$

$$900 \times 10^3 = 4710 \sigma_s + 2669 \sigma_s$$

$$900 \times 10^3 = 7379 \sigma_s$$

$$\sigma_s = \frac{900 \times 10^3}{7379}$$

$$\therefore \sigma_s = 121.967 \text{ N/mm}^2$$

$$\sigma_b = 0.5 \times 121.967$$

$$= 60.983 \text{ N/mm}^2$$

$$P_s = \sigma_s A_s$$

$$= 121.967 \times 4710$$

$$= 574464.57$$

$$P_b = \sigma_b A_b$$

$$= 60.983 \times 5338 = 325527.254$$

$$\Delta_s = \frac{P_s L_s}{A_s E_s}$$

$$= \frac{574464.57 \times 140}{4710 \times 2 \times 10^5}$$

$$= 0.08537 \text{ mm}$$

$$\Delta_b = \frac{P_b L_b}{A_b E_b} = \frac{325527.254 \times 140}{5338 \times 1 \times 10^5}$$

$$= 0.08537 \text{ mm}$$

2) Dia of each rod = 2 cm = 20 mm
Length of each rod = 4 m = 4000 mm

$$P = 5000 \text{ N}$$

$$E_s = 2 \times 10^5 \text{ N/mm}^2$$

$$E_c = 1 \times 10^5 \text{ N/mm}^2$$

$$A_s = A_c = \frac{\pi}{4} (20)^2 = 314.159 \text{ mm}^2$$

$$\frac{\sigma_s}{E_s} = \frac{\sigma_c}{E_c}$$

$$\sigma_s = \sigma_c \times \frac{E_s}{E_c}$$


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$$\sigma_s = \frac{2 \times 10^5}{1 \times 10^5} \sigma_c$$

$$\sigma_s = 2\sigma_c$$

Total load = load on Ca + load on steel.

$$5000 = \sigma_s A_s + \sigma_c A_c$$

$$5000 = 2\sigma_c \times 314 \cdot 159 + \sigma_c \times 314 \cdot 159$$

$$5000 = 628 \cdot 318 \sigma_c + 314 \cdot 159 \sigma_c$$

$$5000 = 942 \cdot 477 \sigma_c$$

$$\sigma_c = \frac{5000}{942 \cdot 477} = 5 \cdot 305 \text{ N/mm}^2$$

$$\therefore \sigma_s = 2 \times 5 \cdot 305 = 10 \cdot 61 \text{ N/mm}^2$$

$$\sigma_s = 10 \cdot 61 \text{ N/mm}^2$$

$$\frac{50}{23} = \frac{20}{23}$$

$$\frac{23}{23} \times 50 = 50$$

$$A_c = \frac{11}{4} 10^3 \times 4 = 314 \cdot 159 \text{ mm}^2$$

$$A_c = 500 \times 500 = 314 \cdot 159$$

$$= 249685 \cdot 841 \text{ mm}^2$$

Total load = load of steel + load of concrete.

$$2 \times 10^6 = P_s + P_c \quad \text{--- (1)}$$

$$\frac{\sigma_s}{E_s} = \frac{\sigma_c}{E_c}$$

$$\sigma_s = \frac{E_s}{E_c} \sigma_c$$

$$= \frac{2 \cdot 1 \times 10^5}{1 \cdot 4 \times 10^5} \sigma_c$$

$$\sigma_s = 15 \sigma_c$$

$$\sigma_s A_s + \sigma_c A_c = 2 \times 10^6$$

$$15 \sigma_c \times 314 \cdot 159 + \sigma_c \times 249685 \cdot 841 = 2 \times 10^6$$

$$4712 \cdot 385 \sigma_c + \sigma_c 249685 \cdot 841 = 2 \times 10^6$$

$$254398 \cdot 226 \sigma_c = 2 \times 10^6$$

$$\sigma_c = \frac{2 \times 10^6}{254398 \cdot 226}$$


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$$\sigma_c = 7.861 \text{ N/mm}^2$$

$$\sigma_s = 15 \times 7.861 = 117.915 \text{ N/mm}^2$$

10/2

$$\frac{20}{23} = \frac{20}{23}$$

$$\frac{201 \times 10.5}{201 \times 10.1}$$

$$5021 = 20$$

$$201 \times 5 = 5A_{50} + 2A_{20}$$

$$148.28392 \times 50 + 21.415 \times 50 = 5021$$

$$201 \times 5 =$$

$$201 \times 5 = 148.28392 \times 50 + 21.415 \times 50$$

$$201 \times 5 = 5025.89842$$

$$201 \times 5 = 50$$

$$255.39542$$

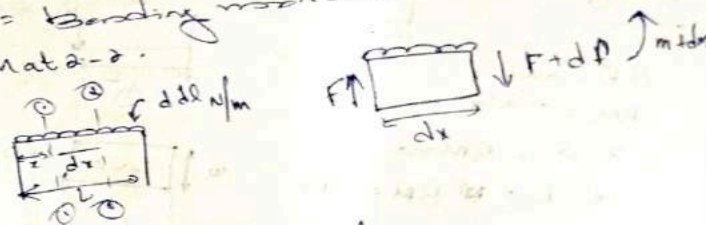
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Tutorial-4

1. Infer the relation b/w intensity of loading, SF & BM.

→ Consider a beam carrying uniformly distributed load w per unit length. Consider a length dx of beam between section 1-1 & 2-2. This portion is at a distance x from left support. Let F = shear force at 1-1, $F + dF$ = shear force at 2-2, M = Bending moment at 1-1, $M + dM$ = BM at 2-2.



Eqⁿ of equilibrium of vertical forces,

$$F - w dx - (F + dF) = 0$$

$$F = w dx - F - dF = 0$$

$$1 - w dx - dF = 0$$

$$w = \frac{-dF}{dx}$$

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moment at ②-②

$$M + Fdx - w dx \times \frac{dx}{2} - (M + dM) = 0$$

$$M + Fdx - \frac{w dx^2}{2} - M - dM = 0$$

$$Fdx - dM = 0$$

$$P = \frac{dM}{dx} \quad \frac{w dx^2}{2} \text{ is -ve.}$$

Interpret BMD & SFD for cantilever beam subjected to central concentrated load

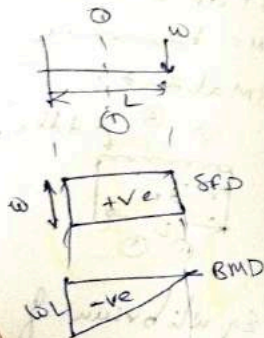
①-①

$$SF = +w$$

$$BM = -wx$$

$$x=0, BM=0$$

$$x=L, BM = -wL$$



10/10

Tutorial-5

A steel rod of length 900 mm & dia 25 mm has a bronze sleeve BC of length 300 mm. Securely bonded to its for a rise in temp of 200°C.

- i) strain in steel rod & bronze sleeve.
- ii) compressive force developed in bronze sleeve.
- iii) Elongation of bronze sleeve.
- iv) Total elongation of steel rod.

$$E_s = 200 \text{ GPa} \quad E_B = 100 \text{ GPa} \quad \alpha_s = 1.2 \times 10^{-5} / ^\circ\text{C}$$

$$\alpha_B = 2.03 \times 10^{-5}$$

Length of steel rod = 900 mm

bronze sleeve = 300 mm

internal dia = 25 mm.

external dia = 30 mm.

$$\text{area of steel} = \frac{\pi}{4} \times 25^2 = 490.87 \text{ mm}^2$$

$$\text{bronze} = \frac{\pi}{4} (30^2 - 25^2) = 215.984 \text{ mm}^2$$

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ii) Compressive force in bronze = stress in bronze
 $= 406 \times 215.924$
 $= 37629.504 \text{ N}$

iii) Elongation of bronze sleeve = $\frac{\text{stress}}{\text{strain}} = \text{Young's modulus}$
 $= \frac{406}{\text{strain}} = 1 \times 10^5$ strain = $\frac{406}{1 \times 10^5}$
 $= 4.06 \times 10^{-3}$

Strain = $\frac{\text{Change in length}}{\text{original length}}$

$4.06 \times 10^{-3} = \frac{\Delta L}{300}$

$4.06 \times 10^{-3} \times 300 = \Delta L$

$\Delta L = 1.218 \text{ mm}$

iv) Total elongation of steel rod,
 strain = $\frac{400}{1 \times 10^5} = 2.4 \times 10^{-3}$

Elongation = strain $\times$ Original length
 $= 2.4 \times 10^{-3} \times 900$
 $= 2.16 \text{ mm}$

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2.2. Draw the SFD & BMD of given beam.

Tutorial - 6

1) Draw the SFD & BMD of given beam.

$$\sum F_y = 0$$

$$3 \times 20 + 40 = R_A + R_B$$

$$R_A + R_B = 60 + 40$$

$$R_A + R_B = 100$$

$$\sum M_A = 0$$

$$20 \times 1.5 + 40 \times 3 + 20 \times 4.5 = R_B \times 6$$

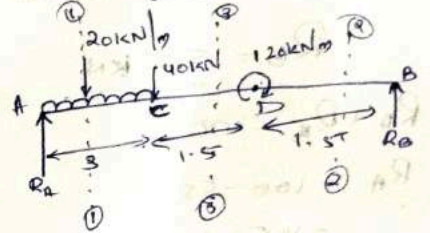
$$30 + 120 + 90 = R_B \times 6$$

$$240 = R_B \times 6$$

$$R_B = \frac{240}{6} = 40 \text{ kN}$$

$$R_A = 100 - R_B$$

$$= 100 - 40 = 60 \text{ kN}$$



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$$\sum M_A = 0$$

$$20 \times 3 \times 1.5 + 40 \times 3 + 120 = R_B \times 6$$

$$90 + 120 + 120 = R_B \times 6$$

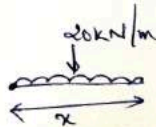
$$R_B = \underline{\underline{55 \text{ kN}}}$$

$$R_A + R_B = 100$$

$$R_A = 100 - 55$$

$$= \underline{\underline{45 \text{ kN}}}$$

①-① (AC)



$$SF = -20x + 45$$

$$x=0 \quad SF = \underline{\underline{45 \text{ kN}}}$$

$$x=3 \quad SF = 20 \times 3 + 45$$

$$= \underline{\underline{-60 \text{ kN}}}$$

$$= -60 + 45$$

$$= \underline{\underline{-15 \text{ kN}}}$$

$$BM = -20x \times x/2 + 45x$$

$$= -10x^2 + 45x$$

$$x=0 \quad BM=0$$

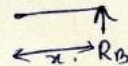
$$x=3 \quad BM = -10 \times 3^2 + 45 \times 3$$

$$BM = 45 \times 3 - 90$$

$$= 45 \times 3 - 90$$

$$= \underline{\underline{45 \text{ kN}}}$$

②-② AD



$$SF = \underline{\underline{55 \text{ kN}}}$$

$$BM = +55x$$

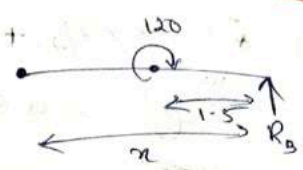
$$x=0 \quad BM=0$$

$$x=1.5 \quad BM = 55 \times 1.5 = \underline{\underline{82.5 \text{ kNm}}}$$

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③-③ (C D)



$SF = -55 \text{ kN}$

$BM = 55x - 120$

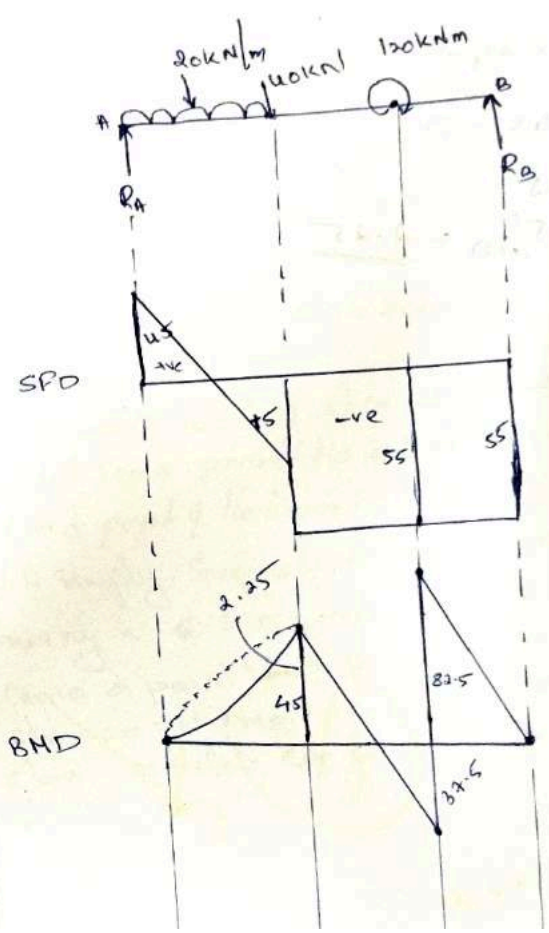
$x = 1.5$

$BM = 55 \times 1.5 - 120$
 $= -37.5 \text{ kNm}$

$x = 3$

$BM = 55 \times 3 - 120$
 $= 45 \text{ kNm}$

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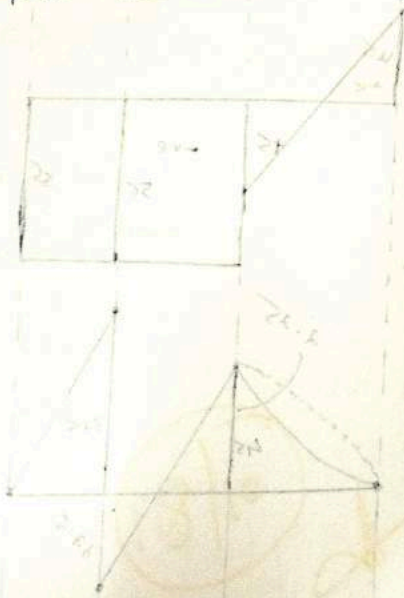
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$$SF = -20x + 45$$

$$-20x + 45 = 0$$

$$20x = 45$$

$$x = 45/20 = \underline{2.25}$$



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Tutorial 7

1) A simply supported beam ABC of 5m span is carrying a UDL of 20 kN/m. The beam is made up of a rectangular CS of dimension 300 mm x 450 mm.

i) Draw the bending stress distribution at critical sections.

ii) Draw shear stress distribution considering critical section of shear.

iii) Calculate bending stress and shear stress on layers located 50 mm above the neutral axis on the CS at mid point of the beam.

2) A simply supported wooden beam of span 1.3m having a 50 mm wide & 250 mm deep carries a point load at the centre. The permissible stress is 7 N/mm² in bending and 1 N/mm² in shear. Calculate safe load.

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2) $b = 150 \text{ mm}$, $d = 250 \text{ mm}$, $L = 1.3 \text{ m}$

$\sigma_b = 7 \text{ N/mm}^2$ $q_{\text{max}} = 1 \text{ N/mm}^2$

$M = \frac{WL}{4} = \frac{W \times 1.3}{4} = 0.325W - \text{Nm}$

Max SF = $\frac{W}{2} = 0.5W \text{ N}$

For rectangular sectⁿ

$A = b \times d = 150 \times 250 = 37500 \text{ mm}^2$

$I = \frac{bd^3}{12} = \frac{150 \times 250^3}{12} = 195.31 \times 10^6 \text{ mm}^4$

$y_{\text{max}} = d/2 = \frac{250}{2} = 125 \text{ mm}$

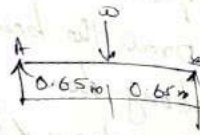
$\frac{M}{I} = \frac{\sigma}{y} \therefore M = \frac{\sigma}{y} \times y$

$0.325W = \frac{7 \times 195.31 \times 10^6}{125}$

$W = 33653.41 \text{ N} = 33.65 \text{ kN}$

Value of W for shear stress criteria

$q_{\text{max}} = \frac{1.55}{A}$



$l = \frac{1.55 \times 10^6}{37500} = 33.65 \text{ kN}$

$W = 50000 \text{ N} = 50 \text{ kN}$

$W = 50000 \text{ N} = 50 \text{ kN}$

Safe Value, $W = 33.65 \text{ kN}$

1) $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$

Curver $\rightarrow$

$W = 20 \text{ kN}$

$L = 5 \text{ m}$

$b = 300$

$d = 650$

$I = \frac{bd^3}{12} = \frac{300 \times 650^3}{12} = 2278125000 \text{ mm}^4$

$M = \frac{WL^2}{8} = \frac{20 \times 5^2}{8} = 62.5 \text{ kNm}$

$y = \frac{650}{2} = 325$

$\frac{M}{I} = \frac{\sigma}{y}$

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$$\therefore \sigma = \frac{62.5 \times 10^6 \times 225}{2278125000} = 6.172$$

$$F = \frac{WL}{2} = \frac{20 \times 5}{2} = 50 \text{ N}$$

$$A = 300 \times 225 = 67500$$

$$\bar{y} = \frac{225}{2} = 112.5$$

$$I = 2278125000$$

$$b = 300$$

$$\therefore z = 0.55$$

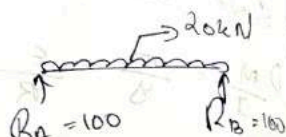
$$\text{ii) } \frac{M}{I} = \frac{\sigma}{y}$$

$$y = 50$$

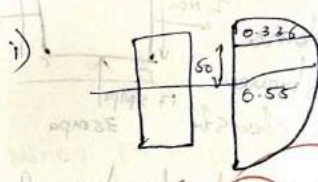
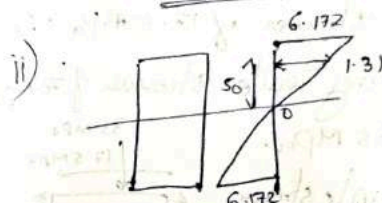
$$\sigma = \frac{80.5 \times 10^6 \times 50}{0.55 \times 10^9} = 1.37$$

$$\bar{y} = \frac{175}{2} = 87.5$$

$$A = 175 \times 300 = 52500 \text{ mm}^2$$



$$z = \frac{50 \times 10^3 \times 52500 \times 87.5}{2278125000 \times 300} = 0.336$$

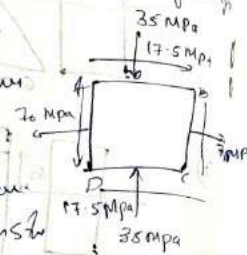


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Tutorial-8

1) A rectangular element ABCD of an elastic material is subjected to a shear stress of 17.5 MPa . The planes at right angle carry tensile stress of 70 MPa and compressive stress of 35 MPa .



- The magnitude of principle stress
- The direction of principle planes
- Magnitude of max shear stress
- Orientation of plane of max shear

2) An elemental cube is subjected to tensile stress of 30 N/mm^2 and 15 N/mm^2 acting on two mutually 90° planes and a shear stress of 25 N/mm^2 is there. Determine magnitude and direction of principle stress - who calculated greatest shear stress and its planes.

$$\sigma_1 = 70 \text{ MPa}$$

$$\sigma_2 = -35 \text{ MPa}$$

$$\tau = -17.5 \text{ MPa}$$

i) Major principle

$$= \frac{\sigma_1 + \sigma_2}{2} + \sqrt{\frac{(\sigma_1 - \sigma_2)^2}{4} + \tau^2}$$

$$= \frac{70 - 35}{2} + \sqrt{\frac{(70 + 35)^2}{4} + (-17.5)^2}$$

$$= 17.5 + \sqrt{17.5^2 + 17.5^2}$$

$$= 17.5 + 24.62807$$

$$= 42.12807 \text{ MPa}$$

Minor principle stress

$$= \frac{\sigma_1 + \sigma_2}{2} - \sqrt{\frac{(\sigma_1 - \sigma_2)^2}{4} + \tau^2}$$

$$= \frac{70 - 35}{2} - \sqrt{\frac{(70 + 35)^2}{4} + (-17.5)^2}$$

$$= 17.5 - 24.62807$$

$$= -7.12807 \text{ MPa}$$

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$$ii) \tan 2\theta = \frac{2\tau}{\sigma_1 - \sigma_2} = \frac{2 \times 14.5}{70 + 35} = -1/3$$

$$2\theta = \tan^{-1}(-1/3)$$

$$\theta = -9.217^\circ$$

$$= -9^\circ 13' 2.91''$$

$$iii) (\sigma_x)_{\max} = \frac{1}{2} \sqrt{(\sigma_1 - \sigma_2)^2 + 4\tau^2}$$

$$= \frac{1}{2} \sqrt{(70 + 35)^2 + 4 \times (-17.5)^2}$$

$$= 55.33985 \text{ N/mm}^2$$

$$iv) \tan 2\theta = \frac{2\tau}{\sigma_1 - \sigma_2}$$

$$= \frac{2 \times -17.5}{70 + 35}$$

$$= -1/3$$

$$2\theta = \tan^{-1}(1/3)$$

$$\theta = -9.217^\circ$$

$$= -9^\circ 13' 2.91''$$

$$i) \sigma_1 = 30 \text{ N/mm}^2$$

$$\sigma_2 = 15 \text{ N/mm}^2$$

$$\tau = 25 \text{ N/mm}^2$$

Major principle stress,

$$= \frac{\sigma_1 + \sigma_2}{2} + \sqrt{\left(\frac{\sigma_1 - \sigma_2}{2}\right)^2 + \tau^2}$$

$$= \frac{30 + 15}{2} + \sqrt{\left(\frac{30 - 15}{2}\right)^2 + 25^2}$$

$$= 49.65 \text{ N/mm}^2$$

Major Principle stress,

$$= \frac{\sigma_1 + \sigma_2}{2} - \sqrt{\left(\frac{\sigma_1 - \sigma_2}{2}\right)^2 + \tau^2}$$

$$= -4.65 \text{ N/mm}^2$$

Directⁿ 2 principle stress

$$\tan 2\theta = \frac{2\tau}{\sigma_1 - \sigma_2} = 3.33$$


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$$2\theta = \tan^{-1}(3.83) \cdot 1 = 75.1^\circ$$

$$\therefore \theta = 37.55^\circ$$

$$(\sigma_t)_{\max} = \frac{1}{2} \sqrt{(\sigma_1 - \sigma_2)^2 + 4\tau^2}$$

$$= \underline{26.100 \text{ N/mm}^2}$$

~~10/10~~

$$\sigma_{\max} = \frac{\sigma_1 + \sigma_2}{2} + \frac{\sigma_1 - \sigma_2}{2} \cos 2\theta + \tau \sin 2\theta$$

$$= \frac{50 + 10}{2} + \frac{50 - 10}{2} \cos 75.1^\circ + 20 \sin 75.1^\circ$$

$$= 26.100 \text{ N/mm}^2$$

$$\sigma_{\min} = \frac{\sigma_1 + \sigma_2}{2} - \frac{\sigma_1 - \sigma_2}{2} \cos 2\theta - \tau \sin 2\theta$$

$$= \frac{50 + 10}{2} - \frac{50 - 10}{2} \cos 75.1^\circ - 20 \sin 75.1^\circ$$

$$= -11.89 \text{ N/mm}^2$$

$$\sigma_{\max} = \frac{\sigma_1 + \sigma_2}{2} + \frac{\sigma_1 - \sigma_2}{2} \cos 2\theta + \tau \sin 2\theta$$

$$= \frac{50 + 10}{2} + \frac{50 - 10}{2} \cos 75.1^\circ + 20 \sin 75.1^\circ$$

$$= 26.100 \text{ N/mm}^2$$

$$\sigma_{\min} = \frac{\sigma_1 + \sigma_2}{2} - \frac{\sigma_1 - \sigma_2}{2} \cos 2\theta - \tau \sin 2\theta$$

$$= \frac{50 + 10}{2} - \frac{50 - 10}{2} \cos 75.1^\circ - 20 \sin 75.1^\circ$$

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$$\sigma_{\max} = \frac{\sigma_1 + \sigma_2}{2} + \frac{\sigma_1 - \sigma_2}{2} \cos 2\theta + \tau \sin 2\theta$$

$$= \frac{50 + 10}{2} + \frac{50 - 10}{2} \cos 75.1^\circ + 20 \sin 75.1^\circ$$

$$= 26.100 \text{ N/mm}^2$$

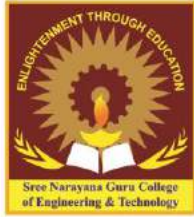
$$\sigma_{\min} = \frac{\sigma_1 + \sigma_2}{2} - \frac{\sigma_1 - \sigma_2}{2} \cos 2\theta - \tau \sin 2\theta$$

$$= \frac{50 + 10}{2} - \frac{50 - 10}{2} \cos 75.1^\circ - 20 \sin 75.1^\circ$$

$$= -11.89 \text{ N/mm}^2$$

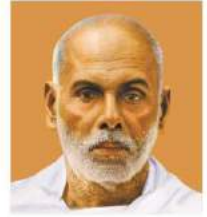
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



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NAME OF STAFF Nimisha M.K.

DESIGNATION Assistant Professor

DEPARTMENT Computer Science & Engineering

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KANNUR**

Santhosh
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DEGREE / BRANCH Computer Science & Engineering
SEMESTER.....3..... SUBJECT CODE.....CST...205.....
SUBJECT Object Oriented Programming Using Java
CLASSES
COMMENCING DATE 12/9/22 ENDING DATE 21/12/22
ACADEMIC YEAR2022-2023.....



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of excellence for
socio-economic progress
embedded in clearly articulated values
and supported by commitments.

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A knowledge society promoting
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enlightenment through
effective education.

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1	Abhinav Dharmaraj		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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CLASS ROLE NO.	NAME
1	Abhinav Dharmara
2	Abhinav K
3	Abhinav K
4	Abhisree Ashok
5	Abhiram Sunil
6	Adarsh Chandran V
7	Adarsh K.V
8	Adhithya Jithesh
9	Adarsh S Nirav
10	Akshay P.K
11	Amina Fiza K.V
12	Anurdeep K
13	Anupam K.V
14	Aarathi T.V
15	Arjun P.P
16	Arjun K.V
17	Aswathi A.V
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20	Athul Parithran
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23	Fathimath Thanse
24	Haifa C
25	Hiba T.K
27	Jeylith Visal
28	Jishnu K.R
29	Keerthana K
30	M. Mohammed Fird
31	Mohammed Zakhan J
32	Mohammed Amen No
32	Muhammed Adnan
34	Muhammed Shabaz S
35	Muhammed Thajudeen
36	Nandana M
37	Navya P
38	Neeraj Ravi P.V
40	Raihana T.P
41	Sarang V
42	Shakeem A.V

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Degree / Branch : CSE

CLASS ROLL NO.	NAME	MC	DA	HC
----------------------	------	----	----	----

43	Sreya Krishnan
----	----------------

44 Cthara M.V

h5 Naishray K.P

46	Nishak K. B.
----	--------------

47	Vishal Y.Y
----	------------

48 Vyshak Umeshan

49 | YadhuKrishnan K.

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43	Sreyas Krishnan
44	Uthaya M.V
45	Vaishnav K.P
46	Vishak K.R
47	Vishal V.V
48	Vyshak Umeshan
49	YadhuKrishnan K.

ASSIGNMENT / RECORDS / PRESENTATION				
1	2	3	4	5

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TOTAL HOURS ENGAGED

TOTAL HOURS ENGAGED											
AWARDING OF MARKS											
ROLL NO.	Hours Present	Test I	Test II	Test III			100% (15)	ATTEN DANCE %	ATTEN DANCE MARK	SESS MARK OUT OF 50	ROLL NO.
40	46	30	25				15	96	10	42	40
41	45	34	25				10	94	10	35	41
42	43	31	20	25			11	90	10	35	42
43	46	40	25				10	96	10	36	43
44	46	45	20				15	98	10	42	44
45	46	43	A	30			12	98	10	42	45
46	47	42	30				12	98	10	40	46
47	46	A	13	26			15	96	10	35	47
48	47	40	30				12	98	10	40	48
49	47	30	A	23			11	98	10	35	49
									</		

Signature of Staff Member

Module Co-ordinator

HOB

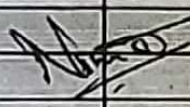
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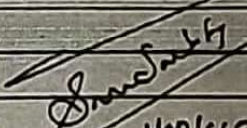
DETAILS OF Tutorials

Tutorial
Assignment
No.

DETAILS

1	14/9/22	Mod-1 → Java program.	29/9/22
2	1/10/22	Mod-1 → JML Diagram	10/10/22
3	7/10/22	Mod-2 → Control statements	14/10/22
4	17/10/22	Mod-2 → Class, Packages Polymorphism	25/10/22
5	31/10/22	Mod-3 → Packages, Interface, Java programs	11/11/22
6	22/11/22	Mod-3 → File handling, Operations in Java	30/11/22
7	2/12/22	Mod-4 → Events & Event Listener Interface	15/12/22
8	12/12/22	Mod-5 → Scoring Layout Managers	21/12/22


Faculty


HOD/CSE

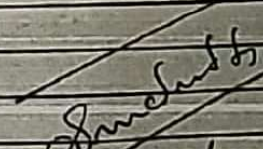
DETAILS OF TEST

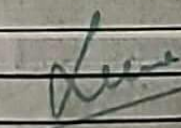
Test No.

DETAILS

1	8/11/22	Mod 1, 2, 3	9:30 to 11:30
2	12/12/22	Mod 3, 4, 5	9:30 to 11:30
3	5/1/23	Mod 1, 3, 5	9:30 to 11:30


Faculty


HOD/CSE


Dr. LEENA A.V.
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KANNUR

CST 205 Object oriented Programming Using Java.

Tutorial No./ Date	Topic/module	Faculty Name	No. of Batches	Sign
1 (14/9/2022)	Java Programs (Module 1)	Nimisha MK	2	Nimisha 14/9/22
2 (3/10/2022)	UML diagrams (Module 1)	Nimisha MK	2	Nimisha 10/10/22
3 (07/10/2022)	Control statements (Module 2)	Nimisha MK	2	Nimisha 07/10/22
4 (17/10/22)	Concept of class, object, polymorphisms (Module 2)	Nimisha MK	2	Nimisha 17/10/22
5 (31/10/22)	Java Programs (Module 3)	Nimisha MK	2	Nimisha 31/10/22
6 (22/11/22)	File handling Operations (Module 3)	Nimisha MK	2	Nimisha 22/11/22
7 (2/12/22)	Event classes & Listener Interface (Module 4)	Nimisha MK	2	Nimisha 2/12/22
8 (12/12/22)	Swing layout Manager (Module 5)	Nimisha MK	2	Nimisha 12/12/22

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TUTORIAL FORMAT FOR IQAC APPROVAL

- I. Details of tutorial [to be filled by the faculty setting the question paper]**
[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CST 205 Object Oriented Programming in Java
2	Name of the faculty and department	Nimisha M.K CSE
3	Date of issue	14/9/2022
4	Date of submission	30/9/2022
5	Date of return	6/10/2022
6	Dated signature of the subject faculty	Nimisha 14/9/2022

- II. CHECK -LIST [to be filled by the module coordinator]**

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	yes	
3	Whether questions are numbered correctly?	yes	
4	Whether marking scheme is attached?	yes	

Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	Veena.K.K 14/9/22
Name and dated Signature of the Head of the Department	Sunder.V 14/9/22



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<i>Tutorial</i>	1	<i>Academic Year / Semester</i>	2022-23/5
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	14/09/2022	<i>Date of submission</i>	29/09/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Illustrate the following java program: 1. Check the given number is prime or not 2. Check the given number is odd or even 3. Check the given string is palindrome or not 4. Print Fibonacci series 5. Matrix Addition 6. Sum of elements in an array. 7. Print a pyramid series	35	I	2

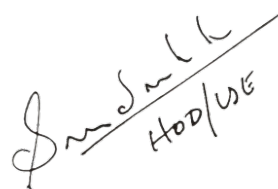
CO - Course Outcome [CO]

CO 1: Implement programs in Java which use data types, operators, control statements, built in packages & interfaces, Input/output streams and Files.

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding


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ANSWER KEY/VALUATION SCHEME

<i>Tutorial</i>	1 (SCHEME)	<i>Academic Year / Semester</i>	2022-23/5
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	14/09/2022	<i>Date of submission</i>	29/09/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Illustrate the following java program: 1. Check the given number is prime or not 2. Check the given number is odd or even 3. Check the given string is palindrome or not 4. Print Fibonacci series 5. Matrix Addition 6. Sum of elements in an array. 7. Print a pyramid series Each programs – 5 marks	35	I	2

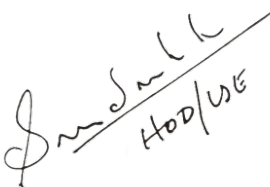
CO - Course Outcome [CO]

CO 1: Implement programs in Java which use data types, operators, control statements, built in packages & interfaces, Input/output streams and Files.

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding


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SREE NARAYANA GURU COLLEGE OF ENGINEERING & TECHNOLOGY

TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of tutorial [to be filled by the faculty setting the question paper]

[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CST 205 Object oriented Programming in java
2	Name of the faculty and department	Nimisha M.K. CSE
3	Date of issue	1/10/2022
4	Date of submission	10/10/2022
5	Date of return	15/10/2022
6	Dated signature of the subject faculty	Nimisha 1/10/2022

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	yes	
3	Whether questions are numbered correctly?	yes	
4	Whether marking scheme is attached?	yes	

Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	Veena. KIC 1/10/22
Name and dated Signature of the Head of the Department	Sunder. V 1/10/22



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<i>Tutorial</i>	2	<i>Academic Year / Semester</i>	2022-23/5
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	1/10/2022	<i>Date of submission</i>	10/10/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Illustrate the following UML diagram: 1. Use case for Movie Reservation System. 2. Use case for Online Music Player System. 3. Class diagram for a Library Management System. 4. Class diagram for Online Movie Ticket Booking. 5. Activity diagram for Food Ordering System.	25	I	2

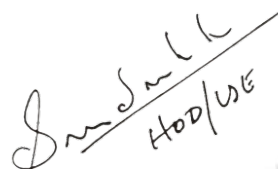
CO - Course Outcome [CO]

CO 1: Implement programs in Java which use data types, operators, control statements, built in packages & interfaces, Input/output streams and Files.

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding


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ANSWER KEY/VALUATION SCHEME

<i>Tutorial</i>	2 (SCHEME)	<i>Academic Year / Semester</i>	2022-23/5
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	1/10/2022	<i>Date of submission</i>	10/10/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Illustrate the following UML diagram: 1. Use case for Movie Reservation System. 2. Use case for Online Music Player System. 3. Class diagram for a Library Management System. 4. Class diagram for Online Movie Ticket Booking. 5. Activity diagram for Food Ordering System. Diagram- 5 marks each	25	I	2

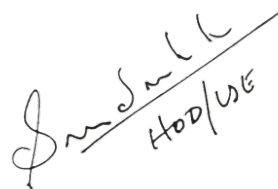
CO - Course Outcome [CO]

CO 1: Implement programs in Java which use data types, operators, control statements, built in packages & interfaces, Input/output streams and Files.

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding


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TUTORIAL FORMAT FOR IQAC APPROVAL

**I. Details of Tutorial [to be filled by the faculty setting the question paper]
[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]**

Sl No.	Particulars	Details
1	Course name with code	EST205 Object oriented Programming
2	Name of the faculty and department	Nimisha MK, CSE
3	Date of issue	07/10/22
4	Date of submission	14/10/22
5	Date of return	17/10/22
6	Dated signature of the subject faculty	Nimisha MK 7/10/22

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	yes	
3	Whether questions are numbered correctly?	yes	
4	Whether marking scheme is attached?	yes	

Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	Approved with following modifications NIL
Name and dated signature of the module coordinator	Veena K K 17/10/22
Name and dated Signature of the Head of the Department	Sunder V Sunder V 17/10/22



SREE NARAYANA GURU COLLEGE OF ENGINEERING & TECHNOLOGY

<i>Tutorial</i>	3	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	07/10/2022	<i>Date of submission</i>	14/10/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Demonstrate the following control statements in Java: i. Decision Making /Selection Statements ii. Looping Statements iii. Jump Statements	10	2	2

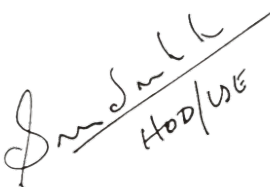
CO - Course Outcome [CO]

CO 2 : To get thorough knowledge of java languages and to utilize the features of java like datatypes, operators, control statements etc and how to use the object oriented concepts - classes, objects ,constructors, data hiding, inheritance and polymorphism.

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding


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Answer key /Valuation Scheme

<i>Tutorial</i>	3(Scheme)	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	07/10/2022	<i>Date of submission</i>	14/10/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Demonstrate the following control statements in Java: i. Decision Making /Selection Statements ii. Looping Statements iii. Jump Statements Syntax and Flowchart – 5 marks for each , Programming Example – 5 marks for each	30	2	2

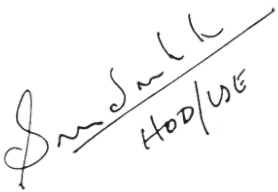
CO - Course Outcome [CO]

CO 2 :To get thorough knowledge of java languages and to utilize the features of java like datatypes, operators, control statements etc and how to use the object oriented concepts - classes, objects ,constructors, data hiding, inheritance and polymorphism.

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding


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TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of Tutorial [to be filled by the faculty setting the question paper]

[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CS7205 Object oriented programming using Java
2	Name of the faculty and department	Nimisha M.K, CSE
3	Date of issue	17/10/22
4	Date of submission	25/10/22
5	Date of return	28/10/22
6	Dated signature of the subject faculty	Nimisha 17/10/22

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	yes	
3	Whether questions are numbered correctly?	yes	
4	Whether marking scheme is attached?	yes	

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications NIL
Name and dated signature of the module coordinator	Veera.K.K 17/10/22
Name and dated Signature of the Head of the Department	Sunder. 17/10/22

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**SREE NARAYANA GURU COLLEGE OF ENGINEERING &
TECHNOLOGY**

<i>Tutorial</i>	4	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	17/10/2022	<i>Date of submission</i>	25/10/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Contrast the difference between Method overloading and Method Overriding.	5	2	2
2.	Define abstract class.	5	2	1
3.	Compare and contrast class and abstract class.	5	2	2

CO - Course Outcome [CO]

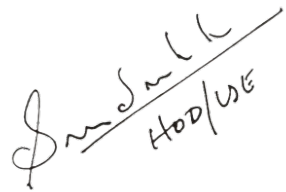
CO 2 : To get thorough knowledge of java languages and to utilize the features of java like datatypes, operators, control statements etc and how to use the object oriented concepts - classes, objects ,constructors, data hiding, inheritance and polymorphism.

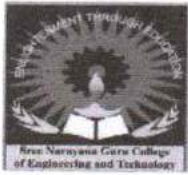
LEVEL - Bloom's Taxonomy Level

Level 1: Remembering

Level 2: Understanding


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TECHNOLOGY**

Answer Key/Valuation Scheme

<i>Tutorial</i>	4(Scheme)	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	17/10/2022	<i>Date of submission</i>	25/10/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Contrast the difference between Method overloading and Method Overriding. Any 5 points – 5 marks	5	2	2
2.	Define abstract class. Definition -1 mark, Explanation – 4 marks	5	2	1
3.	Compare and contrast class and abstract class. Comparison – 5 marks	5	2	2

CO - Course Outcome [CO]

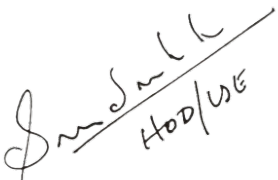
CO 2 : To get thorough knowledge of java languages and to utilize the features of java like datatypes, operators, control statements etc and how to use the object oriented concepts - classes, objects ,constructors, data hiding, inheritance and polymorphism.

LEVEL - Bloom's Taxonomy Level

Level 1: Remembering

Level 2: Understanding


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TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of Tutorial [to be filled by the faculty setting the question paper]
[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CST 205 Object Oriented programming
2	Name of the faculty and department	Nimisha M.K, CSE
3	Date of issue	31/10/22
4	Date of submission	11/10/22
5	Date of return	15/11/22
6	Dated signature of the subject faculty	Nimisha 31/10/22

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	Yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	
3	Whether questions are numbered correctly?	Yes	
4	Whether marking scheme is attached?	Yes	

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications NIL
Name and dated signature of the module coordinator	Veena K.K 12/10/22
Name and dated Signature of the Head of the Department	Sunder ✓ Sunder



**SREE NARAYANA GURU COLLEGE OF ENGINEERING &
TECHNOLOGY**

<i>Tutorial</i>	5	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	31/10/2022	<i>Date of submission</i>	11/11/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Develop a java package named primepackage, with a class Prime containing a static method that check whether a number is prime or not and returns that information. Import this package in another class and use to check a number is prime or not.	5	3	3
2.	Illustrate a java package named "even" package with a class Even containing a static method to check whether a given number is even or not.	5	3	2
3.	Contrast the difference between packages and interface.	5	3	2

CO - Course Outcome [CO]

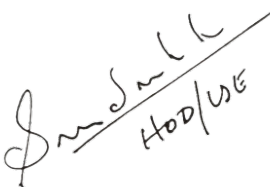
CO 3: To understand the utilization of built in packages & interfaces and to illustrate how robust programs can be written in Java using exception handling mechanism , Input/ Output Streams and Files in Java to develop programs

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding

Level 3: Applying


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**SREE NARAYANA GURU COLLEGE OF ENGINEERING &
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Answer Key / Valuation Scheme

<i>Tutorial</i>	5(Scheme)	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	31/10/2022	<i>Date of submission</i>	11/11/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Develop a java package named primepackage, with a class Prime containing a static method that check whether a number is prime or not and returns that information. Import this package in another class and use to check a number is prime or not. Syntax and logic -2.5 mark , Program – 2.5 marks.	5	3	3
2.	Illustrate a java package named “even” package with a class Even containing a static method to check whether a given number is even or not. Syntax and logic -2.5 mark , Program – 2.5 marks.	5	3	2
3.	Contrast the difference between packages and interface. Any 5 points -5 marks.	5	3	2

CO - Course Outcome [CO]

CO 3: To understand the utilization of built in packages & interfaces and to illustrate how robust programs can be written in Java using exception handling mechanism , Input/ Output Streams and Files in Java to develop programs

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding

Level 3: Applying

Leena
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PAYYANUR, KANNUR**

S. S. S. S. S.
HOD/USE



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TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of tutorial [to be filled by the faculty setting the question paper]

[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	CST 205 object oriented programming
2	Name of the faculty and department	Nirmisha M.K.
3	Date of issue	22/11/22
4	Date of submission	30/11/22
5	Date of return	2/12/22
6	Dated signature of the subject faculty	Nirmisha 22/11/22

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	yes	
3	Whether questions are numbered correctly?	yes	
4	Whether marking scheme is attached?	yes	

Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	—
Name and dated signature of the module coordinator	Veena.K.K. 22/11/22
Name and dated Signature of the Head of the Department	Sunder.V. 22/11/2022

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**SREE NARAYANA GURU COLLEGE OF ENGINEERING
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<i>Tutorial</i>	6	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	22/11/2022	<i>Date of submission</i>	30/11/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Explain in detail following file handling operations in java: i. Create a file ii. Get information of a file iii. Read from a file iv. Write to a file v. Delete a file	10	3	2

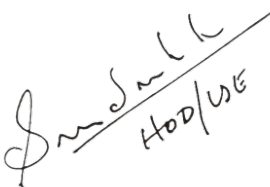
CO - Course Outcome [CO]

CO 3: To understand the utilization of built in packages & interfaces and to illustrate how robust programs can be written in Java using exception handling mechanism , Input/ Output Streams and Files in Java to develop programs

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding


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& TECHNOLOGY**

Valuation Key/ Answer Scheme

<i>Tutorial</i>	6(Scheme)	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	22/11/2022	<i>Date of submission</i>	30/11/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Explain in detail following file handling operations in java: i. Create a file ii. Get information of a file iii. Read from a file iv. Write to a file v. Delete a file Each operation with simple java program – 10 marks.	10	3	2

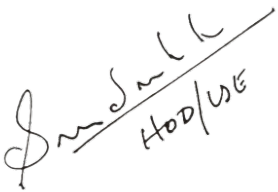
CO - Course Outcome [CO]

CO 3: To understand the utilization of built in packages & interfaces and to illustrate how robust programs can be written in Java using exception handling mechanism , Input/ Output Streams and Files in Java to develop programs

LEVEL - Bloom's Taxonomy Level

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TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of tutorial [to be filled by the faculty setting the question paper] [ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

SI No.	Particulars	Details
1	Course name with code	CS7205 Object oriented Programming using Java
2	Name of the faculty and department	Nimisha KK
3	Date of issue	02/12/22
4	Date of submission	15/12/22
5	Date of return	18/12/22
6	Dated signature of the subject faculty	Nimisha 2/12/22

II. CHECK -LIST [to be filled by the module coordinator]

SI No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	Yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	
3	Whether questions are numbered correctly?	Yes	
4	Whether marking scheme is attached?	Yes	

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications —
Name and dated signature of the module coordinator	Veera KK 15/12/22
Name and dated Signature of the Head of the Department	Saunders V 02/12/2022



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<i>Tutorial</i>	7	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	02/12/2022	<i>Date of submission</i>	15/12/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Illustrate different event classes and event listener interface in java.	10	4	2

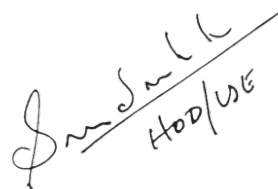
CO - Course Outcome [CO]

CO 4: To provide basic exposure for the application of programs in java using multithreading, string handling mechanisms, collection framework and event handling mechanisms.

LEVEL - Bloom's Taxonomy Level

Level 2: Understanding


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Valuation Key/ Answer Scheme

<i>Tutorial</i>	7(Scheme)	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	02/12/2022	<i>Date of submission</i>	15/12/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Illustrate different event classes and event listener interface in java. List out the event class and event listener interface- 2 marks, Explanation – 8 marks.	10	4	2

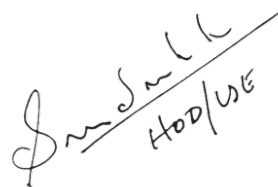
CO - Course Outcome [CO]

CO 4: To provide basic exposure for the application of programs in java using multithreading, string handling mechanisms, collection framework and event handling mechanisms.

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TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of tutorial [to be filled by the faculty setting the question paper] **[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]**

Sl No.	Particulars	Details
1	Course name with code	CST205 Object oriented programming using Java
2	Name of the faculty and department	Nirmisha M.K.
3	Date of issue	12/12/22
4	Date of submission	21/12/22
5	Date of return	22/12/22
6	Dated signature of the subject faculty	Nirmisha 12/12/22

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	Yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	
3	Whether questions are numbered correctly?	Yes	
4	Whether marking scheme is attached?	Yes	

Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	Approved with following modifications —
Name and dated signature of the module coordinator	Nirmisha M.K. 12/12/22
Name and dated Signature of the Head of the Department	Sunder V. 21/12/2022



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<i>Tutorial</i>	8	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	12/12/2022	<i>Date of submission</i>	21/12/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Explain in detail different Swing layout managers in Java swing.	10	5	2

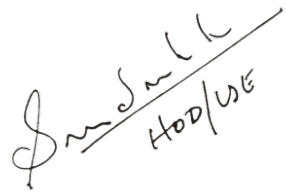
CO - Course Outcome [CO]

CO 5: To impart the techniques of creating GUI based applications and database connectivity.

LEVEL - Bloom's Taxonomy Level

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Valuation Key/ Answer Scheme

<i>Tutorial</i>	8(Scheme)	<i>Academic Year / Semester</i>	2022-23/ 3
<i>Subject name with code</i>	CST 205 OBJECT ORIENTED PROGRAMMING USING JAVA	<i>Branch</i>	CSE
<i>Date of Issue</i>	12/12/2022	<i>Date of submission</i>	21/12/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Mark</i>	<i>CO</i>	<i>Level</i>
1.	Explain in detail different Swing layout managers in Java swing. List out the Swing layout manager - 2 marks, Explanation with figures- 8 marks.	10	5	2

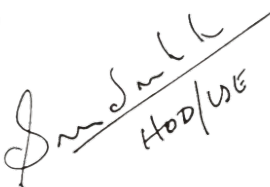
CO - Course Outcome [CO]

CO 5: To impart the techniques of creating GUI based applications and database connectivity.

LEVEL - Bloom's Taxonomy Level

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Tutorial-1

20/9/22

- Q1) check given number is prime or not
- Q2) check given number is odd or even
- Q3) check given string is palindrome or not
- Q4) print fibonacci
- Q5) print a pyramid pattern
- Q6) matrix addition
- Q7) sum of elements in an array.

Done

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Q1) Prime or not

```
import java.util.Scanner;  
class prime
```

```
{
```

```
public static void main (String args[])
```

```
{
```

```
int n, c=1, i=2;
```

```
Scanner sc = new Scanner (System.in);
```

```
System.out.print ("\n enter a number=");
```

```
n = sc.nextInt();
```

```
for (i=2; i<=n; i++)
```

```
{
```

```
if (n % i == 0 || n % 3 == 0)
```

```
{
```

```
c=0;
```

```
break;
```

```
}
```

```
}
```

```
if (c==1)
```

Sumith
HOD/USE

```

system.out.println (nt "is prime number");
else
system.out.println (nt "is not a prime number");
}
}

```

Q2) odd or even

```

import java.util.Scanner;

public class oddoreven
{
    public static void main (String [] args)
    {
        int n;

        Scanner sc = new Scanner (System.in);
        System.out.print ("Enter the number");
        n = sc.nextInt();
        if (n % 2 == 0)
        {

```

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```

system.out.println ("the given number is
even");
}
else
{
    system.out.println ("the given number is odd");
}
}
}

```

Q4) Fibonacci

```

import java.util.*;

public class first
{
    public static void main (String [] args)
    {
        Scanner sc = new Scanner (System.in);
        int a = 0, b = 1, c, i = 3, n;

```



```

system.out.print("enter the number");
n = sc.nextInt();
system.out.print(a + " " + b);
while (i <= n)
{
    c = a + b;
    system.out.print(" " + c);
    a = b;
    b = c;
    i++;
}
}

```

Q5) pyramid pattern

```

import java.io.*;
public class pyramid
{

```

```

    public static void main (String[] args)

```

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```

int rows = 5;
for (int i = 1; i <= rows; i++)
{
    for (int j = i; j <= i; j++)
    {
        system.out.print(" ");
    }
    system.out.print("\n");
}
}

```

Q7) sum of elements in array

```

import java.io.*;

```

```

public class sum of array
{

```

```

    public static void main (String[] args)
    {

```

```

        int[] arr = new int[] {1, 2, 3, 4, 5};
        int sum = 0;

```

```

for (int i=0; i<arr.length; i++)
{
    sum = sum + arr[i];
}
System.out.println("sum of all the elements of
an array: " + sum);
}
}

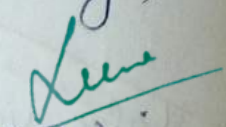
```

Q6) Matrix addition

```

import java.util.Scanner;
public class matrix sum
{
    public static void main (String [] args)
    {
int int a[][] , b[][] , c[][] , i , j
a = new int [3][3];

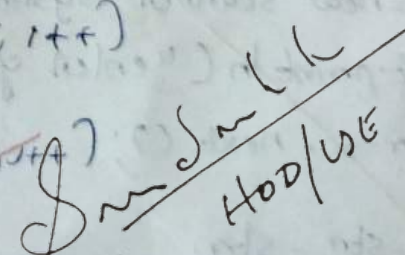
```


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```

b = new int [3][3];
c = new int [3][3];
Scanner sc = new Scanner (System.in);
System.out.println ("enter the 1st matrix");
for (i=0; i<3; i++)
    for (j=0; j<3; j++)
        a[i][j] = sc.nextInt();
System.out.println ("enter 2nd matrix");
{
    for (i=0; i<3; i++)
        {
for for (j=0; j<3; j++)
            {
                b[i][j] = sc.nextInt();
                System.out.println ("addition ...");
            }
        }
    for (i=0; i<3; i++)
        {
            for (j=0; j<3; j++)
                c[i][j] = a[i][j] + b[i][j]
        }
}

```


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```

}
system.out.println(cc[j][j] + "\t");
}
system.out.println(ln);
}
}
}

```

Q3) palindrome

```

import java.util.Scanner;
public class palindrome string
{
    public static void main (String[] args)
    {
        Scanner sc = new Scanner (System.in);
        System.out.println("enter your string");
        string str = sc.next();
        string org-str = str;
        string rev = " ";
    }
}

```

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```

int ln = str.length();
for (int i = ln-1; i >= 0; i--)
{
    rev = rev + str.charAt(i);
}
if (org-str.equals(rev))
{
    System.out.println(org-str + "is palindrome string");
}
else
{
    System.out.println(org-str + "is not a palindrome string");
}
}
}

```

~~Nimish~~
10/10

~~Samir~~
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Tutorial-2

1) Illustrate the following UML diagram

a) use case for movie reservation system

b) use case for online music playing system

c) use case for movie reservation system

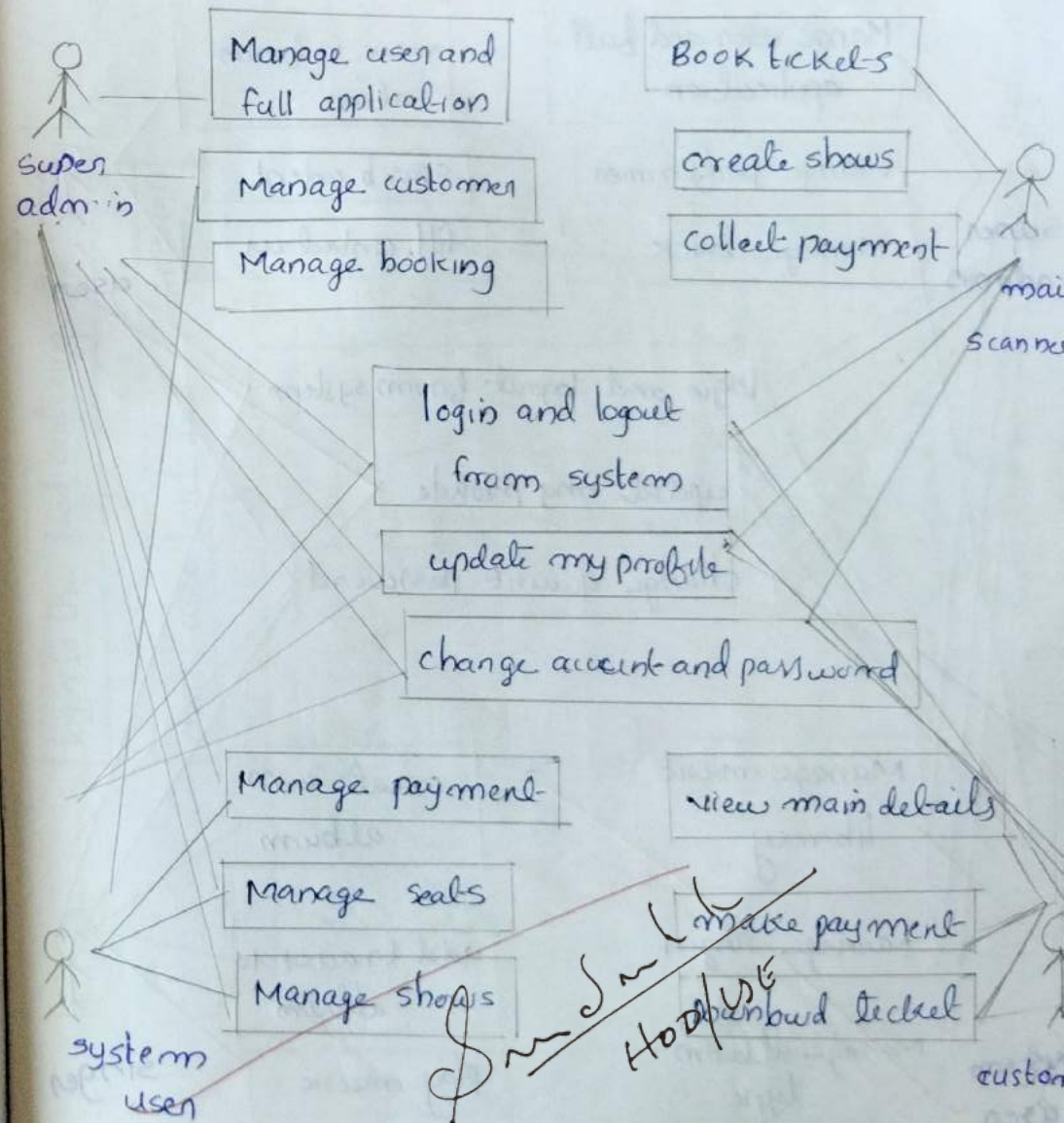
d) class diagram for a book and student

e) class diagram for online movie ticket booking system which contains classes like admin, registered user, visitor and guest user.

f) activity diagram for food ordering system which contains activities like order, delivery-food item, category and payment.

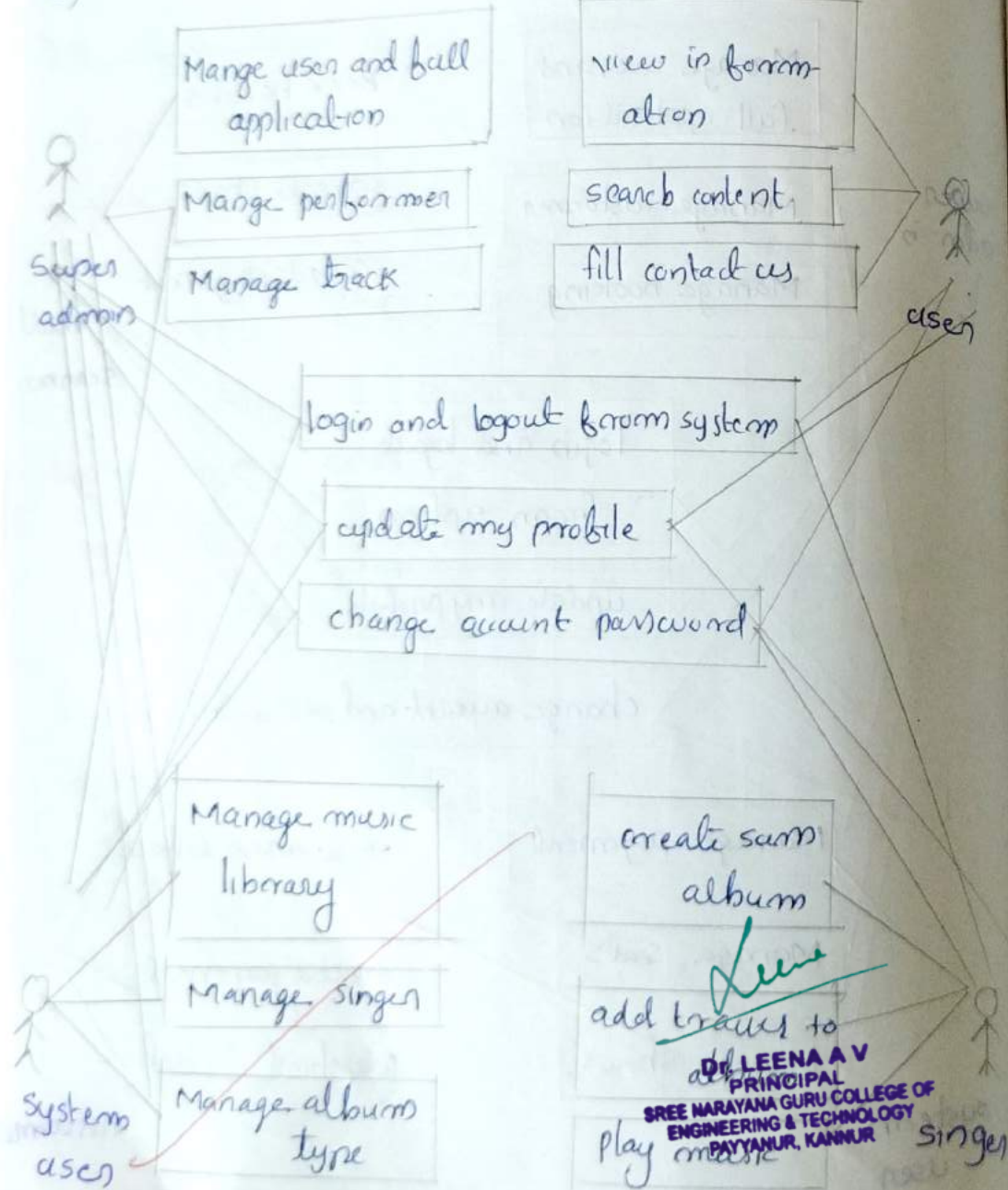
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a)

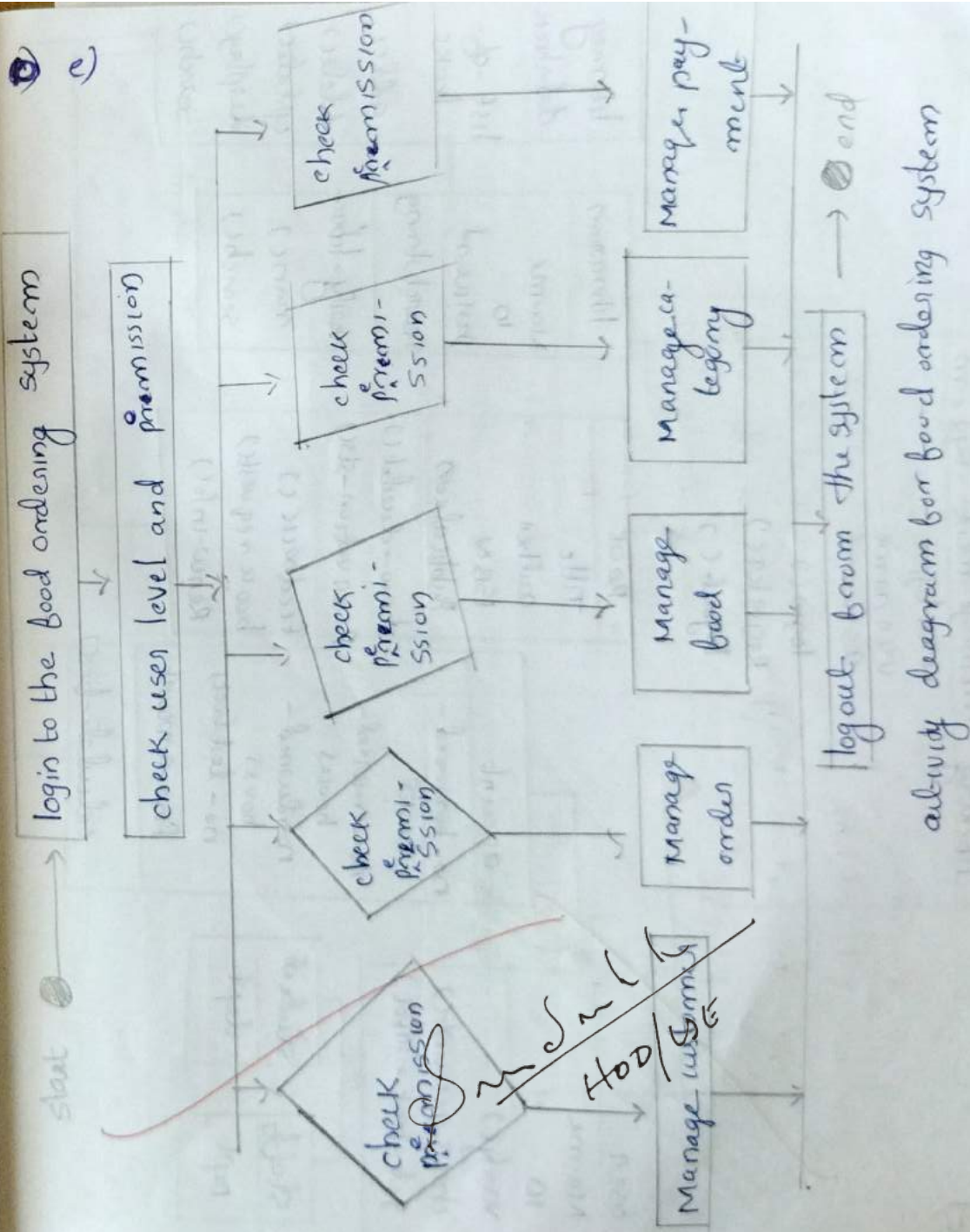


USE diagram of movie ticket booking system

b)

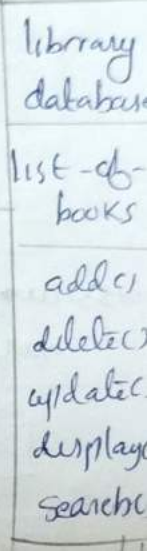
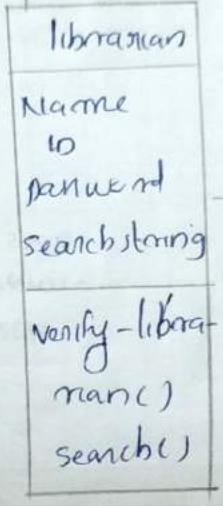
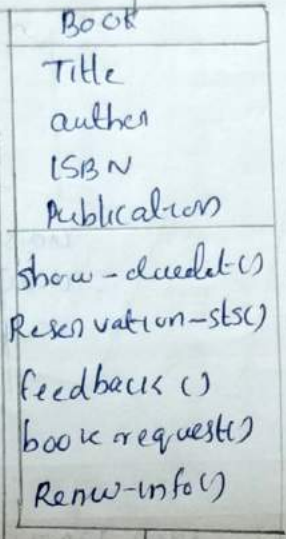
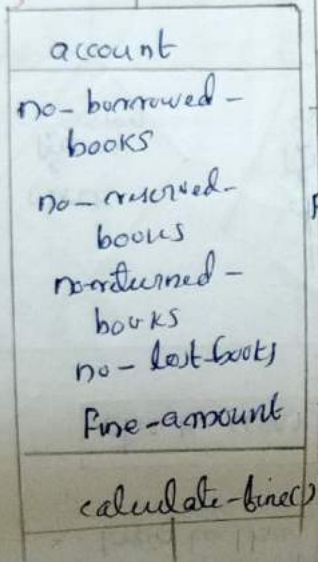
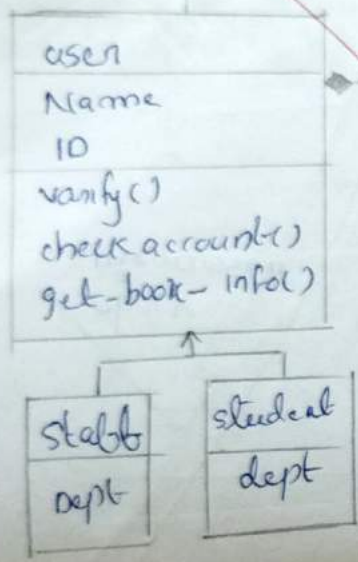
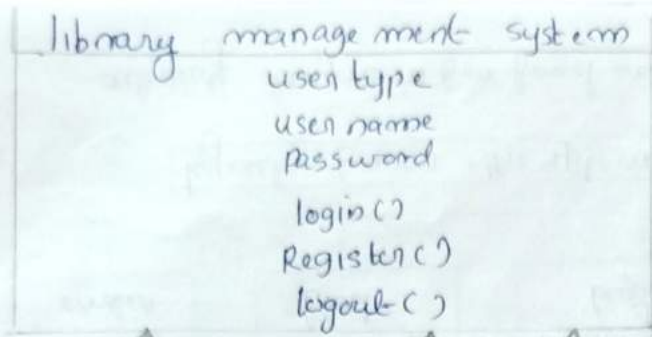


e)



activity diagram for food ordering system

c)



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d)

Roleclass

role-id: int
role-title: string
role-description: string
add Role()
edit Role()
delete Role()
search Role()
assign Role()

Permission class

permission-id: int
permission-role-id: int
permission-title: string
permission-module: string
permission-description: string
add permission()
edit permission()
delete permission()
search permission()

Booking class

booking-id: int
booking-type: string
booking-description: string
booking-title: string
booking-ticket: string
booking-date: date
add booking()
edit booking()
delete booking()
search booking()

userclass

user-id: int
user-role-id: int
user-name: string
user-email: string
user-dob: date
user-address: string
add user()
edit user()
delete user()
search user()

payment class

payment-id: int
payment-amount: string
payment-description: string
payment-customer-id: int
payment-date: date
add payment()
edit payment()
delete payment()
search payment()

customer class

customer-id: int
customer-username: string
customer-password: string
customer-name: string
customer-mobile: string
customer-email: string
customer-address: string
add customer()
edit customer()
delete customer()
search customer()

Movie class

movie-id: int
movie-name: string
movie-language: string
movie-year: string
movie-type: string
movie-description: string
add movie()
edit movie()
delete movie()
search movie()

show class

show-id: int
show-name: string
show-description: string
show-type: string
show-date: date
add show()
edit show()
delete show()
search show()

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Tutorial-3

Decision making statement

i) if statement

Syntax: →

```
if (condition)
```

```
{
```

// block of code to be executed if the condition is true

```
}
```

eg: class sample if

```
{
```

```
public static void main (String args[])
```

```
{
```

```
int a=10;
```

```
if (a>0)
```

```
{
```

```
system.out.println("a is greater than 0");
```

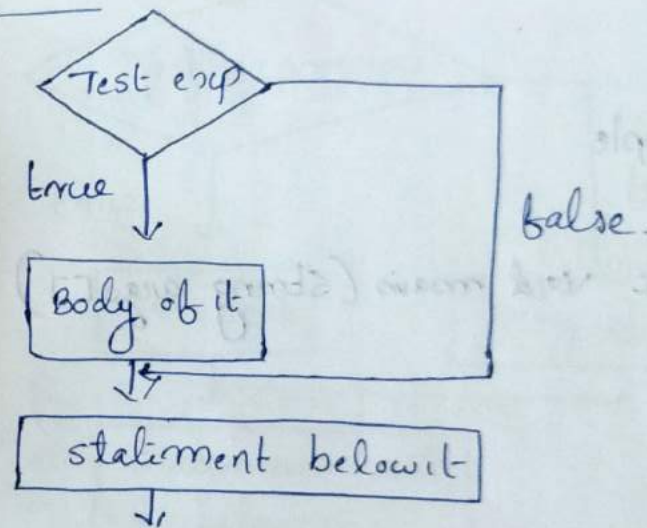
```
}
```

```
}
```

```
}
```

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flow chart



ii) if else statement

Syntax: →

```
if (condition)
```

```
{
```

// block of code to be executed if true

```
}
```

```
else
```

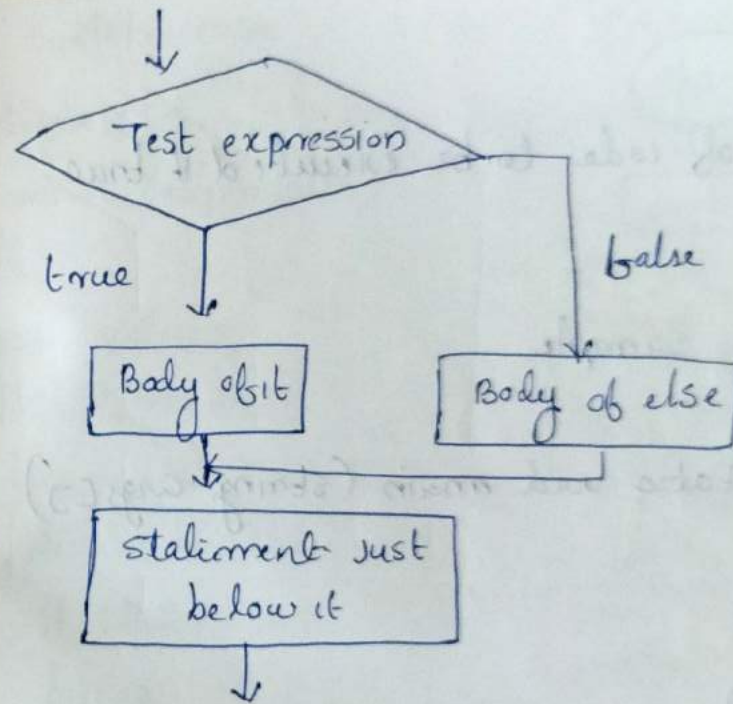
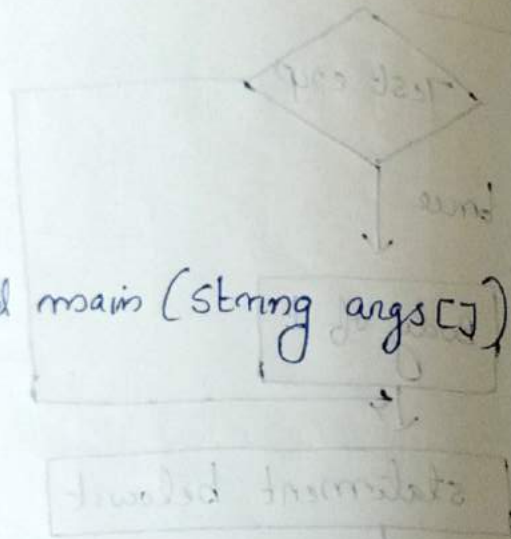
```
{
```

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// block of code to be executed if false
}

eg: class sample

```
{
    public static void main (String args[])
    {
        int a,b;
        if(a>b)
        {
            System.out.println ("a is greater than b");
        }
        else
        {
            System.out.println ("b is greater than a");
        }
    }
}
```



iii) if else if ladder

Syntax

if (condition)

{

// block of code to be executed if true

}

else if (condition)

{

// block of code to be executed if true

}

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```

else
{
// block of code to be executed if true
}

```

eg: class sample

```

{
public static void main (String args[])
{
int a, b;
if (a > b)
{
system.out.println ("a is greater than b");
}
else if (b > a)
{

```

Leena
system.out.println ("b is greater than a");

else

```

{
system.out.println ("a is equal to b");
}
}

```

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IV) switch case

Syntax $\Rightarrow$

switch (expression)

{

case values;

// statement

break;

case value 2;

// statement

break;

...

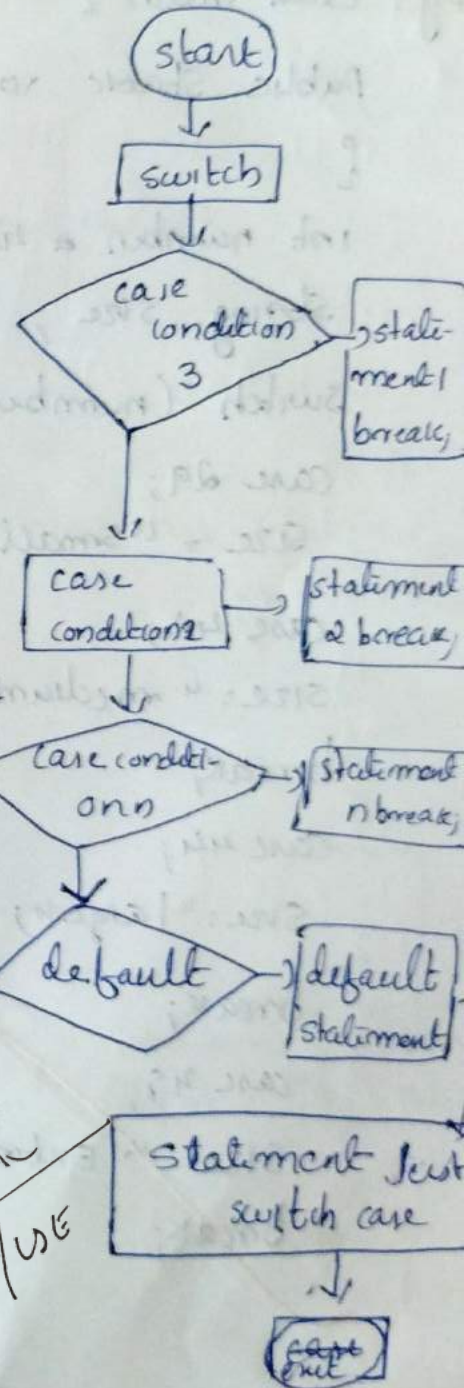
case value n;

// statement

break;

default;

// default statement
}



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eg: class main 2

```
public static void main (String [] args)
```

```
{
```

```
int number = 44;
```

```
String size;
```

```
switch (number) {
```

```
case 29;
```

```
size = "small";
```

```
case 42;
```

```
size = "medium";
```

```
break;
```

```
case 44;
```

```
size = "large";
```

```
break;
```

```
case 48;
```

```
size = "Extra large";
```

```
break;
```

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default

```
size = "unknown";
```

```
break;
```

```
}
```

```
System.out.println ("size: " + size);
```

```
}
```

```
}
```

looping statement

i) while

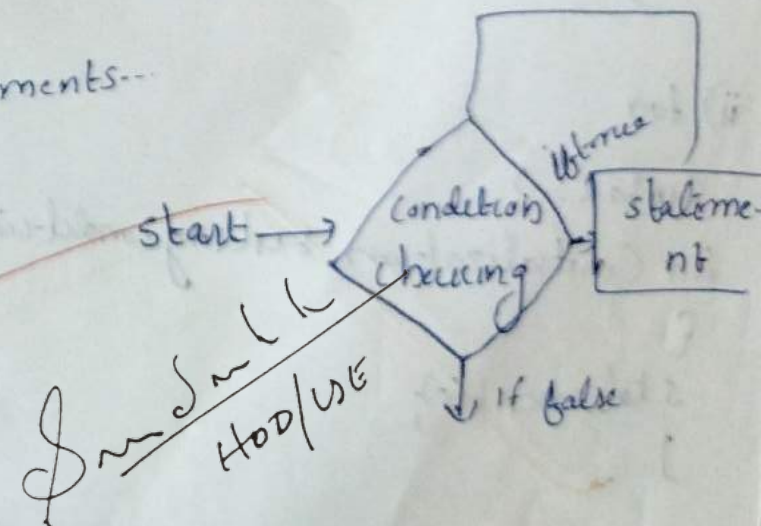
syntax:->

```
while (condition)
```

```
{
```

```
loop statements...
```

```
}
```



eg. class while loop demo

```

{
    public static void main (String args[])
    {
        int x=1;
        while (x<=4)
        {
            System.out.println ("value of x: "+x);
            x++;
        }
    }
}

```

ii) for

Syntax:-

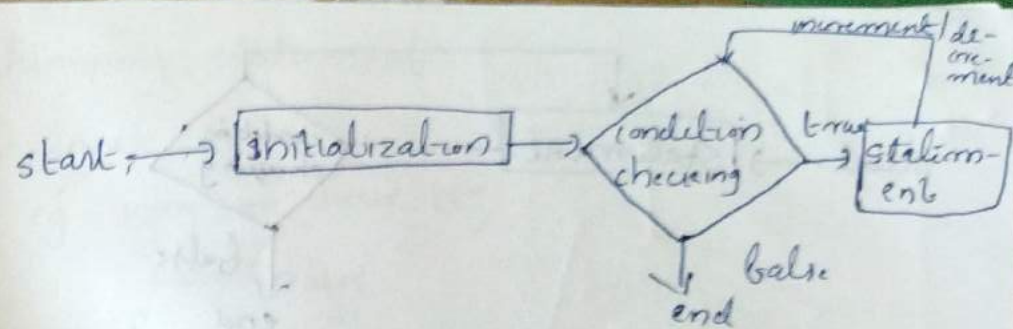
for (initialization, testing condition)

```

{
    statements;
}

```

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eg: class for loop demo

```

{
    public static void main (String args[])
    {
        for (int x=2; x<=4; x++)
        {
            System.out.println ("value of x: "+x);
        }
    }
}

```

iii) do

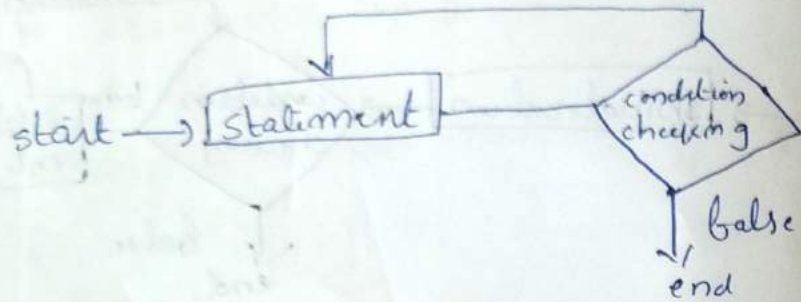
Syntax:-

```

do
{
    statements;
}
while (condition);

```

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eg: class dowhile loop demo

```

{
  public static void main (String args[])
  {
    int x=21;
    do
    {
      system.out.println ("value of x:" + x);
      x++;
    }
    while (x < 20)
  }
}
  
```

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Jumping statement

1) Break

eg: import java.io.*;
 class Breaks {

```

  public static void main (String args[])
  {
    int n=10;
    for (int i=0; i<n; i++) {
      if (i==6)
        break;
      system.out.println(i);
    }
  }
}
  
```

syntax:->

break;

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Tutorial-4

25/10/22

- 1) difference b/w method overriding and method overloading with example
- 2) write a note on abstract class
- 3) diff b/w abstract class and normal class
- 4) diff b/w JVM and JRE
- 5) features of oop or concept of oop

i) Method overloading

- Method overloading is used to increase the readability of the program.
- Method overloading is performed within class
- in case of method overloading, parameters must be different
- Method overloading is the example of compile time polymorphism

Method overriding

- Method overriding is used to provide the specific implementation of the method that is already provided by its super class.
- Method overriding occurs in two classes that is already provided have is-A
- in case of method overriding parameters must be same
- method overriding is the example of runtime polymorphism.

2) abstract class → is a restricted class that cannot be used to create objects

Rule

- an abstract class must be declared with abstract keyword
- it can have abstract and non-abstract method

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- it cannot be instantiated
- it can have final method
- it can have constructors and static method also.

Eg: abstract class animal

```

{
    public abstract void animal sound();
    public void sleep();
    System.out.println("zzzz");
}

class pig extends animal {
    public void animal sound() {
        System.out.println("The pig says: Wee Wee!");
    }
}

class My main class {
    public static void main (String [] args) {
        pig my pig = new pig();
        my pig . animal sound();
        my pig . sleep();
    }
}

```

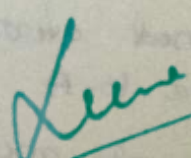
3)

4) JRE

JRE creates a runtime environment
can run effectively.

JRE becomes operational at the moment when the application
program is executed

JRE is installed into JDK by default.


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... creates
... becomes operational when the byte code needs to be interpreted
into machine language.

JVM is sub bundled with JRE, whose main function is to read
the generated bytecode

5) . easy to learn and understand

- it is object oriented programming language
- object oriented concept
- object
- class
- data abstraction and data encapsulation
- polymorphism
- inheritance
- platform independent
- powerful
- Robust
- Java is a ~~WORA~~ WORA programming language

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Tutorial-5

Aravind
S3CSE Roll No: 1

1) Develop a java package prime and use it in a program

Package prime

```
{  
int x=0, n;  
public void check()  
{  
for (int i=2; i<n/2; i++)  
if (n%i==0)  
x++;  
}  
if (x==0)
```

```
system.out.println ("The no. is prime number"  
else
```

```
system.out.println ("The no. is not a prime  
number");
```

```
}  
}
```

```
import java. prime package.*;
```

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```

import java.util.Scanner;
class find
{
    Scanner sc = new Scanner (System.in);
    System.out.println ("Enter the value");
    int n = sc.nextInt();
    public static void main (String[] args)
    {
        prime pr = new prime();
        pr.check();
    }
}

```

Q) Illustrate a java package "even" with a class Even containing a static method to check even or not

package Even odd

class Even

```

{
    int n;

```

```

void check()
{
    if (n % 2 == 0)
        System.out.println ("Even number");
    else
        System.out.println ("Odd number");
}
}
import java Even odd.*;

```

```

import java.util.*;
class find Even odd

```

```

{
    Scanner sc = new Scanner (System.in);
    System.out.println ("Enter the no:");
    int n = sc.nextInt();
    public static void main (String args[])
    {

```

Even e = new Even();

e.check();

```

}
}

```

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3) Difference b/w package and interface

package

- group of classes/interface
- created using 'package' keyword
- it can be imported
- uses import keyword to import

interface

- group of abstract method and constant fields
- created using 'interface' keyword
- it can only be extended by another interface and implemented
- uses 'implement' keyword to implement

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~~10/10~~

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```

system.out.println("An error occurred.");
e.printStackTrace();
}
}
}

```

2) Get file information

```

import java.io.file;

public class file information {
    public static void main (String [] args) {
        file myobj = new file ("NewFile1.txt");
        if (myobj.exists()) {
            system.out.println ("file name: " + myobj.getName());
            system.out.println ("Absolute path: " + myobj.getAbsolutePath());
            system.out.println ("writeable: " + myobj.canWrite());
            system.out.println ("Readable: " + myobj.canRead());
            system.out.println ("file size in bytes: " + myobj.length());
        } else {
            system.out.println ("The file does not exist");
        }
    }
}

```

Read from a file

```

import java.io.file;
import java.io.file not found Exception;
import java.util.scanner;

public static Read from file {
    public static void main (String [] args) {
        try {
            file myobj = new file ("D:\Aleh handling New file 11.txt");
            Scanner myReader = new scanner (my obj);
            while (my Reader.hasNextLine()) {
                string data = my Reader.nextLine();
                system.out.println (data);
            }
            my Reader.close();
        } catch (file not found Exception e) {
            system.out.println ("An error occurred");
            e.printStackTrace();
        }
    }
}

```

Write to a file

```

import java.io.file writer
import java.io Exception
public class write to file {
    public static void main (String [] args) {
        try {

```


File writer my writer = new file writer ("file name. txt")
my writer. write ("files in java might be tricky, but it is fun
enough");

my writer. close();
system.out.println ("successfully wrote to the file");

} catch (IOException e){
system.out.println ("An error occurred");
e.printStackTrace();
}
}

Delete a file

import java.io.file;

Public class delete file {

Public static void main (String [] args){

file myobj = new file ("file name. txt");

if (myobj. delete()){

system.out.println ("deleted the file" + myobj. getName());

} else {

system.out.println ("failed to delete the file");

}

}

}

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Tutorial-7

Foreground events

- Those events which require the direct interaction of user.
- They are generated as consequences of a person interacting with the graphical components in graphical user interface.
- For example, clicking on a button, moving the mouse entering a character through keyboard, selecting an item from list, scrolling the page etc.

Background events

- Those events that require the interaction of end user are known as background events.
- operating system interrupts, hardware or software failure, time expires, an operation completion are the example of background events.

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- The object is registered using `addItemListener()` method.
- When the action event occurs, the object's `itemStateChanged()` method is invoked.
- The interface method:
`void itemStateChanged (ItemEvent)`
 → invoked when an item has been selected or deselected by the user.

KeyListener interface

- The Java `KeyListener` is notified whenever you change the state of key.
- The class which processes the key event.
- Implements the `KeyListener` interface.
- The object of the class must be registered with a component.
- The object is registered using `addKeyListener()` method.
- The interface method:
 i. `void keyPressed (KeyEvent)`
 invoked when a key has been pressed.

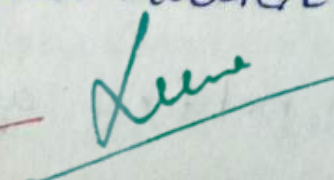
ii) void keyReleased (key event)
invoked when a key has been released

iii) void keyTyped (key event)
invoked when a key has been typed

Mouse Listener interface

- Java mouse listener is notified whenever you change the state of mouse
- The class which processes the mouse event
- implements the mouse listener interface
- The object of the class must be registered with a component
- The object is registered using addMouseListener() method
- The interface method

i) void mouseClicked (mouse event)
invoked when the mouse button has been clicked on a component


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- ii) void mouseEntered (MouseEvent)
invoked when mouse enters a component
- iii) void mouseExited (MouseEvent)
invoked when mouse exits a component
- iv) void mousePressed (MouseEvent)
invoked when mouse button been pressed on a component
- v) void mouseReleased (MouseEvent)
invoked when mouse button has been released on a component.

5 MouseMotionListener interface

- The java mouse.motionListener is notified whenever you move or drag mouse
- it is notified against MouseEvent
- used for receiving mouse events on a component
- The class that process mouse motion events needs to implements MouseMotionListener interface
- The interface method:

i) void mouseDragged (MouseEvent)
invoked when mouse button is pressed on a component and then dragged

ii) void mouseMoved (MouseEvent)
invoked when mouse cursor has been moved onto a component but no buttons have been pushed

6) WindowListener interface

- The Java WindowListener is notified whenever you change the state of window
- It is notified against WindowEvent
- The WindowListener interface is found in java.awt.event package
- It has seven methods

i) void windowActivated (WindowEvent) - invoked when the window is set to be active window

ii) void windowClosed (WindowEvent) - invoked when a window has been closed as the result of calling dispose on the window

iii) void windowClosing (WindowEvent) - invoked when the user attempts to close the window from

the window's system menu.

- v) void window deactivated (window event -e)-invoked when a window is no longer the active window
- v) void window reiconified (window event -e)-invoked when a window is changed from a minimized to a normal state
- vi) void window iconified (window event -e)-invoked when a window is changed from a normal to a minimized state.
- vii) void window opened (window event -e)-invoked the first time a window is made visible.

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Tutorial-8

Explain different swing layout managers

- layout refers to the arrangement of components within containers
- The task of laying out the controls is done automatically by the layout managers
- properties like size, shape and arrangement varies from one layout manager to other

The class that the layout managers are

1. java.awt.BorderLayout
2. java.awt.CardLayout
3. java.awt.FlowLayout
4. java.awt.GridLayout
5. java.awt.GridBagLayout
6. javax.swing.BoxLayout
7. javax.swing.GroupLayout
8. javax.swing.ScrollPaneLayout
9. javax.swing.SpringLayout

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1) Border Layout

- The border layout is used to arrange the components in five regions
north, south, west, east, center
- each region may contain one component only
- The border layout provides ~~to~~ five constants for each region

- 1) public static final int NORTH
- 2) public static final int SOUTH
- 3) public static final int EAST
- 4) public static final int WEST
- 5) public static final int CENTER

constructions:-

- Border layout ()
- Border layout (int h gap, int v gap)

eg: import java.awt.*;

import javax.swing.*;

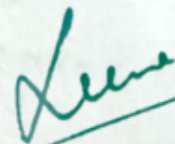
public class Border

{

JFrame f;

Border()

{



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f = new JFrame();

JButton b1 = new JButton("NORTH");

JButton b2 = new JButton("SOUTH");

JButton b3 = new JButton("EAST");

JButton b4 = new JButton("WEST");

JButton b5 = new JButton("CENTER");

f.add(b1, BorderLayout.NORTH);

f.add(b2, BorderLayout.SOUTH);

f.add(b3, BorderLayout.EAST);

f.add(b4, BorderLayout.WEST);

f.add(b5, BorderLayout.CENTER);

f.setSize(300, 300);

f.setVisible(true);

}

public static void main (String [] args)

{

new BorderLayout();

}

2) Grid layout

- The Java Grid layout class is used to arrange the components in rectangular grid.
- one component is displayed in each rectangle

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constructions:-

- Grid layout-()
- Grid layout (int rows, int columns)
- Grid layout (int rows, int columns, int hgap, int vgap)

3) Flow layout

- The java flow layout class is used to arrange the components in a line, one after another
- It is the default layout of the applet or panel field of flow layout class

1) public static final int LEFT

2) public static final int RIGHT

3) public static final int CENTER

4) public static final int LEADING

5) public static final int TRAILING

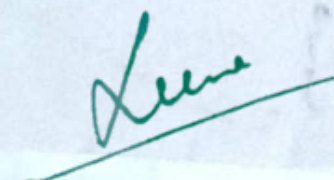
constructions:-

- flow layout-()
- flow layout (int align)
- flow layout (int align, int hgap, int vgap)

eg:- import java.awt.*;

import javax.swing.*;

public class flow layout . example


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```
JFrame frameObj;  
flow layout Example()
```

```
{
```

```
frame obj = new JFrame();
```

```
JButton b1 = new JButton("1");
```

```
JButton b2 = new JButton("2");
```

```
JButton b3 = new JButton("3");
```

```
JButton b4 = new JButton("4");
```

```
JButton b5 = new JButton("5");
```

```
frame obj.add(b1);
```

```
frame obj.add(b2);
```

```
frame obj.add(b3);
```

```
frame obj.add(b4);
```

```
frame obj.add(b5);
```

```
frame obj.setLayout(new FlowLayout());
```

```
frame obj.setSize(300,300);
```

```
frame obj.setVisible(true);
```

```
}
```

```
public static void main(String[] args)
```

```
{
```

```
new flow layout Example();
```

```
}
```

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Box layout

- The Java Box layout class is used to arrange the components either vertically or horizontally
- it is available in javax.swing package

Field of Box layout class

public static final int X_AXIS

public static final int Y_AXIS

public static final int LINE_AXIS

public static final int PAGE_AXIS

constructor:- Box layout (Container container)

eg:- import java.awt.*;

import javax.swing.*;

public class Box layout example extends JFrame

{
Button buttons[];

public Box layout Example()

{
buttons = new Button[5];

for(int i=0; i<5; i++)

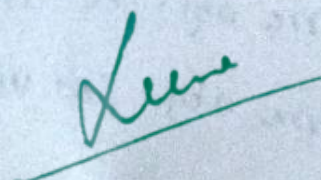
{

buttons[i] = new Button("Button " + i);

add(buttons[i]);

}

set layout (new Box layout (this Box layout . Y_AXIS));


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```
set visible (true);  
}
```

```
public static void main (String args[])
```

```
{  
    BoxLayout example = new BoxLayout (example);  
}
```

5) Card Layout

- The Java CardLayout class manages the components in such a manner that only one component is visible at a time.

constructors:- CardLayout ()

CardLayout (int hgap, int vgap)

common used method of CardLayout class

1) public void next (Container parent)

2) public void previous (Container parent)

3) public void first (Container parent)

4) public void last (Container parent)

5) public void show (Container parent)

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6) Grid bag layout

- The java, grid bag layout class is used to align components vertically, horizontally or along their baseline.
- The components may not be of same size.
- each grid bag layout object maintains a dynamic, rectangular grid of cells.
- each component is associated an instance of grid bag constraints.

constructors: - grid bag layout()

7) Group layout

- Group layout groups its components and place them in a container hierarchically.
- The grouping is done by instance of the Group class.
- Group is an abstract class, and two concrete classes which implements this group class are sequential group and ~~parallel group~~ parallel group.

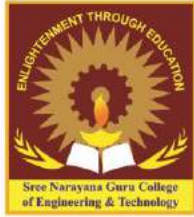
8) spring layout

- A spring layout positions the children of its associated container according to a set of constraints.

10/10
Nimish

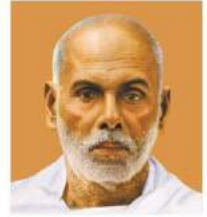
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DEPARTMENT OF ELECTRONICS AND COMMUNICATIONS ENGINEERING

DEGREE / BRANCH..... ECE
SEMESTER..... S5..... SUBJECT CODE..... ECT303
SUBJECT..... Digital Signal Processing.....
CLASSES
COMMENCING DATE..... 19/09/2022..... ENDING DATE..... 07/01/2023
ACADEMIC YEAR..... 2022-2023.....



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HOD ECE

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Mission

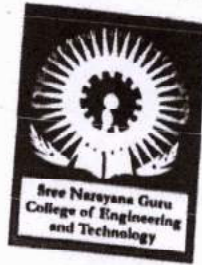
To provide technical education
of the highest quality and standard
of excellence for
socio-economic progress
embedded in clearly articulated values
and supported by commitments.

Vision

A knowledge society promoting
human excellence and
enlightenment through
effective education.

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[illegible][illegible]

CLASS ROLL NO.	NAME	M D H
1.	Deepna C (Female)	
2.	Hameera Sultana (F)	
3.	Sangay Sudhakara	
4.	Sooraj Suresh V.O	
5.	Thejasree T.K (Female)	
6.	Fathema Naeela M.V	
7.	Meghana Gangadhara	

19	19	22	22	22	23	23	29	29	30
2	5	2	3	4	4	5	2	4	1
A	A	X	X	X	A	A	X	X	X
X	A	X	X	Y	A	A	Y	Y	X
X	X	X	✓	X	A	A	X	X	X
A	A	A	A	A	X	X	X	X	X
X	A	X	X	Y	X	X	X	X	X
X	A	X	X	X	X	X	X	X	X
X	A	A	A	A	X	X	X	X	X

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12	12	12	12	12	12	12	12	12	12
3	3	3	5	6	6	7	7	7	7
2	4	5	6	3	4	1	1	1	1
X	X	X	X	X	X	X	X	X	X
X	X	X	A	X	X	X	X	X	X
X	X	X	X	Y	X	A	A	A	A
X	X	X	X	Y	X	X	X	X	X
X	X	X	X	Y	X	X	X	X	X
X	X	X	X	Y	X	X	X	X	X
X	X	X	X	Y	X	X	X	X	X
A	A	A	X	Y	Y	X	X	X	X

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Degree / Branch : BTECH / ECE

CLASS ROLL NO	NAME	MC DA HC
1.	Deepna. C (Female)	
2.	Hanisha Suthana (Fe)	
3.	Sanjay Sudhakara	
4.	Sooraj Suresh. V	
5.	Thejasree. T. K (Female)	
6.	Fathima Nasir. M. V	
7.	Meghana Gangadhar	

15	12	31	01	8	7	9	10	10
5	1	2	3	1	4	6	4	3
X	A	A	A	X	X	X	X	X
A	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X
A	X	X	X	X	X	X	X	X
A	X	X	X	X	X	X	X	X
A	X	X	X	X	X	X	X	X

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11	T	51
2.1	12	39 76
X	10	41 80
X	5	46 90
X	5	46 90
X	3	48 94
X	3	48 94
X	10	41 80

* * *

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Degree / Branch : BTECH / ECE

Series Exam

CLASS ROLL NO.	NAME	M/ D/ H
1.	Deepna. C (Female)	
2.	Haneena Sulthana (Fe	
3.	Sanjay Sudhakaran	
4.	Sooraj Suresh. V. G	
5.	Thejasree. T. K (Female)	
6.	Fathima Nasir. M. V (	
7.	Meghana Gangadhara	

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Assignment
No.

DETAILS

1. Properties of DFT, FFT & radix-2 FFT, types of windows.
2. Radix-2 FFT, DIF, DIT
3. Design of filters using different methods
4. Realization of digital filters
5. Architecture of DSP processor & finite word length effects.

DETAILS OF TEST

Test No.

DETAILS

1. Internal assessment - I - 05/11/2022
2. Internal assessment - II - 12/12/2022
3. Retest - 04/01/2023

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Subject: ECT303 Digital Signal Processing

Faculty Name: Abhaya D.K

- | | | | |
|---|------------|--------------------------|--------------------------|
| 1. Numerical problems related to DFT, convolution & overlap save method | 17/10/2022 | 20/10/2022 | 20/10/2022 |
| 2. Numerical problems related to radix-8 FFT DIF, DIT | 18/10/2022 | 25/10/2022 | 25/10/2022 |
| 3. Numerical problems related to design of linear phase filters | 31/10/2022 | 03/11/2022 | 03/11/2022 |
| 4. Numerical problems related to the realization of digital filters | 03/12/2022 | 06/12/2022 | 06/12/2022 |
| 5. Topics related to the architecture of DSP processor & finite word length effects | 21/12/22 | 03/01/2023
07/01/2023 | 03/01/2023
07/01/2023 |


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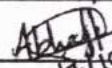


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TUTORIAL FORMAT FOR IQAC APPROVAL

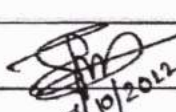
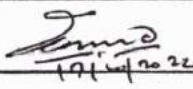
I. Details of Tutorial [to be filled by the faculty setting the question paper]

[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	Digital Signal Processing-ECT303
2	Name of the faculty and department	Abhaya D K ECE
3	Date of issue	17/10/2022
4	Date of submission	21/10/2022
5	Date of return	21/10/2022
6	Dated signature of the subject faculty	 17/10/2022

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	yes	
3	Whether questions are numbered correctly?	yes	
4	Whether marking scheme is attached?	yes	

Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	Maeza M  17/10/2022
Name and dated Signature of the Head of the Department	 17/10/2022 Prof. K. Raveendran

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TUTORIAL	1	Academic Year/Semester	2022-23 S5
Subject name with code	DIGITAL SIGNAL PROCESSING	Branch	ECE
Date of Issue	17/10/2022	Date of submission	21/10/2022

Q.No	QUESTIONS	Marks	CO	Level
1	Calculate the 4 point DFT of $\cos(\frac{n\pi}{4})$	5	1	3
2	Calculate the 4 point DFT of causal three sample sequence given by $x(n) = 1/3 ; 0 \leq n \leq 2$ $= 0 ; \text{else}$	5	1	3
3	Find the circular convolution of two sequences $x_1(n)$ and $x_2(n)$ using concentric circle and matrix multiplication method. $x_1(n) = \{1, -1, -2, 3, -1\}$ $x_2(n) = \{1, 2, 3\}$	5	1	3
4	Find the output $y(n)$ of a filter whose impulse response is $h(n) = \{1, 1, 2, 1\}$ and $x(n) = \{1, -1, 2, 1, 0, 1, -4, 3, 2, 1, 0, 1, 1\}$ using overlap save method.	5	1	3

CO - Course Outcome [CO]

CO 1: State and prove the fundamental properties and relations relevant to DFT and solve basic problems involving DFT based filtering methods

LEVEL - Bloom's Taxonomy Level

Level 1: Remember

Level 2: Understand

Level 3: Apply

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TUTORIAL	1	Academic Year/Semester	2022-23 SS
Subject name with code	DIGITAL SIGNAL PROCESSING	Branch	ECE
Date of Issue	17/10/2022	Date of submission	21/10/2022

Q.No	QUESTION	Marks	CO	Level
1	Equation 1 Solution 4	5	1	3
2	Equation 1 Solution 4	5	1	3
3	Equation 1 Solution 4	5	1	3
4	Equation 1 Solution 4	5	1	3

CO - Course Outcome [CO]

CO 1 :State and prove the fundamental properties and relations relevant to DFT and solve basic problems involving DFT based filtering methods

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Level 2: Understand

Level 3: Apply

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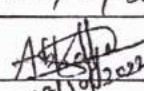
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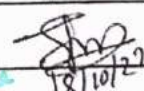
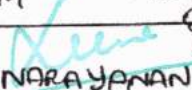
TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of Tutorial [to be filled by the faculty setting the question paper]
[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	Digital Signal Processing-ECT303
2	Name of the faculty and department	Abhaya D K ECE
3	Date of issue	18/10/2022
4	Date of submission	25/10/2022
5	Date of return	25/10/2022
6	Dated signature of the subject faculty	 18/10/2022

II. CHECK-LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	yes	
3	Whether questions are numbered correctly?	yes	
4	Whether marking scheme is attached?	yes	

Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	Meera M  18/10/22
Name and dated Signature of the Head of the Department	For LEENA NARAYANAN  18/10/22


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TUTORIAL	2	Academic Year/Semester	2022-23 S5
Subject name with code	DIGITAL SIGNAL PROCESSING	Branch	ECE
Date of Issue	18/10/2022	Date of submission	25/10/2022

Q.No	QUESTIONS	Marks	CO	Level
1	An 8-point sequence is given by $x(n) = \{2, 1, 2, 1, 1, 2, 1, 2\}$. Compute 8-point DFT of $x(n)$ by radix 2 DIT FFT.	5	II	3
2	An 8-point sequence is given by $x(n) = \{2, 1, 2, 1, 1, 2, 1, 2\}$. Compute 8-point DFT of $x(n)$ by radix 2 DIF FFT.	5	II	3

CO - Course Outcome [CO]

CO II: Compute DFT and IDFT using DIT and DIF radix-2 FFT algorithms.

LEVEL - Bloom's Taxonomy Level

Level 1: Remember

Level 2: Understand

Level 3: Apply

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TUTORIAL	2	Academic Year/Semester	2022-23/ S5
Subject name with code	DIGITAL SIGNAL PROCESSING	Branch	ECE
Date of Issue	18/10/2022	Date of submission	25/10/2022

Q.No	SCHEME	Marks	CO	Level
1	Steps (4) Answer (1)	5	II	3
2	Steps (4) Answer (1)	5	II	3

CO - Course Outcome [CO]

CO II: Compute DFT and IDFT using DIT and DIF radix-2 FFT algorithms.

LEVEL - Bloom's Taxonomy Level

Level 1: Remember

Level 2: Understand

Level 3: Apply

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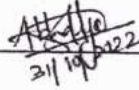
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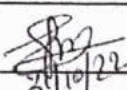
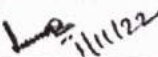
TUTORIAL FORMAT FOR IQAC APPROVAL

**I. Details of Tutorial [to be filled by the faculty setting the question paper]
ATTACH TUTORIAL QUESTION PAPER SEPARATELY**

Sl No.	Particulars	Details
1	Course name with code	Digital Signal Processing-ECT303
2	Name of the faculty and department	Abhaya D K ECE
3	Date of issue	31/10/2022
4	Date of submission	03/11/2022
5	Date of return	03/11/2022
6	Dated signature of the subject faculty	 31/10/2022

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	yes	
3	Whether questions are numbered correctly?	yes	
4	Whether marking scheme is attached?	yes	

Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	Meera M  31/10/22
Name and dated Signature of the Head of the Department	LEENA NARAYANAN  11/11/22

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TUTORIAL	3	<i>Academic Year/Semester</i>	2022-23 S5
<i>Subject name with code</i>	DIGITAL SIGNAL PROCESSING	<i>Branch</i>	ECE
<i>Date of Issue</i>	<i>31/10/2022</i>	<i>Date of submission</i>	<i>03/11/2022</i>

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Design a linear phase FIR low pass filter using hamming window by taking 5 samples of window sequence and with a cut off frequency $\omega_c=0.35\pi$ rad/sample.	5	III	3
2	Design a linear phase FIR band pass filter to pass frequencies in the range 0.35π to 0.48π rad/sample by taking 5 samples of rectangular window sequence.	5	III	3

CO - Course Outcome [CO]

CO III: Design linear phase FIR filters and IIR filters for a given specification.

LEVEL - Bloom's Taxonomy Level

Level 1: Remember

Level 2: Understand

Level 3: Apply

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<i>TUTORIAL</i>	3	<i>Academic Year/Semester</i>	2022-23/S5
<i>Subject name with code</i>	DIGITAL SIGNAL PROCESSING	<i>Branch</i>	ECE
<i>Date of Issue</i>	31/10/2022	<i>Date of submission</i>	03/11/2022

<i>Q.No</i>	<i>SCHEME</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Steps (4) Answer (1)	5	III	3
2	Steps (4) Answer (1)	5	III	3

CO - Course Outcome [CO]

CO III: Design linear phase FIR filters and IIR filters for a given specification.

LEVEL - Bloom's Taxonomy Level

Level 1: Remember
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Level 3: Apply

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TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of Tutorial [to be filled by the faculty setting the question paper]

[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	Digital Signal Processing-ECT303
2	Name of the faculty and department	Abhaya D K ECE
3	Date of issue	03/12/2022
4	Date of submission	06/12/2022
5	Date of return	06/12/2022
6	Dated signature of the subject faculty	Abhaya D K 03/12/22

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	yes	
3	Whether questions are numbered correctly?	yes	
4	Whether marking scheme is attached?	yes	

Recommendation remarks of the module coordinator and approval status	Approved
Modifications suggested by the module coordinator	Approved with following modifications
Name and dated signature of the module coordinator	Meena M 03/12/22
Name and dated Signature of the Head of the Department	LEENA NARAYANAN 03/12/22

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TUTORIAL	4	<i>Academic Year/Semester</i>	2022-23/S5
<i>Subject name with code</i>	DIGITAL SIGNAL PROCESSING ECT303	<i>Branch</i>	ECE
<i>Date of Issue</i>		<i>Date of submission</i>	

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Obtain the direct form I & II realization for a 3 rd order IIR transfer function which is expressed as $H(z) = \frac{0.28z + 0.319z + 0.04}{0.5z^3 + 0.3z^2 + 0.17z - 0.2}$	10	4	3
2	Determine the direct form II realization for the following system $y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.25x(n-2)$	5	4	3

CO - Course Outcome [CO]

CO4: Illustrate the various FIR and IIR filter structures for the realization of the given system function

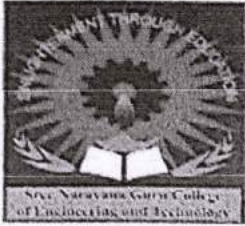
LEVEL - Bloom's Taxonomy Level

Level 1: Remember
Level 2: Understand
Level 3: Apply

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<i>TUTORIAL</i>	4	<i>Academic Year/Semester</i>	2022-23/S5
<i>Subject name with code</i>	DIGITAL SIGNAL PROCESSING ECT 303	<i>Branch</i>	ECE
<i>Date of Issue</i>		<i>Date of submission</i>	

<i>Q.No</i>	<i>SCHEME</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Direct form I Structure (3) Steps (2) Direct form II Structure (3) Steps (2)	10	4	3
2	Direct form II Structure (3) Steps (2)	5	4	3

CO - Course Outcome [CO]

CO4: Illustrate the various FIR and IIR filter structures for the realization of the given system function

LEVEL - Bloom's Taxonomy Level

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Level 3: Apply

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**SREE NARAYANA GURU COLLEGE OF ENGINEERING &
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TUTORIAL	5	<i>Academic Year/Semester</i>	2022-23/S5
<i>Subject name with code</i>	DIGITAL SIGNAL PROCESSING ECT303	<i>Branch</i>	ECE
<i>Date of Issue</i>		<i>Date of submission</i>	

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Explain about Harvard architecture and Pipelining method with neat diagram?	15	5	2
2	Describe with example fixed and floating points?	15	5	2
3	With neat diagram define MAC?	15	5	2
4	What you mean by ADC quantization noise?	15	5	2
5	In detail, explain the architecture of TMS320C67XX?	15	5	2
6	Write about quantization error in FFT algorithms?	15	5	2
7	Comment on finite word length effect in IIR digital filter coefficient quantization error	15	5	2

CO - Course Outcome [CO]

CO 5: Explain the architecture of DSP processor (TMS320C67xx) and the finite word length effects

LEVEL - Bloom's Taxonomy Level

Level 1: Remember
Level 2: Understand
Level 3: Apply

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TUTORIAL	5	Academic Year/Semester	2022-23/S5
Subject name with code	DIGITAL SIGNAL PROCESSING ECT303	Branch	ECE
Date of Issue		Date of submission	

Q.No	SCHEME	Marks	C'O	Level
1	Block Diagram (6) Explanation (9)	15	5	2
2	Block Diagram (6) Explanation (9)	15	5	2
3	Figures (6) Explanation (9)	15	5	2
4	Block Diagram (6) Explanation (9)	15	5	2
5	Figures (6) Explanation (9)	15	5	2
6	Block Diagram (6) Explanation (9)	15	5	2
7	Figures (6) Explanation (9)	15	5	2

CO - Course Outcome [CO]

CO 5: Explain the architecture of DSP processor (TMS320C67xx) and the finite word length effects

LEVEL - Bloom's Taxonomy Level

Level 1: Remember
Level 2: Understand
Level 3: Apply

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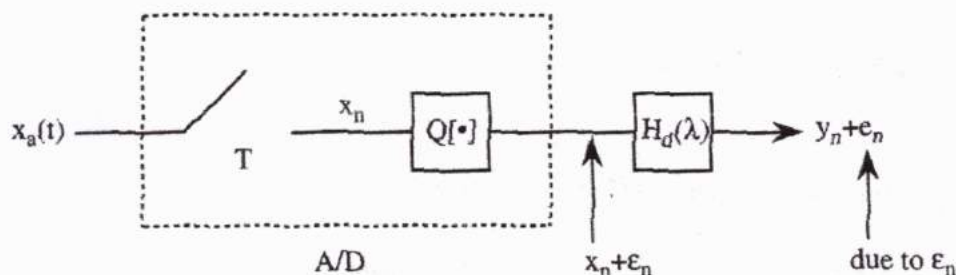
DIGITAL SIGNAL PROCESSING

Overview of Effects of Finite Register Length in DSP

- 1) Quantization in A/D
- 2) Coefficient inaccuracy
- 3) Arithmetic "roundoff"
 - a) "Roundoff noise"
 - b) Adder overflow
 - c) Zero-input limit cycles

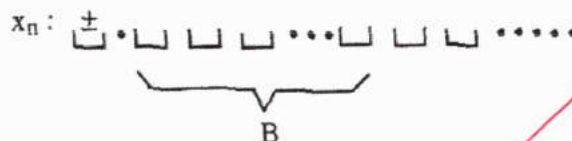
1) Quantization in A/D

The A/D employs a quantizer to round off the value of x_n to fit into the available register length. The rounding operation creates an error ϵ_n that propagates to the output of the DSP system. As an example of this, consider an A/D followed by a digital filter:



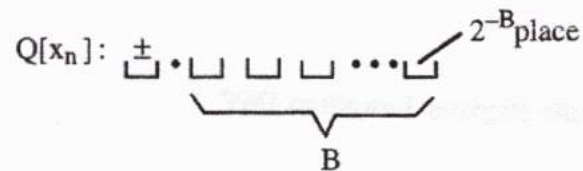
The quantizer Q is a nonlinearity. We will model it by the additive error source $\epsilon_n = Q[x_n] - x_n$

Assume a fixed-point binary arithmetic representation with B bits plus sign. Also assume $|x_a(t)| < 1$ so that x_n is a fraction. An exact binary representation of x_n would generally require an infinite number of bits:



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where each bit is a zero or a one. The quantizer Q rounds or truncates this representation to B bits plus sign:



Suppose $Q[\cdot]$ rounds to B bits plus sign. Then

$$-\frac{2^{-B}}{2} \leq \epsilon_n \leq \frac{2^{-B}}{2}$$

Assuming ϵ_n is a random variable, uniformly distributed on its range, the mean-squared value of ϵ_n is

$$E\{\epsilon_n^2\} = \frac{2^{-2B}}{12}$$

Here, E denotes the mean or probabilistic "average" and the above formula is computed as

$$\int_{-\frac{2^{-B}}{2}}^{\frac{2^{-B}}{2}} \frac{1}{2^{-B}} x^2 dx$$

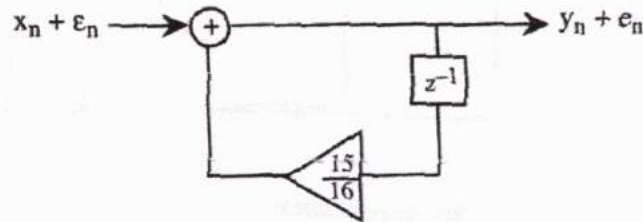
where $\frac{1}{2^{-B}}$ is the uniform probability density function.

Assuming that $\{\epsilon_n\}$ is an uncorrelated, identically distributed sequence of random variables, we can show that the output error of the digital filter is described by

$$E\{e_n^2\} = \frac{2^{-2B}}{12} \cdot \frac{1}{2\pi} \int_{-\pi}^{\pi} |H_d(\lambda)|^2 d\lambda$$

Example

Given the digital filter below, with A/D quantization noise at its input, find the resulting mean-squared error at the filter output.



Solution

$$E\{e_n^2\} = \frac{2^{-2B}}{12} \frac{1}{2\pi} \int_{-\pi}^{\pi} |H_d(\lambda)|^2 d\lambda$$

$$\stackrel{\uparrow}{=} \frac{2^{-2B}}{12} \sum_{n=0}^{\infty} |h_n|^2$$

Parseval

$$= \frac{2^{-2B}}{12} \sum_{n=0}^{\infty} \left[\left(\frac{15}{16} \right)^n \right]^2$$

$$= \frac{2^{-2B}}{12} \frac{1}{1 - \left(\frac{15}{16} \right)^2}$$

$$\approx 8.26 \left(\frac{2^{-2B}}{12} \right)$$

So, the filter increases the mean-squared value of the A/D quantization noise by a factor of about eight.

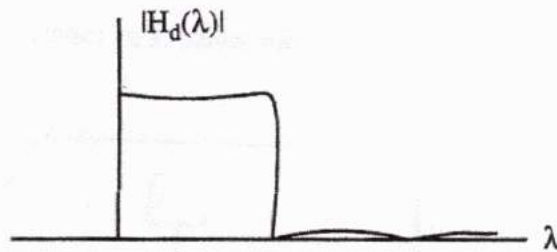
2) Coefficient Inaccuracy

Can be treated deterministically. Suppose the desired infinite-precision frequency response is

$$H_d(\lambda) = \prod_{i=1}^M \frac{a_{0i} + a_{1i} e^{-j\lambda} + a_{2i} e^{-j2\lambda}}{1 + b_{1i} e^{-j\lambda} + b_{2i} e^{-j2\lambda}}$$

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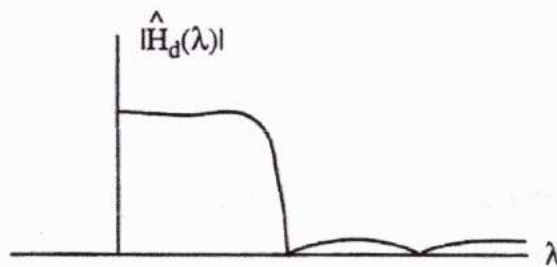


Then the actual frequency response after quantization of the filter coefficients will be

$$\hat{H}_d(\lambda) = \prod_{i=1}^M \frac{\hat{a}_{0i} + \hat{a}_{1i} e^{-j\lambda} + \hat{a}_{2i} e^{-j2\lambda}}{1 + \hat{b}_{1i} e^{-j\lambda} + \hat{b}_{2i} e^{-j2\lambda}}$$

where $\hat{a}_i = Q[a_i]$.

The result of coefficient inaccuracy is a deterministic degradation in the frequency response:



A sensitivity analysis can be helpful in determining, for a given filter structure, how badly the frequency response will be perturbed by a small change in the filter coefficients. Study:

$$\begin{aligned} \frac{\partial}{\partial a_k} |H_d(\lambda)|, & \quad \frac{\partial}{\partial b_k} |H_d(\lambda)|, \\ \frac{\partial}{\partial a_k} \angle H_d(\lambda), & \quad \frac{\partial}{\partial b_k} \angle H_d(\lambda) \end{aligned}$$

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Tutorial - 1

- 1) Calculate the 4 point DFT of $\cos(n\pi)$
- 2) Calculate the 4 point DFT of causal three sample sequence given by

$$x(n) = \frac{1}{3} ; 0 \leq n \leq 2$$

$$= 0 \text{ else}$$

- 3) Find the circular Convolution of two sequences $x_1(n)$ & $x_2(n)$ using concentric circle & matrix multiplication method.

$$x_1(n) = \{1, -1, -2, 3, -1\}$$

$$x_2(n) = \{1, 2, 3\}$$

- 4) Find the o/p $y(n)$ of a filter whose impulse response is $h(n) = \{1, 1, 2, 1\}$ and $x(n) = \{1, -1, 1, 2, 1, 0, 1, -4, 3, 2, 1, 0, 1, 1\}$ using overlap save method.

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$$= 1 + \frac{1}{\sqrt{2}} e^{-j\pi} + 0 + \frac{-1}{\sqrt{2}} e^{-j3\pi}$$

$$= 1 + \frac{1}{\sqrt{2}} e^{-j\pi} - \frac{1}{\sqrt{2}} e^{-j3\pi}$$

$$= 1 + \frac{-1}{\sqrt{2}} + \frac{1}{\sqrt{2}}$$

$$= 1$$

k=3

$$X(3) = 1 + \frac{1}{\sqrt{2}} e^{j\pi} - 0.707(-j) \cos 3\pi - j \sin 3\pi$$

$$X(3) = 1 + j1.414$$

$$X(k) = \{1, 1-j1.414, 1, 1+j1.414\}$$

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2) Calculate the 4 point DFT of causal three sample sequence given by

$$x(n) = \frac{1}{3}, 0 \leq n \leq 2$$

$$0, \text{ else}$$

$$x(n) = \frac{1}{3}, 0 \leq n \leq 2$$

$$x(n) = \left\{ \frac{1}{3}, \frac{1}{3}, \frac{1}{3} \right\}$$

$$X(k) = \sum_{n=0}^2 x(n) e^{-j2\pi kn/N}$$

$$X(0) = x(0) + x(1) + x(2)$$

$$= 1$$

$$X(1) = \frac{1}{3} + \frac{1}{3} e^{-j\pi} + \frac{1}{3} e^{j2\pi}$$

$$\frac{1}{3} - \frac{1}{3} + \frac{1}{3}$$

$$X(1) = \frac{1}{3}$$

1) Calculate the 4 point DFT of $\cos(\frac{n\pi}{4})$?

N=4

n=0, 1, 2, 3

$$x(n) = \cos \frac{n\pi}{4}$$

$$n=0 \cos 0 = 1$$

$$n=1 \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}} = 0.707$$

$$n=2 \cos \frac{2\pi}{4} = \frac{1}{\sqrt{2}} = 0.707$$

$$n=3 \cos \frac{3\pi}{4} = \frac{-1}{\sqrt{2}} = -0.707$$

$$x(n) = \left\{ 1, \frac{1}{\sqrt{2}}, 0, \frac{-1}{\sqrt{2}} \right\}$$

$$X(k) = \sum_{n=0}^3 x(n) e^{-j2\pi kn/N}$$

$$X(k) = \sum_{n=0}^3 x(n) e^{-j2\pi kn/N}$$

$$X(0) = x(0) e^{-j0} + x(1) e^{-j\pi/2} + x(2) e^{-j\pi} + x(3) e^{-j3\pi/2}$$

$$= 1 + \frac{1}{\sqrt{2}}(-j) - \frac{1}{\sqrt{2}} + j$$

$$= 1 - j1.414 + j1.414$$

$$= 1$$

$$= 1 + \frac{1}{\sqrt{2}} + 0 + \frac{-1}{\sqrt{2}}$$

$$= 1$$

k=1

$$X(1) = x(0) e^{-j0} + x(1) e^{-j\pi/2} + x(2) e^{-j\pi} + x(3) e^{-j3\pi/2}$$

$$= 1 + \frac{1}{\sqrt{2}} e^{-j\pi/2} + 0 + \frac{-1}{\sqrt{2}} e^{-j3\pi/2}$$

$$= 1 + \frac{1}{\sqrt{2}}(-j) - \frac{j}{\sqrt{2}}$$

$$= 1 - j\left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}\right)$$

$$= 1 - j1.414$$

k=2

$$X(2) = 1 + \frac{1}{\sqrt{2}} e^{-j\pi} + x(2) e^{-j2\pi} + x(3) e^{-j3\pi}$$

$$= 1 + \frac{1}{\sqrt{2}}(-1) + \frac{1}{\sqrt{2}} + (-1)$$

$$= 1 - \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} - 1$$

$$= 0$$

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$$x(n) = \{1, -1, 1, 2, 1, 0, 1, -4, 3, 2, 1, 0, 1, 1\}$$

$$x_1(n) = \{0, 0, 0, 1, -1, 1\}$$

$$x_2(n) = \{1, -1, 1, 2, 1, 0\}$$

$$x_3(n) = \{2, 1, 0, 1, -4, 3\}$$

$$x_4(n) = \{1, -4, 3, 2, 1, 0\}$$

$$x_5(n) = \{2, 1, 0, 1, 1, 0\}$$

$$h(n) = \{1, 1, 2, 1, 0, 0\}$$

$$h(n) = \{1, 1, 2, 1, 0, 0\}$$

$$y_1(n) = x(n) \times h(n)$$

0	1	-1	1	0	0	1
0	0	1	-1	1	0	1
0	0	0	1	-1	1	2
1	0	0	0	1	-1	1
-1	1	0	0	0	1	0
1	-1	1	0	0	0	0

$$= \begin{bmatrix} 0+1+(-2)+1+0+0 \\ 0+0+2+(-1)+0+0 \\ 0+0+0+1+0+0 \\ (-1)+0+0+0+0+0 \\ (-1)+1+0+0+0+0 \\ 1+(-1)+2+0+0+0 \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \\ 1 \\ 1 \\ 0 \\ 2 \end{bmatrix}$$

$$y_2(n) = x_2(n) \times h(n)$$

$$= 0 + (-1) + 6 + (-6) + 0$$

$$= -1$$

$$y(n) = \{8, -2, -1, -4, -1\}$$

Matrix Multiplication Method

$$x_1(n) = \begin{bmatrix} 1 & -1 & 3 & -2 & -1 \\ -1 & 1 & -1 & 3 & -2 \\ -2 & -1 & 1 & -1 & 3 \\ 3 & -2 & -1 & 1 & -1 \\ -1 & 3 & -2 & -1 & 1 \end{bmatrix} \quad x_2(n) = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 0 \\ 0 \end{bmatrix}$$

$$x_1(n) \times x_2(n)$$

$$= \begin{bmatrix} (1 \times 1) + (-1 \times 2) + (3 \times 3) + (-2 \times 0) + (-1 \times 0) \\ (-1 \times 1) + (1 \times 2) + (-1 \times 3) + (3 \times 0) + (-2 \times 0) \\ (-2 \times 1) + (-1 \times 2) + (1 \times 3) + (-1 \times 0) + (3 \times 0) \\ (3 \times 1) + (-2 \times 2) + (-1 \times 3) + (1 \times 0) + (-1 \times 0) \\ (-1 \times 1) + (3 \times 2) + (-2 \times 3) + (-1 \times 0) + (1 \times 0) \end{bmatrix}$$

$$= \begin{bmatrix} 1+(-2)+9+0+0 \\ (-1)+(2)+(-3)+0+0 \\ (-2)+(-2)+3+0+0 \\ 3+(-4)+(-3)+0+0 \\ (-1)+6+(-6)+0+0 \end{bmatrix} = \begin{bmatrix} 8 \\ -2 \\ -1 \\ -4 \\ -1 \end{bmatrix}$$

$$y(n) = \{8, -2, -1, -4, -1\}$$

4) Find the o/p $y(n)$ of a filter whose impulse response is $h(n) = \{1, 1, 2, 1\}$ and $x(n) = \{1, -1, 1, 2, 1, 0, 1, -4, 3, 2, 1, 0, 1, 1\}$ using overlap save method.

$$Lx(n) = 14$$

$$Mh(n) = 4$$

$$Lx(n) = 14$$

$$= 4 - 1 = 3$$

add 3 zeros to left side

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$$y_4(n) = \begin{bmatrix} 1 & 0 & 1 & 2 & 3 & -4 \\ -4 & 1 & 0 & 1 & 2 & 3 \\ 3 & -4 & 1 & 0 & 1 & 2 \\ 2 & 3 & -4 & 1 & 0 & 1 \\ 1 & 2 & 3 & -4 & 1 & 0 \\ 0 & 1 & 2 & 3 & -4 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 2 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

$$= \begin{bmatrix} 1+0+2+0+0+2 \\ (-4)+1+0+1+0+0 \\ 2+3+(-4)+1+0+0 \\ 1+2+6+(-4)+0+0 \\ 0+1+4+3+0+0 \end{bmatrix} = \begin{bmatrix} 5 \\ -2 \\ -2 \\ 5 \\ 8 \end{bmatrix}$$

$$y_5(n) = x_5(n) \times h(n)$$

$$y_5(n) = \begin{bmatrix} 2 & 0 & 1 & 1 & 0 & 1 \\ 1 & 2 & 0 & 1 & 1 & 0 \\ 0 & 1 & 2 & 0 & 1 & 1 \\ 1 & 0 & 1 & 2 & 0 & 1 \\ 1 & 1 & 0 & 1 & 2 & 0 \\ 0 & 1 & 1 & 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 2 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

$$= \begin{bmatrix} 2+0+2+1+0+0 \\ 1+2+0+1+0+0 \\ 0+1+4+0+0+0 \\ 1+0+2+2+0+0 \\ 0+1+2+1+0+0 \end{bmatrix} = \begin{bmatrix} 5 \\ 4 \\ 5 \\ 5 \\ 3 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 1 & 1 & 0 & 2 \\ 5 & 1 & 2 & 2 & 4 & 6 \\ -2 & 5 & 8 & 5 & -2 & 1 \\ 5 & -2 & 1 & -2 & 5 & 8 \\ 1 \end{bmatrix}$$

$$x_5(n) = \begin{bmatrix} 1 \\ -1 \\ 1 \\ 2 \\ 1 \\ 0 \end{bmatrix}$$

$$y_2(n) = \begin{bmatrix} 1 & 0 & 1 & 2 & 1 & -1 \\ -1 & 1 & 0 & 1 & 2 & -1 \\ 1 & -1 & 1 & 0 & 1 & 2 \\ 2 & 1 & -1 & 1 & 0 & 1 \\ 1 & 2 & 1 & -1 & 1 & 0 \\ 0 & 1 & 2 & 1 & -1 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 2 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

$$= \begin{bmatrix} 1+0+2+2+0+0 \\ -1+1+0+1+0+0 \\ 1+(-1)+2+0+0+0 \\ 2+1+(-2)+1+0+0 \\ 1+2+2+(-1)+0+0 \\ 0+1+4+1+0+0 \end{bmatrix} = \begin{bmatrix} 5 \\ 1 \\ 2 \\ 2 \\ 4 \\ 1 \end{bmatrix}$$

$$y_2(n) = x_2(n) \times h(n)$$

$$y_3(n) = \begin{bmatrix} 2 & 3 & -4 & 1 & 0 & 1 \\ 1 & 2 & 3 & -4 & 1 & 0 \\ 0 & 1 & 2 & 3 & -4 & 1 \\ 1 & 0 & 1 & 2 & 3 & -4 \\ -4 & 1 & 0 & 1 & 2 & 3 \\ 3 & -4 & 1 & 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 2 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

$$= \begin{bmatrix} 2+3+(-8)+1+0+0 \\ 1+2+6+(-4)+0+0 \\ 0+1+4+3+0+0 \\ 1+0+2+2+0+0 \\ (-4)+1+0+1+0+0 \\ 3+(-4)+2+0+0+0 \end{bmatrix} = \begin{bmatrix} -2 \\ 5 \\ 8 \\ 5 \\ -2 \\ 1 \end{bmatrix}$$

$$y_4(n) = x_4(n) \times h(n)$$

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Step 3: $M = \log_2 N$

$3 = \log_2 8$

Step 4: $N = 8$ point
 $N = 8$

$\frac{8}{2} = 4$ no. of butterflies

Step 5: here $M = 3$

So 3 stages

$m=1$ $2^{m-1} = 2^{1-1} = 1$ Samples
 $m=2$ $2^{m-1} = 2^{2-1} = 2$ Samples
 $m=3$ $2^{m-1} = 2^{3-1} = 4$ Samples

Step 6: $\frac{N}{2} \log_2 N$
 $= 4 \times \log_2 8 = 4 \times 3 = 12$

Step 7: $N \log_2 N = 8 \times 3 = 24$

Step 8: $k = \frac{N \times t}{2^m}$

$m=1$ $k = \frac{N \times t}{2^1} = \frac{8 \times 0}{2} = 0$
 $m=2$ $k = \frac{N \times t}{2^2} = \frac{8 \times 0}{4} = 0$
 $m=3$ $k = \frac{N \times t}{2^3} = \frac{8 \times 0}{8} = 0$
 $t=1$ $k = \frac{N \times t}{2^3} = \frac{8 \times 1}{8} = 1$
 $t=2$ $k = \frac{N \times t}{2^3} = \frac{8 \times 2}{8} = 2$
 $t=3$ $k = \frac{N \times t}{2^3} = \frac{8 \times 3}{8} = 3$

Tutorial -2

1) An 8 point Sequence is given by $x(n) = \{2, 1, 2, 1, 1, 2, 1, 2\}$. Compute 8 point DFT of $x(n)$ by radix 2 DIT FFT.

Step 1: $N = 2^M$

$2^M = 8$

$M = 3$

Step 2:

Index	Binary Representation	Bit reversal Index	Bit reversal Index
0	000	000	0
1	001	100	4
2	010	010	2
3	011	110	6
4	100	001	1
5	101	101	5
6	110	011	3
7	111	111	7

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$m=3$
 $6+6=12=X(0)$
 $(1-j)+(1+j)\left(\frac{1}{\sqrt{2}}-j\frac{1}{\sqrt{2}}\right) = 1-j-\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{2}} = 1+j\left(-1+\frac{2}{\sqrt{2}}\right) = 1+j0.414 = X(1)$
 $0+0 \times (-j) = 0 = X(2)$
 $(1+j)+(-1-j)\left(-\frac{1}{\sqrt{2}}-j\frac{1}{\sqrt{2}}\right) = 1+j+\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{2}} = 1+j\left(1+\frac{2}{\sqrt{2}}\right) = 1+j2.414 = X(3)$
 $0-6=0=X(4)$
 $(1-j)-(-1+j)\left(\frac{1}{\sqrt{2}}-j\frac{1}{\sqrt{2}}\right) = 1-j-\left(-\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{2}}\right) = 1-j\left(1+\frac{2}{\sqrt{2}}\right) = 1-j2.414 = X(5)$
 $0-0 \times (-j) = 0 = X(6)$
 $(1+j)-(-1-j)\left(-\frac{1}{\sqrt{2}}-j\frac{1}{\sqrt{2}}\right) = 1+j-\left(\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{2}}\right) = 1+j\left(1-\frac{2}{\sqrt{2}}\right) = 1-j0.414 = X(7)$

$w_8^0 = e^{-j\frac{2\pi \times 0}{8}} = e^0 = 1$
 $w_8^1 = e^{-j\frac{2\pi \times 1}{8}} = e^{-j\frac{\pi}{4}} = \cos\left(-\frac{\pi}{4}\right) + j\sin\left(-\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}} - j\frac{1}{\sqrt{2}}$
 $w_8^2 = e^{-j\frac{2\pi \times 2}{8}} = e^{-j\frac{\pi}{2}} = \cos\left(-\frac{\pi}{2}\right) + j\sin\left(-\frac{\pi}{2}\right) = -j$
 $w_8^3 = e^{-j\frac{2\pi \times 3}{8}} = e^{-j\frac{3\pi}{4}} = \cos\left(-\frac{3\pi}{4}\right) + j\sin\left(-\frac{3\pi}{4}\right) = -\frac{1}{\sqrt{2}} - j\frac{1}{\sqrt{2}}$

at $t=0$
 $k=t=0$

at $t=1$ $k=t=1$

at $t=2$ $k=t=2$

at $t=3$ $k=t=3$

Step 9: 2^{M-m} $m=1, 2, 3$

$m=1$
 $2^{3-1} = 2^2 = 4$ butterflies

$m=2$
 $2^{3-2} = 2^1 = 2$ butterflies

$m=3$
 $2^{3-3} = 2^0 = 1$ butterfly

4, 2, 1 no. of butterflies

Step 10: 2^{M-m}

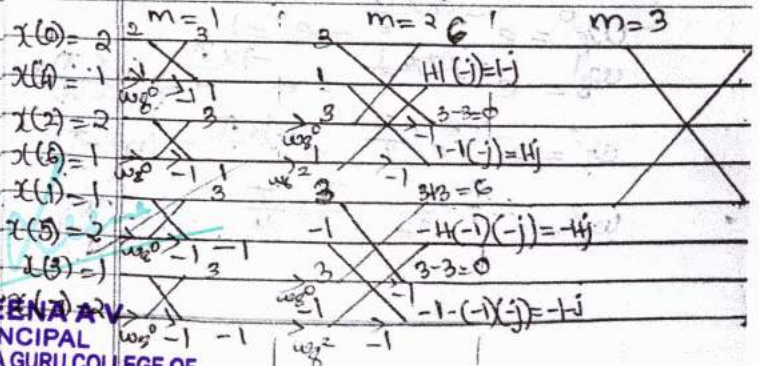
$m=1$ $m=2$ $m=3$
 2^{3-1} 2^{3-2} 2^{3-3}
 $= 2^2$ $= 2^1$ $= 2^0$
 $= 4$ $= 2$ $= 1$

4, 2, 1 are no. of times

$m=1$ 4 times

$m=2$ 2 times

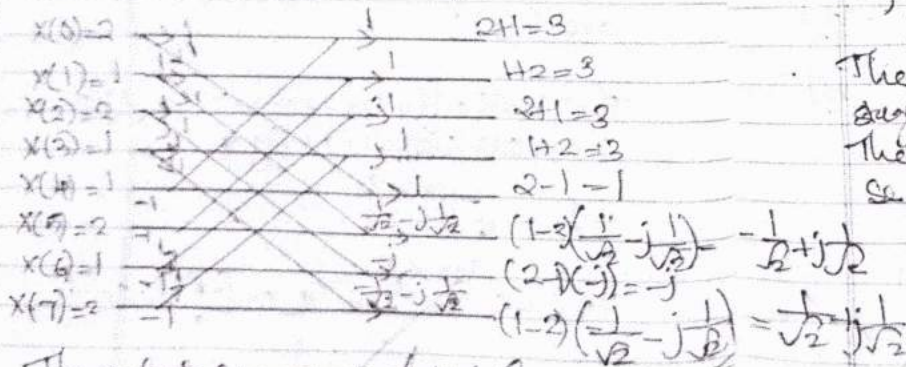
$m=3$ 1 time



$$w_8^3 = e^{-j2\pi \times \frac{3}{8}} = e^{-j\frac{3\pi}{4}}$$

$$= \cos\left(-\frac{3\pi}{4}\right) + j\sin\left(-\frac{3\pi}{4}\right)$$

$$= -\frac{1}{\sqrt{2}} - j\frac{1}{\sqrt{2}}$$



The output sequence of first stage of computation = $\{3, 3, 3, 3, 1, \frac{1}{\sqrt{2}} + j\frac{1}{\sqrt{2}}, -j\frac{1}{\sqrt{2}} + j\frac{1}{\sqrt{2}}\}$

Second stage computation

The input sequence for second stage of computation = $\{3, 3, 3, 3, 1, \frac{1}{\sqrt{2}} + j\frac{1}{\sqrt{2}}, -j\frac{1}{\sqrt{2}} + j\frac{1}{\sqrt{2}}\}$

The phase factors involved in second stage computation are w_4^0 and w_4^1 . The butterfly computations of second stage are shown in fig 5.

$$\therefore \text{DFT}\{x(n)\} = X(k) = 8$$

$$= \{12, 1+j0.414, 0, 1+j2.414, 0, 1-j2.414, 0, 1-j0.414\}$$

a) An 8 point Sequence is given by $x(n) = \{2, 1, 2, 1, 1, 2, 1, 2\}$. Compute 8 point DFT of $x(n)$ by radix 2 DIF FFT.

For 8 point DFT by radix-2 FFT we require 3 stages of computation with 4 butterfly computation in each stage. The given sequence is the input to first stage. For other stages of computations, the output of previous stage will be the input for current stage.

First stage computation

The input sequence for first stage of computation = $\{2, 1, 2, 1, 1, 2, 1, 2\}$

The phase factors involved in first stage computation are w_8^0, w_8^1, w_8^2 and w_8^3 .

The butterfly computations of first stage are shown in fig 4.

$$w_8^0 = e^{-j2\pi \times \frac{0}{8}} = 1$$

$$w_8^1 = e^{-j2\pi \times \frac{1}{8}} = e^{-j\frac{\pi}{4}} = \cos\left(-\frac{\pi}{4}\right) + j\sin\left(-\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}} - j\frac{1}{\sqrt{2}}$$

$$w_8^2 = e^{-j2\pi \times \frac{2}{8}} = e^{-j\frac{\pi}{2}} = \cos\left(-\frac{\pi}{2}\right) + j\sin\left(-\frac{\pi}{2}\right) = -j$$

$6+6=12=X(0)$
 $6-6=0=X(4)$
 $0+0=0=X(2)$
 $0-0=0=X(6)$
 $(1-j)+j\frac{2}{\sqrt{2}}=1+j0.414=X(1)$
 $(1-j)-j\frac{2}{\sqrt{2}}=1-j2.414=X(5)$
 $(1+j)+j\frac{2}{\sqrt{2}}=1+j2.414=X(3)$
 $(1+j)-j\frac{2}{\sqrt{2}}=1-j0.414=X(7)$

The output sequence of third stage of computation = $\{12, 0, 0, 0, 1+j0.414, 1-j2.414, 1+j2.414, 1-j0.414\}$
 The output sequence of third stage of computation is the Spinal DFT of the given sequence in bit reversed order.

In DIF FFT algorithm the input to

1st stage is in normal order and the output of third stage will be in the bit reversed order. Hence the actual result is obtained by arranging the output sequence of third stage in normal order as shown below.

The sequence $X(k)$ in bit reversed order	The sequence $X(k)$ in normal order
$X(0)=12$	$X(0)=12$
$X(4)=0$	$X(1)=1+j0.414$
$X(2)=0$	$X(2)=0$
$X(6)=0$	$X(3)=1+j2.414$
$X(1)=1+j0.414$	$X(4)=0$
$X(5)=1-j2.414$	$X(5)=1-j2.414$
$X(3)=1+j2.414$	$X(6)=0$
$X(7)=1-j0.414$	$X(7)=1-j0.414$

$3+3=6$
 $3+3=6$
 $3-3=0$
 $(3-3)(-j)=0$
 $H(-j)=1-j$
 $(\frac{-1}{\sqrt{2}}+j\frac{1}{\sqrt{2}})+(\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}})j\frac{2}{\sqrt{2}}$
 $1-(-j)=1+j$
 $[(\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}})-(\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}})(-j)]=j\frac{2}{\sqrt{2}}$

$$w_4^0 = e^{-j2\pi \times \frac{0}{4}} = 1$$

$$\begin{aligned}
 w_4^1 &= e^{-j2\pi \times \frac{1}{4}} = e^{-j\frac{\pi}{2}} \\
 &= \cos\left(-\frac{\pi}{2}\right) + j\sin\left(-\frac{\pi}{2}\right) \\
 &= -j
 \end{aligned}$$

The output sequence of second stage of computation = $\{6, 6, 0, 0, 1+j, j\frac{2}{\sqrt{2}}\}$
 $1+j, j\frac{2}{\sqrt{2}}$

Third stage computation

The input sequence to third stage of computation = $\{6, 6, 0, 0, 1+j, j\frac{2}{\sqrt{2}}, 1+j, j\frac{2}{\sqrt{2}}\}$

The butterfly computations of third stage are shown in fig 6

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$$h_d(n) = \frac{1}{2\pi} \int_{-\pi}^{\pi} H_d(e^{j\omega}) e^{j\omega n} d\omega$$

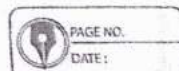
$$= \frac{1}{2\pi} \int_{-\pi}^{\pi} H_d(e^{j\omega}) e^{j\omega n} d\omega$$

$$= \frac{1}{2\pi} \int_{-0.35\pi}^{0.35\pi} 1 \cdot e^{j\omega n} d\omega$$

$$= \frac{1}{2\pi} \left[\frac{e^{j\omega n}}{jn} \right]_{-0.35\pi}^{0.35\pi}$$

$$= \frac{1}{2\pi j n} \left[e^{j0.35\pi n} - e^{-j0.35\pi n} \right]$$

$$= \frac{1}{2\pi j n} \cdot 2j \sin(0.35\pi n) = \frac{\sin(0.35\pi n)}{\pi n}$$



$$h_d(n) = \frac{\sin(0.35\pi n)}{\pi n}$$

$$\lim_{n \rightarrow 0} \frac{\sin(0.35\pi n)}{\pi n} = 0.35$$

$$\lim_{n \rightarrow 0} \frac{\sin(0.2\pi n)}{0.2\pi n} \times 0.2$$

$$= 0.2 \times 1 = 0.2$$

$$\lim_{n \rightarrow 0} \frac{\sin(0.35\pi n)}{0.35\pi n} \times 0.35$$

$$= 0.35 \times 1 = 0.35$$

when $n = 0, 0.2$

Step 3: Choose the window sequence $w(n)$ and multiply it with $h_d(n)$ to convert the infinite duration impulse response to finite duration impulse response

$$h(n) = h_d(n) \times w(n)$$



$$\therefore \text{DFT}\{x(n)\} = X(k) =$$

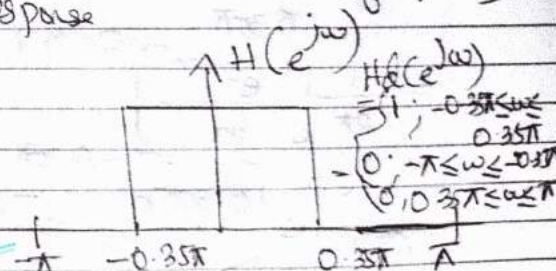
$$\{1, 1+j0.414, 0, 1-j0.414, 0,$$

$$1-j0.414, 0, 1+j0.414\}$$

Tutorial-3

- 1) Design a linear phase FIR lowpass filter using hamming window with 8 samples of window sequence and with a cutoff frequency $\omega_c = 0.35\pi$ rad/sample.

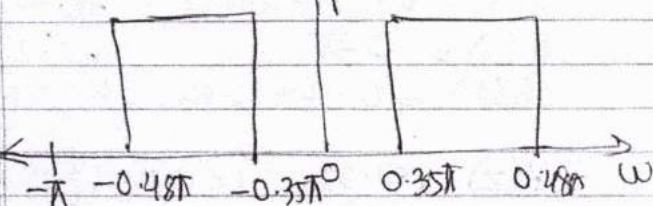
Step 1: Plot the desired frequency response



Step 2: find inverse fourier transform

Step 1: plot desired frequency response

$H_d(e^{j\omega})$



Step 2: find inverse Fourier transform

$$H_d(e^{j\omega}) = \begin{cases} 1 & -0.48\pi \leq \omega \leq 0.35\pi \\ 0 & 0.35\pi \leq \omega \leq 0.48\pi \\ 0 & -\pi \leq \omega \leq -0.48\pi \\ 0 & -0.35\pi \leq \omega \leq 0 \end{cases}$$

Step 2: find inverse Fourier transform

$$h_d(n) = \frac{1}{2\pi} \int_{-\pi}^{\pi} H_d(e^{j\omega}) e^{j\omega n} d\omega$$

$$= \frac{1}{2\pi} \int_{-0.48\pi}^{0.35\pi} e^{j\omega n} d\omega + \frac{1}{2\pi} \int_{0.35\pi}^{0.48\pi} e^{j\omega n} d\omega$$

$$= \frac{1}{2\pi} \left[\frac{e^{j\omega n}}{jn} \right]_{-0.48\pi}^{0.35\pi} + \frac{1}{2\pi} \left[\frac{e^{j\omega n}}{jn} \right]_{0.35\pi}^{0.48\pi}$$

$$= \frac{1}{2\pi jn} \left[e^{j0.35\pi n} - e^{-j0.48\pi n} \right] + \frac{1}{2\pi jn} \left[e^{j0.48\pi n} - e^{j0.35\pi n} \right]$$

$$= \frac{1}{2\pi jn} \left[e^{j0.35\pi n} - e^{-j0.48\pi n} - e^{j0.48\pi n} + e^{j0.35\pi n} \right]$$

$$= \frac{1}{2\pi jn} \left[2e^{j0.35\pi n} - e^{-j0.48\pi n} - e^{j0.48\pi n} \right]$$

$$h_d(n) = \frac{\sin(0.48\pi n) - \sin(0.35\pi n)}{\pi n}$$

Step 3: choose the window sequence $w(n)$ & multiply it with $h_d(n)$ to correct

hanning window

$$w_H(n) = 0.54 + 0.46 \cos\left(\frac{2\pi n}{N-1}\right)$$

for $-\frac{(N-1)}{2}$ to $+\frac{(N-1)}{2}$

$$N = 5 \left(\frac{5-1}{2} \right) \text{ to } \left(\frac{5-1}{2} \right) = -2 \text{ to } 2$$

$$H(n) = \frac{1}{N} \sum_{k=0}^{N-1} h_d\left(\frac{n-k}{N}\right)$$

$$= \frac{1}{5} \left[h_d\left(\frac{n-0}{5}\right) + h_d\left(\frac{n-1}{5}\right) + h_d\left(\frac{n-2}{5}\right) + h_d\left(\frac{n-3}{5}\right) + h_d\left(\frac{n-4}{5}\right) \right]$$

$$= 0.7$$

$$h(n) = h_d(n) \times w_H(n)$$

$$w_H(0) = 0.54 + 0.46 \cos\left(\frac{2\pi \times 0}{5-1}\right)$$

$$w_H(0) = 0.54 + 0.46 \cos(0)$$

$$= 0.54 + 0.46 = 1$$

$$h(0) = h_d(0) \times w_H(0) = 0.35 \times 1 = 0.35$$

$$h(1) = h_d(1) \times w_H(1) = 0.35 \times 0.54 = 0.189$$

$$h(2) = 0.283674 = h(-2)$$

$$H(z) = 0.35z^{-2} + 0.189[z^{-1} + z^{-3}] + 0.0103[1 + z^4]$$

2) Design a linear phase FIR bandpass filter to pass frequencies in the range 0.35π to 0.48π rad/sample by taking 5 samples of rectangular window sequence.

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Tutorial - 4

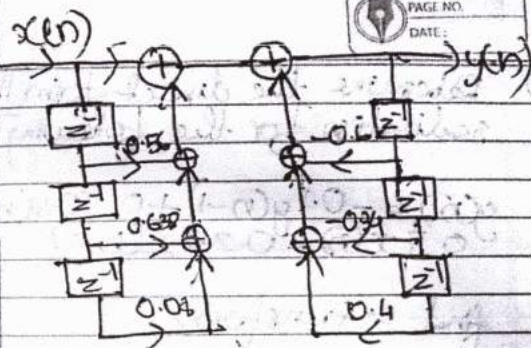
Obtain the direct form - I realization for a 3 poles IIR transfer function which is expressed as

$$H(z) = \frac{0.25z^2 + 0.319z + 0.04}{0.5z^3 + 0.3z^2 + 0.17z - 0.2}$$

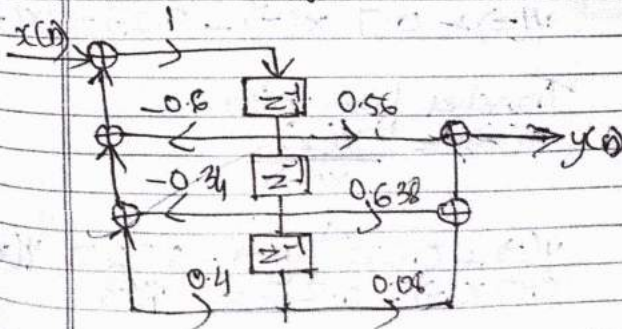
multiply $2x = z^{-3}$ numerator & denominator

$$= \frac{(0.25z^2 + 0.319z + 0.04) \times 2z^3}{(0.5z^3 + 0.3z^2 + 0.17z - 0.2) \times 2z^3}$$

$$= \frac{0.5z^5 + 0.638z^4 + 0.08z^3}{1.0z^6 + 0.6z^5 + 0.34z^4 - 0.4z^3}$$



Direct form - I



the infinite duration impulse response to finite duration impulse response

$$h(n) = h_d(n) \times w_{H(n)}$$

$$h_d(0) = 16 \sin 0.48\pi n - 16 \sin 0.35\pi n$$

$$h_d(0) = 0.48 - 0.35 = 0.13$$

$$h(n) = h_d(n) \times w_{H(n)}$$

$$h(0) = h_d(0) \times 1 = 0.13$$

$$h(1) = h_d(1) \times w_{H(1)} = -0.108$$

$$h(2) = h_d(2) \times w_{H(2)} = 0.0340$$

Step 4: Z transform

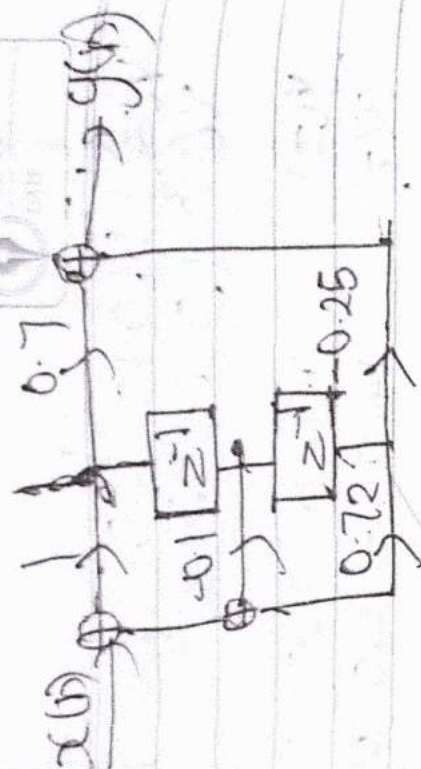
$$\frac{N-1}{2} = \frac{5-1}{2} = 2$$

$$H(z) = 0.13z^2 + 0.0340[z + z^{-3}] - 0.108[1 + z^{-4}]$$

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Determine the direct form II realisation for the following system

$$y[n] = -0.1y[n-1] + 0.72y[n-2] + 0.7x[n] - 0.25x[n-2]$$

find z-transform

$$Y(z) = -0.1z^{-1}Y(z) + 0.72z^{-2}Y(z) + 0.7X(z) - 0.25z^{-2}X(z)$$

Transfer function

$$H(z) = \frac{Y(z)}{X(z)}$$

$$Y(z) + 0.1z^{-1}Y(z) - 0.72z^{-2}Y(z) = 0.7X(z) - 0.25z^{-2}X(z)$$

$$\frac{Y(z)}{X(z)} \left[1 + 0.1z^{-1} - 0.72z^{-2} \right] = \frac{0.7 - 0.25z^{-2}}{1 + 0.1z^{-1} - 0.72z^{-2}}$$

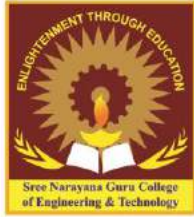
$$\frac{Y(z)}{X(z)} = \frac{0.7 - 0.25z^{-2}}{1 + 0.1z^{-1} - 0.72z^{-2}}$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{Y(z)}{\omega(z)} \times \frac{\omega(z)}{X(z)}$$

$$\omega(z) = 1$$

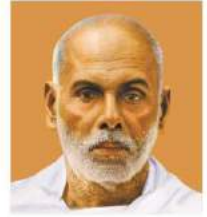
$$= \left(\frac{0.7 - 0.25z^{-2}}{1} \right) \left(\frac{1}{1 + 0.1z^{-1} - 0.72z^{-2}} \right)$$

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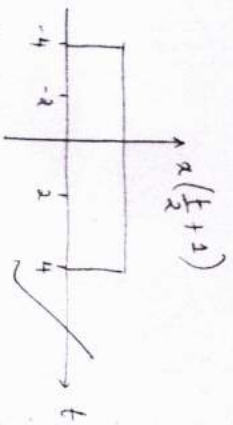
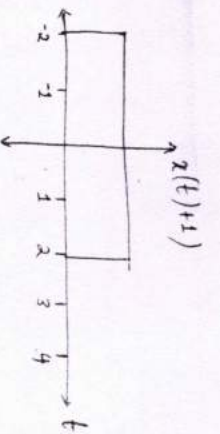


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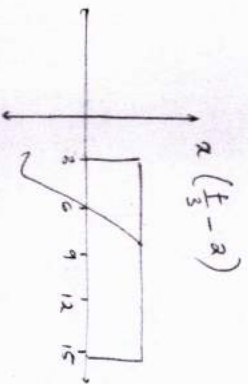
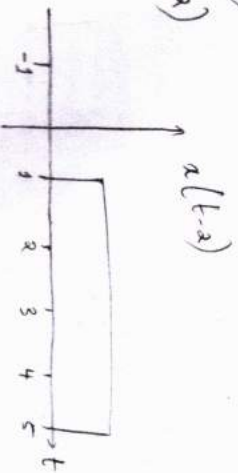
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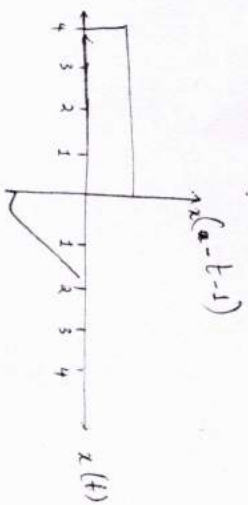
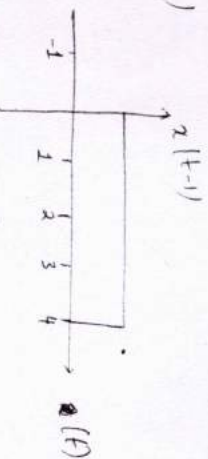
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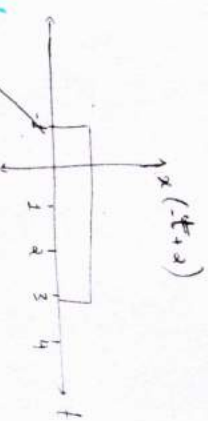
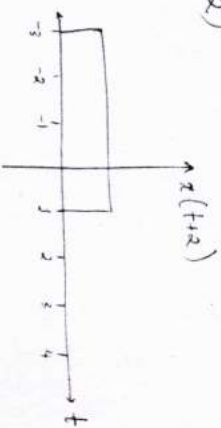
c) $x\left(-\frac{t-6}{3}\right)$
i.e., $x\left(\frac{t}{3}-2\right)$



d) $x(-t-1)$



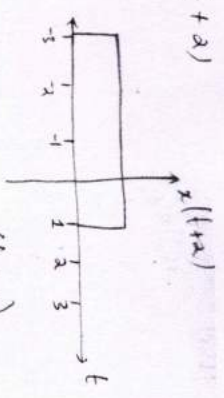
e) $x(-t+2)$



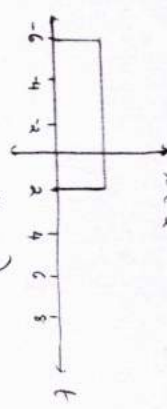
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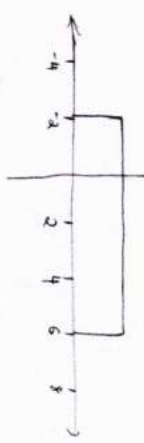
4) $x(-\frac{t}{2} + 2)$



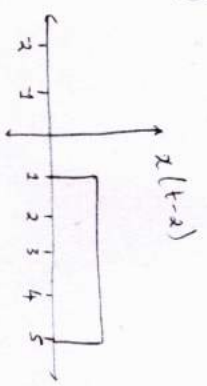
$x(\frac{t}{2} + 2)$



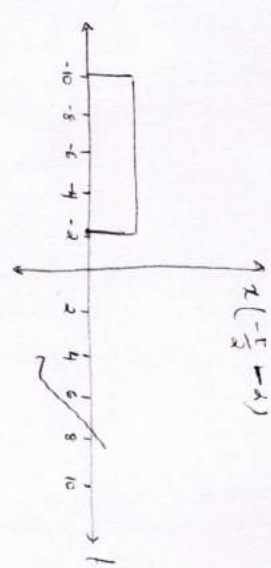
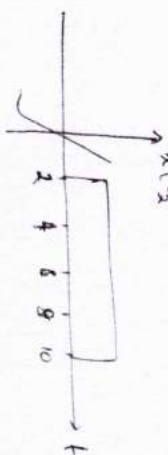
$x(\frac{t}{2} + 2)$



g) $x(-\frac{t}{2} - 2)$



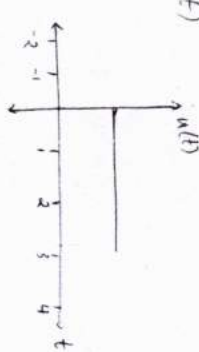
$x(\frac{t}{2} - 2)$



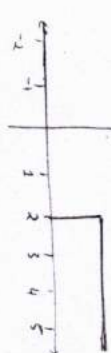
2] Sketch the waveform

$u(t) - u(t-2)$

Solution: $u(t)$

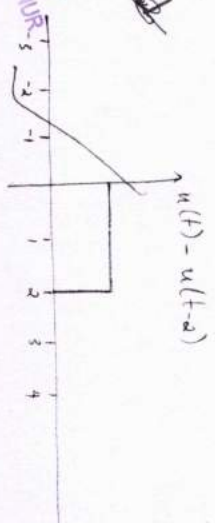


$u(t-2)$



$1+3$

$\frac{10}{10}$

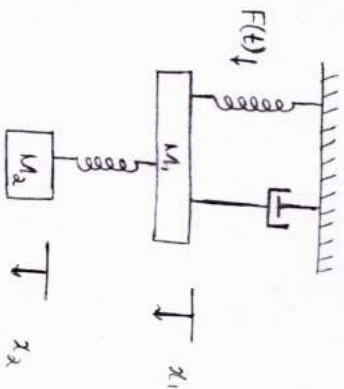


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TUTORIAL-2

Q: Write the diff. equations governing the behaviour of the mechanical system given



Consider M_1 ,

$$k_{12}(x_1 - x_2) + M_1 \frac{d^3 x_1}{dt^3} + B_1 \frac{dx_1}{dt} + k_1 x_1 = f(t)$$

Taking Laplace Transform,

$$k_{12} [X_1(s) - X_2(s)] + M_1 s^3 X_1(s) + B_1 s X_1(s) + k_1 X_1(s) = F(s)$$

$$-k_{12} X_2(s) + X_1(s) [M_1 s^3 + B_1 s + k_1 + k_{12}] = F(s)$$

$$M_1 s^3 \frac{dx_1}{dt^3} + k_{12} (x_1 - x_2) = 0$$

$$M_2 s^3 X_2(s) + [k_{12} X_2(s) - X_1(s)] = 0$$

$$X(s) [M_2 s^3 + k_{12}] - k_{12} X_1(s) = 0$$

$$X(s) [M_2 s^3 + k_{12}] = k_{12} X_1(s)$$

$$X(s) = \frac{k_{12} X_1(s)}{M_2 s^3 + k_{12}}$$

② in ①

$$X_1(s) [M_1 s^3 + B_1 s + k_1 + k_{12}] - k_{12} \left[\frac{k_{12} X_1(s)}{M_2 s^3 + k_{12}} \right] = F(s)$$

$$\left[M_1 s^3 + B_1 s + k_1 + k_{12} - \frac{k_{12}^2}{M_2 s^3 + k_{12}} \right] = \frac{F(s)}{X_1(s)}$$

Q: Solve $y''(t) + y'(t) - 2y(t) = x(t)$

$$\frac{dy(t)}{dt} + \frac{dy(t)}{dt} - 2y(t) = x(t)$$

$$s^2 Y(s) - Y(0) - Y'(0) + s Y(s) - Y(0) - 2Y(s) = X(s)$$

$$Y(0) = Y'(0) = 0$$

$$s^2 Y(s) + s Y(s) - 2Y(s) = X(s)$$

$$Y(s) [s^2 + s - 2] = X(s)$$

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$$H(s) = \frac{Y(s)}{X(s)}$$

When

$$Y(s) = 1$$

$$X(s) = s^2 + s - 2$$

$$H(s) = \frac{1}{s^2 + s - 2}$$

$$= \frac{1}{(s+1)(s-2)}$$

$$= \frac{A}{(s+1)} + \frac{B}{(s-2)}$$

$$A = \frac{s+1}{(s+1)(s-1)} \Big|_{s=-1}$$

$$= \frac{-1/3}{-1/3}$$

$$B = \frac{s-2}{(s+1)(s-2)} \Big|_{s=2}$$

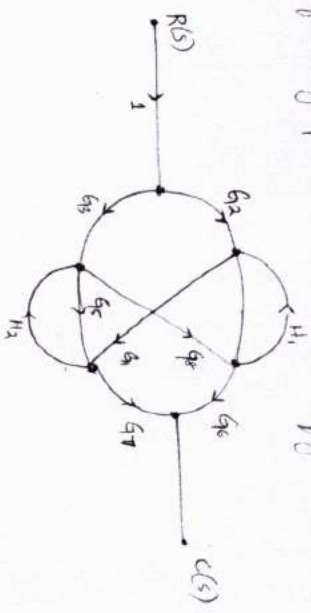
$$= \frac{1}{3}$$

$$H(s) = \frac{-1/3}{s+1} + \frac{1/3}{s-2}$$

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HOD EEE

② Tutorial - 3

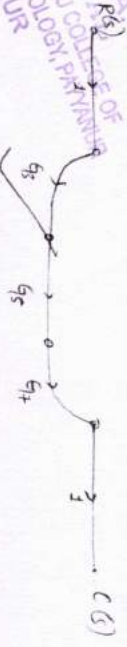
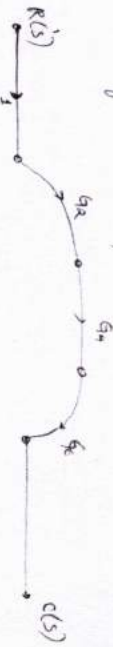
Q) Obtain the overall $H(s)$, $\frac{C(s)}{R(s)}$ if the signal flow graph is shown in fig



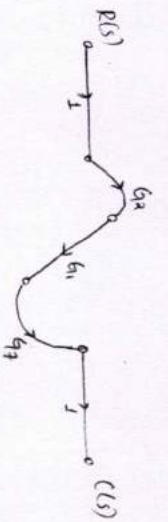
Solution, Step 1:

Find Forward path gain

(No. of forward paths) $k = 4$



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Forward Path gain, $P_1 = G_1 G_2 G_3 G_4 G_5 G_6$

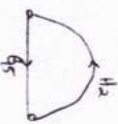
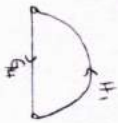
$$P_2 = G_2 G_3 G_4 G_5 G_6$$

$$P_3 = G_2 G_3 G_4 G_5 G_6$$

$$P_4 = G_1 G_2 G_3 G_4 G_5 G_6$$

Step 3:

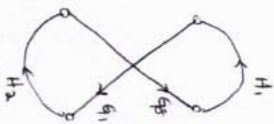
Individual Loop Gain



Loop gain of individual path 1, $P_1 = G_1 H_1$

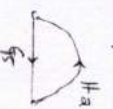
$$P_2 = G_2 H_2$$

$$P_3 = G_1 G_2 H_1 H_2$$



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Step 3: Gain product of Non-touching loops



Gain product of combinations, $P_1 = H_1 H_2 G_1 G_2$

Step 4:

Calculation of Δ and ΔK

$\Delta = 1 - \text{Sum of individual loop gain} + \text{Sum of gain product of 2 non-touching loops}$

$$= 1 - (G_1 H_1 + G_2 H_2 + G_1 G_2 H_1 H_2) + (H_1 H_2 G_1 G_2)$$

$$= 1 - G_1 H_1 + G_2 H_2 + G_1 G_2 H_1 H_2 + G_1 G_2 H_1 H_2$$

$\Delta_1 = 1 - \text{part of graph not-touching path 1}$

$$= 1 - G_1 H_1$$

$\Delta_2 = 1 - \text{part of graph not-touching path 2}$

$$= 1 - G_2 H_2$$

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$$A_3 = 1 - 0 = 1$$

$$A_4 = 1 - 0 = 1$$

Steps: Transfer Function

$$T = \frac{1}{\Delta} \sum_k P_k \Delta_k$$

$$= \frac{1}{\Delta} (P_1 \Delta_1 + P_2 \Delta_2 + P_3 \Delta_3 + P_4 \Delta_4)$$

$$= \frac{G_1 G_4 G_6 (1 - G_5 H_2) + G_3 G_5 G_7 (1 - G_4 H_1) + G_2 H_1 G_7 + G_1 G_6 G_6}{G_1 G_6 G_6}$$

$$1 - G_4 H_1 + G_5 H_2 + G_1 G_6 H_1 H_2 + G_4 G_5 H_1 H_2$$

2] Analyze the Stability of the given LTI systems, whose characteristic equation is given by

$$Q(s) = s^3 + 2s^4 + 2s^3 + 4s^2 + 11s + 10, \text{ using Routh's criterion.}$$

$$\text{Solution: } s^3 + 2s^4 + 2s^3 + 4s^2 + 11s + 10 = 0$$

$$2s^4 + 2s^3 + 5s^2 + 11s + 10 = 0$$

$$s^4 \quad 2 \quad 5 \quad 10$$

$$s^3 \quad 2 \quad 11$$

$$s^2 \quad 2 \quad 5 \quad 10$$

Shriman
HOD EEE

$$s^3 \quad 2 \quad 11$$

$$s^2 \quad -6 \quad 10$$

$$s^1 \quad 14.33$$

$$s^0 \quad 10$$

Here on examining element of first column it is observed that there are 2 sign changes, hence 2 roots are lying on the right side of the s axis. So, the system is unstable.

Shriman

$$s^3 \quad 2 \quad 11$$

Shriman

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KANNUR

TUTORIAL-4

1] Find the inverse z-transform of $X(z) = \frac{1 - \frac{1}{3}z^{-1}}{(1-z^{-1})(1+2z^{-1})}$

ROC: $|z| > 2$

Solution:

$$X(z) = \frac{1 - \frac{1}{3}z^{-1}}{(1-z^{-1})(1+2z^{-1})}$$

$$= \frac{A}{(1-z^{-1})} + \frac{B}{(1+2z^{-1})}$$

$$= \frac{A}{(1-z^{-1})} + \frac{B}{(1+2z^{-1})}$$

$$A = \frac{(1-z^{-1})(1-\frac{1}{3}z^{-1})}{(1-z^{-1})(1+2z^{-1})} \Big|_{z=1}$$

$$= \frac{1 - \frac{1}{3}}{1+2} = \frac{2}{9} = 0.222$$

$$B = \frac{(1+2z^{-1})(1-\frac{1}{3}z^{-1})}{(1-z^{-1})(1+2z^{-1})} \Big|_{z=2}$$

$$= \frac{\frac{7}{6}}{\frac{3}{2}} = \frac{7}{9} = 0.778$$

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HOD/EEE

$$\frac{A}{(1-z^{-1})} + \frac{B}{(1+2z^{-1})} = \frac{\frac{2}{9}}{(1-z^{-1})} + \frac{\frac{7}{9}}{(1+2z^{-1})}$$

$$= \frac{0.22}{1-z^{-1}} + \frac{0.778}{1+2z^{-1}}$$

$$= 0.22(1)^n u(n) + 0.778(-2)^n u(n)$$

2) Determine the Convolution of the signals

$$x(n) = \cos \pi n u(n) ; h(n) = (\frac{1}{2})^n u(n)$$

Solution:

$$y(n) = \sum_{k=-\infty}^{\infty} x(k) * h(n-k)$$

$$= \sum_{k=-\infty}^{\infty} \cos \pi k u(k) * (\frac{1}{2})^{n-k} u(n-k)$$

$$= \sum_{k=0}^{\infty} \cos \pi k (\frac{1}{2})^{n-k}$$

$$= \sum_{k=0}^{\infty} \cos \pi k (\frac{1}{2})^n (\frac{1}{2})^{-k}$$

$$= \cos \pi (\frac{1}{2})^n \sum_{k=0}^{\infty} k (\frac{1}{2})^{-k}$$

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$$= \cos \pi \left[\frac{1}{2} \right]^n \sum_{k=0}^{\infty} k \left(\frac{1}{2} \right)^{-k}$$

5+5
(50%)

Shirish
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TUTORIAL-5

Q: Check the stability of the system whose characteristic equation is given by

$$z^3 + 0.2z^2 - 0.25z + 0.05 = 0, \text{ using Jury's Stability Criterion.}$$

Solution:

$$F(z) = z^3 + 0.2z^2 - 0.25z + 0.05$$

$$= a_0 + a_1 z + a_2 z^2 + a_3 z^3$$

$$a_0 = 0.05, \quad a_1 = -0.25, \quad a_2 = 0.2, \quad a_3 = 1$$

Check for necessary condition,

$$F(z) = z^3 + 0.2z^2 - 0.25z + 0.05$$

$$F(1) = 1 - 0.2 - 0.25 + 0.05 = 0.6$$

$$F(-1) = (-1)^3 + 0.2(-1)^2 - 0.25(-1) + 0.05$$

$$= (-1) + (-1 + 0.2 + 0.25 + 0.05)$$

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$$= 1 + 0.2 - 0.25 - 0.05$$

$$= 0.9$$

Here, $F(1) > 0$ and $(-1)^n F(-1) > 0$

∴ The necessary conditions are satisfied check

for sufficient condition.

Here, $n = 3$

∴ $3n - 3 = 6 - 3 = 3$, Hence, 3 rows.

Row	z^0	z^1	z^2	z^3
1	a_0	a_1	a_2	a_3
2	a_2	a_3	a_1	a_0
3	b_0	b_1	b_2	

$$b_0 = \begin{vmatrix} a_0 & a_2 \\ a_3 & a_0 \end{vmatrix} = \begin{vmatrix} 0.05 & 1 \\ 1 & 0.05 \end{vmatrix} = -0.998$$

$$b_1 = \begin{vmatrix} a_0 & a_2 \\ a_3 & a_1 \end{vmatrix} = \begin{vmatrix} 0.05 & -0.2 \\ 1 & -0.25 \end{vmatrix} = 0.19$$

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$$b_2 = \begin{vmatrix} a_0 & a_1 \\ a_3 & a_2 \end{vmatrix} = \begin{vmatrix} 0.05 & -0.25 \\ 1 & -0.2 \end{vmatrix} = 0.24$$

Row	z^0	z^1	z^2	z^3
1	0.05	-0.25	-0.2	1
2	1	-0.2	-0.25	0.05
3	-0.998	0.19	0.24	

Here, $|a_0| < |a_3|$

$$|b_0| > |b_2|$$

Hence, Sufficient category is satisfied.

The necessary and sufficient conditions for the stability are satisfied. Hence, the system is stable.

Shirish

10

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Shirish
HOD/EEE

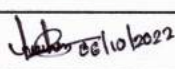


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& TECHNOLOGY**

TUTORIAL FORMAT FOR IOAC APPROVAL

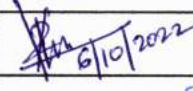
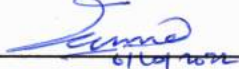
I. Details of Assignment [to be filled by the faculty setting the question paper]

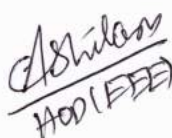
[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

SI No.	Particulars	Details
1	Course name with code	EET 305 - SIGNALS & SYSTEMS
2	Name of the faculty and department	ARCHANA C.P Electrical & Electronics
3	Date of issue	06/10/2022
4	Date of submission	06/10/2022
5	Date of return	10/10/2022
6	Dated signature of the subject faculty	 06/10/2022

II. CHECK -LIST [to be filled by the module coordinator]

SI No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	Yes	-
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	-
3	Whether questions are numbered correctly?	Yes	-
4	Whether marking scheme is attached?	Yes.	-

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications Nel.
Name and dated signature of the module coordinator	 06/10/2022 Prabha Chandran.
Name and dated Signature of the Head of the Department	 06/10/2022


HOD (EET)


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TECHNOLOGY

TUTORIAL	I	Academic Year/Semester	2022-23 / 5 th Semester
Subject name with code	EET305-SIGNALS & SYSTEMS	Branch	EEE
Date of Issue	06/10/2022	Date of submission	06/10/2022

Q.No	QUESTIONS	Marks	CO	Level
1	A Continuous time signal $x(t)$ is shown in figure. Sketch the following signals a) $x(3t-2)$ e) $x(-t+2)$ b) $x(t/2+1)$ f) $x(-t/2+2)$ c) $x(\frac{t-6}{3})$ g) $x(-t/2-2)$ d) $x(-t-1)$	7	1	3
2.	Sketch the waveform, $v(t) - v(t-2)$	3	1	3

CO - Course Outcome [CO]

CO:1 student will be able to explain the basic operations on signals and systems.

LEVEL - Bloom's Taxonomy Level

- Level 1: Reminder
- Level 2: Understood
- Level 3: Apply

Abhilash
HOD(EEE)

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[Signature]
(COURSE INSTRUCTOR)
PAGE 2 OF



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TECHNOLOGY, PAYANUR, KANNUR

SCHEME OF EVALUATION

TUTORIAL	I	Academic Year/Semester	2022-23 / 5th Semester
Subject name with code	EET305-SIGNALS & SYSTEMS	Branch	EEE
Date of Issue	06/10/2022	Date of submission	06/10/2022

Q.No	QUESTIONS
1	Simplification - $7 \times 0.5 = 3.5$ (mark) , 0.5 marks (each) Waveform - $7 \times 0.5 = 3.5$ (mark) , 0.5 marks (each)
2	Simplification - 2 (marks) Waveform - 1 (mark)

Asin
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(COURSE INSTRUCTOR)



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TUTORIAL FORMAT FOR IOAC APPROVAL

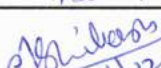
I. Details of Assignment [to be filled by the faculty setting the question paper]

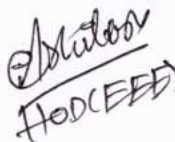
[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	EET 305 - SIGNALS AND SYSTEMS
2	Name of the faculty and department	Archana c.p Electrical & Electronics
3	Date of issue	03/11/2022
4	Date of submission	03/11/2022
5	Date of return	04/11/2022
6	Dated signature of the subject faculty	 03/11/22

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	Yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	
3	Whether questions are numbered correctly?	Yes	
4	Whether marking scheme is attached?	Yes	

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	No/
Name and dated signature of the module coordinator	 3/11/22 Prabha Chandran (AP, EEE)
Name and dated Signature of the Head of the Department	 3/11/22 Ashutosh Chandran (HOD)


HOD (EEE)


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TUTORIAL	II	<i>Academic Year/Semester</i>	2022-23 / 5th Semester
<i>Subject name with code</i>	EET305-SIGNALS & SYSTEMS	<i>Branch</i>	EEE
<i>Date of Issue</i>	03/11/2022	<i>Date of submission</i>	03/11/2022

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Write the differential equations governing the behavior of the mechanical system shown in Fig. 1	5	2	3
2	The differential equation of a causal, continuous- time LTI system is given by $\ddot{y}(t) + \dot{y}(t) - 2y(t) = x(t).$ a) Find the transfer function $H(s)$ of the system. b) Find the impulse response $h(t)$ of this system.	5	2	3

CO - Course Outcome [CO]

CO 2: The student will be able to apply Fourier Series and Fourier Transform concepts for continuous time signals & The student will be able to Analyze the continuous time systems with laplace transform.

LEVEL - Bloom's Taxonomy Level

- Level 1: Reminder
- Level 2: Understood
- Level 3: Apply

Signature
HODEEE



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SCHEME OF EVALUATION

TUTORIAL	II	<i>Academic Year/Semester</i>	2022-23 / 5th Semester
<i>Subject name with code</i>	EET305-SIGNALS & SYSTEMS	<i>Branch</i>	EEE
<i>Date of Issue</i>	03/11/2022	<i>Date of submission</i>	03/11/2022

<i>Q.No</i>	<i>QUESTIONS</i>
1	Differ Force Equation for mass m_1 - (2 marks) Force equation for mass m_2 - (2 marks) Final differential equation - (1 mark)
2	Laplace transform of the differential equation - (2 marks) Transfer function $H(s)$ of the system - (1.5 marks) Impulse response $h(t)$ of the system - (1.5 marks)

Shilpa
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Leena
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TUTORIAL FORMAT FOR IOAC APPROVAL

I. Details of tutorial [to be filled by the faculty setting the question paper]

[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	EET 305 - SIGNALS & SYSTEMS
2	Name of the faculty and department	ARCHANA C.P, Electronics & Electronics
3	Date of issue	28/11/2022
4	Date of submission	28/11/2022
5	Date of return	29/11/2022
6	Dated signature of the subject faculty	<i>[Signature]</i> 28/11/22

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	Yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	
3	Whether questions are numbered correctly?	Yes	
4	Whether marking scheme is attached?	Yes	

Recommendation remarks of the module coordinator and approval status.	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications NIL
Name and dated signature of the module coordinator	<i>[Signature]</i> 28/11/22 Prabha Chandran.
Name and dated Signature of the Head of the Department	<i>[Signature]</i> <i>[Signature]</i> Ho (eee)

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[Signature]
[Signature] Ho (eee)



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TUTORIAL	III	Academic Year/Semester	2022-23 / 5 th Semester
Subject name with code	EET305-SIGNALS & SYSTEMS	Branch	EEE
Date of Issue	28/11/2022	Date of submission	28/11/2022

Q.No	QUESTIONS	Marks	CO	Level
1	Obtain the overall $H(s) = \frac{C(s)}{R(s)}$ of the signal flow graph is shown in fig.	5	3	3
2	Analyze the stability of the given LTI system, whose characteristics equation is given by, $Q(s) = s^2 + 2s^4 + 2s^3 + 4s^2 + 11s + 10$ using Routh's criterion	5	3	3

CO - Course Outcome [CO]

CO3: The student will be able to analyze various system models and response.

LEVEL - Bloom's Taxonomy Level

Level 1: Reminder

Level 2: Understood

Level 3: Apply

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Adilash
H09(EEE)



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SCHEME OF EVALUATION

TUTORIAL	III	<i>Academic Year/Semester</i>	2022-23 / 5th Semester
<i>Subject name with code</i>	EET305-SIGNALS & SYSTEMS	<i>Branch</i>	EEE
<i>Date of Issue</i>	28/11/2022	<i>Date of submission</i>	28/11/2022

<i>Q.No</i>	<i>QUESTIONS</i>
1	Calculation of Transfer function $\frac{C(s)}{R(s)}$ - (2 marks) Steps - (3 marks)
2	Formation of Routh's table - (3 marks) stability analysis - (2 marks)

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Paulan
HOD(EEE)



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TUTORIAL FORMAT FOR IQAC APPROVAL

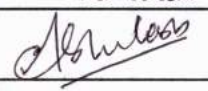
I. Details of tutorial [to be filled by the faculty setting the question paper]

[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

Sl No.	Particulars	Details
1	Course name with code	EET 305 - SIGNALS & SYSTEMS
2	Name of the faculty and department	ARCHANA C.P Electrical & Electronics
3	Date of issue	13/12/2022
4	Date of submission	13/12/2022
5	Date of return	14/12/2022
6	Dated signature of the subject faculty	 13/12/22

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	Yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	
3	Whether questions are numbered correctly?	Yes	
4	Whether marking scheme is attached?	Yes	

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications Nil
Name and dated signature of the module coordinator	Prabha Chandran  13/12/22
Name and dated Signature of the Head of the Department	


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TUTORIAL	IV	Academic Year/Semester	2022-23 / 5 th Semester
Subject name with code	EET305-SIGNALS & SYSTEMS	Branch	EEE
Date of Issue	13/12/2022	Date of submission	13/12/2022

Q.No	QUESTIONS	Marks	CO	Level
1	Find the inverse z- transform of $x(z) = \frac{1 - \frac{1}{3}z^{-1}}{(1-z^{-1})(1+2z^{-1})}$	5	4	3
2	Determine the convolution of the signal $x(n) = \cos n \quad u(n) ; \quad h(n) = \left(\frac{1}{2}\right)^n u(n)$	5	4	3

CO - Course Outcome [CO]

CO4: The student will be able to analyze the discrete time system using Z Transform and sampling.

LEVEL - Bloom's Taxonomy Level

Level 1: Reminder

Level 2: Understood

Level 3: Apply

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SCHEME OF EVALUATION

TUTORIAL	IV	<i>Academic Year/Semester</i>	2022-23 / 5th Semester
<i>Subject name with code</i>	EET305-SIGNALS & SYSTEMS	<i>Branch</i>	EEE
<i>Date of Issue</i>	13/12/2022	<i>Date of submission</i>	13/12/2022

<i>Q.No</i>	<i>QUESTIONS</i>
1	Calculation of $x(z)$ - (2 marks) Steps - (3 marks)
2	Equation - (2 marks) Steps - (2 marks) Calculation of $y(n)$ - (1 marks)

Leena

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Prasanna
HOD(EEE)

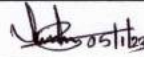


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& TECHNOLOGY**

TUTORIAL FORMAT FOR IOAC APPROVAL

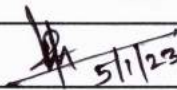
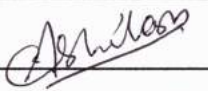
I. Details of tutorial [to be filled by the faculty setting the question paper]

[ATTACH TUTORIAL QUESTION PAPER SEPARATELY]

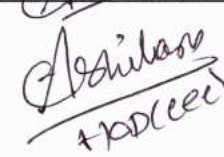
Sl No.	Particulars	Details
1	Course name with code	EET 305 - SIGNALS AND SYSTEMS
2	Name of the faculty and department	ARCHANA C.P. Electrical & Electronics
3	Date of issue	05/01/2023
4	Date of submission	05/01/2023
5	Date of return	06/01/2023
6	Dated signature of the subject faculty	

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	Yes	
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	
3	Whether questions are numbered correctly?	Yes	
4	Whether marking scheme is attached?	Yes	

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	NPL
Name and dated signature of the module coordinator	Prabha Chandran  5/1/23
Name and dated Signature of the Head of the Department	







SREE NARAYANA GURU COLLEGE OF ENGINEERING &

TECHNOLOGY

TUTORIAL	V	Academic Year/Semester	2022-23 / 5 th Semester
Subject name with code	EET305-SIGNALS & SYSTEMS	Branch	EEE
Date of Issue	05/01/2023	Date of submission	05/01/2023

Q.No	QUESTIONS	Marks	CO	Level
1	check the stability of the system whose characteristic equation is given by, $z^3 + 0.2z^2 - 0.25z + 0.05 = 0$, using Jury's stability criterion	10	5	3

CO - Course Outcome [CO]

CO5: The student will be able to apply fourier series and fourier transform concepts for discrete time domain and sampled data systems.

LEVEL - Bloom's Taxonomy Level

- Level 1: Reminder
- Level 2: Understood
- Level 3: Apply


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HOD(EEE)



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TECHNOLOGY

SCHEME OF EVALUATION

TUTORIAL	V	<i>Academic Year/Semester</i>	2022-23 / 5th Semester
<i>Subject name with code</i>	EET305-SIGNALS & SYSTEMS	<i>Branch</i>	EEE
<i>Date of Issue</i>	05/01/2023	<i>Date of submission</i>	05/01/2023

<i>Q.No</i>	<i>QUESTIONS</i>
1	check for necessary condition - (3 marks) Formation of Routh's table - (4 marks) check for sufficient condition - (3 marks)

Leena

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KANNUR

Alston
HOD(EEE)

DEGREE / BRANCH..... ELECTRICAL & ELECTRONICS.....

SEMESTER..... 5th..... SUBJECT CODE..... EET 305.....

SUBJECT..... SIGNALS AND SYSTEMS.....

CLASSES

COMMENCING DATE..... 19/09/2022..... ENDING DATE.....

ACADEMIC YEAR..... 2022 - 23.....



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ATTENDANCE

AND

ASSESSMENT RECORD

[Handwritten Signature]
HODEEE

[Handwritten Signature]
Dr. LEENA A V
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ATTENDANCE AND ASSESSMENT RECORD

NAME OF STAFFARCHANA C.P.....

DESIGNATIONAP. EEE.....

DEPARTMENT ..ELECTRICAL AND ELECTRONICS.....

Dr. Leena A V
HOD EEE

Leena
Dr. LEENA A V
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PAYYANUR, KANNUR

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PAYYANUR, KANNUR

[illegible][illegible][illegible]

Degree / Branch : EEE

(TUTORIAL)

[illegible][illegible]

Alstina
HODEEE

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PAYYANUR, KANNUR

DETAILS OF ASSIGNMENT (TUTORIAL)

[illegible]

DETAILS OF TEST

[illegible]

Alstina
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58

EET 305

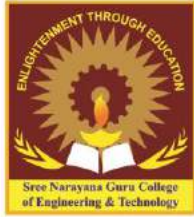
SIGNALS AND SYSTEMS

Faculty : Ms. Archana CP

Sl. No.	Date	Topic	Sign
1.	06/10/2022	Basic operation on signals	<i>[Signature]</i>
2.	03/11/2022	transfer function of mechanical translational system, Laplace transform of LTI system	<i>[Signature]</i>
3.	28/11/2022	Signal flow graph & Routh-Hurwitz criterion	<i>[Signature]</i>
4.	13/12/2022	Inverse z-transform & Convolution of a signal	<i>[Signature]</i>
5.	05/01/2023	Jury's stability criterion	<i>[Signature]</i>

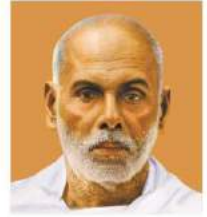
[Signature]
HOD/EEE

[Signature]
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PAYANUR, KANNUR



Sree Narayana Guru College of Engineering & Technology

CHALAKKODE P.O., KOROM, PAYYANUR, KANNUR-670 307



DEPARTMENT OF MECHANICAL ENGINEERING

DEGREE / BRANCH.....MECHANICAL.....

SEMESTER.....8th.....SUBJECT CODE.....MET466.....

SUBJECT.....TECHNOLOGY MANAGEMENT.....

CLASSES

COMMENCING DATE.....02/8/23.....ENDING DATE.....5/5/23.....

ACADEMIC YEAR.....22-23.....



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ATTENDANCE AND ASSESSMENT RECORD

NAME OF STAFF Rahul.C.G
DESIGNATION Assistant Professor
DEPARTMENT Mechanical.


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SREE NARAYANA GURU COLLEGE OF
ENGINEERING & TECHNOLOGY, PAYYANUR
KANNUR

Subject: TM - MGT 461

[illegible][illegible]

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ENGINEERING & TECHNOLOGY, PAYYANUR
KANNUR

CLASS ROLL NO.	NAME
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HAS ME

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KANNUR

NOTES

Remedial 1

5/4/23 Technology tools, Importance of R&D, Corporate Research, production costs & R&D, translation of R&D efforts to technology.

Remedial 2

24/5/23 Human resource management issues in R&D & innovation, technology assessment and environmental impact analysis.

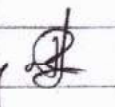


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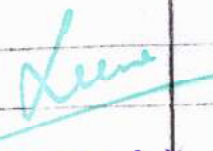


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1.	23/2/23	Explanation on evolution and growth of technology and different forms of technology	
2.	8/3/23	Description on impact of technology on society & business and explanation on Technology and competition -	
3.	4/4/23	Explanation on alternatives for acquiring new technologies and a short note on management of acquired technology	
4.	11/4/23	Importance of technology generation and development & description on planning & forecasting.	
5.	2/5/23	Role of technology transfer and explanation on globalization & innovations	
6.	15/5/23	Short note on technology assessment and environmental impact analysis.	


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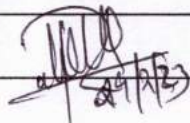

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MANAGEMENT & TECHNOLOGY, BANGALORE



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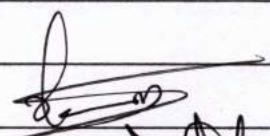
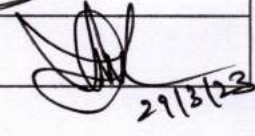
TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of Assignment [to be filled by the faculty setting the question paper]

Sl No.	Particulars	Details
1	Course name with code	MET 466 TECHNOLOGY MANAGEMENT
2	Name of the faculty and department	RAHUL C G ME
3	Date of issue	23/02/2023
4	Date of submission	27/02/2023
5	Date of return	28/02/2023
6	Dated signature of the subject faculty	

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	-
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	-
3	Whether questions are numbered correctly?	Yes	-
4	Whether marking scheme is attached?	Yes	-

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications - Nil -
Name and dated signature of the module coordinator	Rahul A M 
Name and dated Signature of the Head of the Department	JACOB THOMAS  29/3/23


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SREE NARAYANA GURU COLLEGE OF ENGINEERING &
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<i>TUTORIAL</i>	1	<i>Academic Year/Semester</i>	2022-23 / 8th Semester
<i>Subject name with code</i>	MET 466 TECHNOLOGY MANAGEMENT	<i>Branch</i>	ME
<i>Date of Issue</i>	23/02/2023	<i>Date of submission</i>	27/02/2023

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Explain the evolution and growth of technology.	10	1	2
2	Describe the different forms of technology.	10	1	2

CO - Course Outcome [CO]

CO 1: To be conversant with the advanced machining process and to appreciate the effect of process parameters on the surface integrity aspects during the advanced machining process.

LEVEL - Bloom's Taxonomy Level

- Level 1: Remember
- Level 2: Understand
- Level 3: Apply
- Level 4: Analyze


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<i>TUTORIAL</i>	1	<i>Academic Year/Semester</i>	2022-23 / 8th Semester
<i>Subject name with code</i>	MET 466 TECHNOLOGY MANAGEMENT	<i>Branch</i>	ME
<i>Date of Issue</i>	23/02/2023	<i>Date of submission</i>	27/02/2023

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Explanation (10 marks)	10	1	2
2	Explanation (10 marks)	10	1	2

CO - Course Outcome [CO]

CO 1: To be conversant with the advanced machining process and to appreciate the effect of process parameters on the surface integrity aspects during the advanced machining process.

LEVEL - Bloom's Taxonomy Level

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Level 4: Analyze


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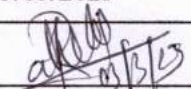

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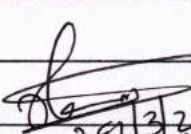
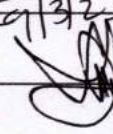
TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of Assignment [to be filled by the faculty setting the question paper]

Sl No.	Particulars	Details
1	Course name with code	MET 466 TECHNOLOGY MANAGEMENT
2	Name of the faculty and department	RAHUL C G ME
3	Date of issue	08/03/2023
4	Date of submission	10/03/2023
5	Date of return	13/03/2023
6	Dated signature of the subject faculty	

II. CHECK -LIST [to be filled by the module coordinator]

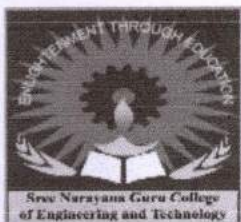
Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	-
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	-
3	Whether questions are numbered correctly?	Yes	-
4	Whether marking scheme is attached?	Yes	-

Recommendation remarks of the module coordinator and approval status	Approved 
Modifications suggested by the module coordinator	Approved with following modifications - nil -
Name and dated signature of the module coordinator	Rahulan  29/3/23
Name and dated Signature of the Head of the Department	JACOB THOMAS  29/3/23


HOD ME


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PAGE 1 OF 2



SREE NARAYANA GURU COLLEGE OF ENGINEERING &
TECHNOLOGY

TUTORIAL	2	<i>Academic Year/Semester</i>	2022-23 / 8th Semester
<i>Subject name with code</i>	MET 466 TECHNOLOGY MANAGEMENT	<i>Branch</i>	ME
<i>Date of Issue</i>	08/03/2023	<i>Date of submission</i>	10/03/2023

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Give explanation on points. 5 Points on business Positive and negative effects on society.	10	1	2
2	Explanation on competition that was brought during the technology improvement.	10	1	2

CO - Course Outcome [CO]

CO 1: To be conversant with the advanced machining process and to appreciate the effect of process parameters on the surface integrity aspects during the advanced machining process.

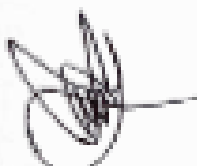
LEVEL - Bloom's Taxonomy Level

Level 1: Remember

Level 2: Understand

Level 3: Apply

Level 4: Analyze


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SREE NARAYANA GURU COLLEGE OF ENGINEERING &
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<i>TUTORIAL</i>	2	<i>Academic Year/Semester</i>	2022-23 / 8th Semester
<i>Subject name with code</i>	MET 466 TECHNOLOGY MANAGEMENT	<i>Branch</i>	ME
<i>Date of Issue</i>	08/03/2023	<i>Date of submission</i>	10/03/2023

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Describe the impact of technology on society and business.	10	1	2
2	Describe "Technology and competition".	10	1	2

CO - Course Outcome [CO]

CO 1: To be conversant with the advanced machining process and to appreciate the effect of process parameters on the surface integrity aspects during the advanced machining process.

LEVEL - Bloom's Taxonomy Level

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TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of Assignment [to be filled by the faculty setting the question paper]

Sl No.	Particulars	Details
1	Course name with code	MET 466 TECHNOLOGY MANAGEMENT
2	Name of the faculty and department	RAHUL C G ME
3	Date of issue	04/04/2023
4	Date of submission	05/04/2023
5	Date of return	05/04/2023
6	Dated signature of the subject faculty	 5/4/23

II. CHECK-LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	—
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	—
3	Whether questions are numbered correctly?	Yes	—
4	Whether marking scheme is attached?	Yes	—

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications Nil — Nil —
Name and dated signature of the module coordinator	Rahul C G 5/4/23
Name and dated Signature of the Head of the Department	Jacob Thomas 5/4/23


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<i>TUTORIAL</i>	3	<i>Academic Year/Semester</i>	2022-23 / 8th Semester
<i>Subject name with code</i>	MET 466 TECHNOLOGY MANAGEMENT	<i>Branch</i>	ME
<i>Date of Issue</i>	04/04/2023	<i>Date of submission</i>	05/04/2023

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Describe the alternatives for acquiring new technologies.	10	II	2
2	Write a short note on management of acquired technology.	10	II	2

CO - Course Outcome [CO]

CO II: Explain the need of technology forecasting.

LEVEL - Bloom's Taxonomy Level

Level 1: Remember

Level 2: Understand

Level 3: Apply

Level 4: Analyze


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TECHNOLOGY

TUTORIAL	3	<i>Academic Year/Semester</i>	2022-23 / 8th Semester
<i>Subject name with code</i>	MET 466 TECHNOLOGY MANAGEMENT	<i>Branch</i>	ME
<i>Date of Issue</i>	04/04/2023	<i>Date of submission</i>	05/04/2023

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Give explanation on Internal R&D, Contracted-out R&D, Licensing, Strategic Alliances, Mergers & Acquisitions.	10	II	2
2	Explanation on Future technology development, Contracts and relationships, Ownership of intellectual property (IP), Technology exploitation, Rights to use a technology, Exchange 'currency', IP protection.	10	II	2

CO - Course Outcome [CO]

CO II: Explain the need of technology forecasting.

LEVEL - Bloom's Taxonomy Level

Level 1: Remember

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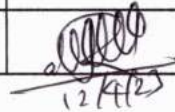

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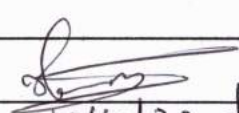
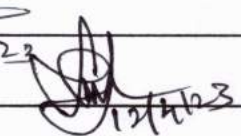
TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of Assignment [to be filled by the faculty setting the question paper]

Sl No.	Particulars	Details
1	Course name with code	MET 466 TECHNOLOGY MANAGEMENT
2	Name of the faculty and department	RAHUL C G ME
3	Date of issue	11/04/2023
4	Date of submission	12/04/2023
5	Date of return	12/04/2023
6	Dated signature of the subject faculty	 12/4/23

II. CHECK-LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	—
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	—
3	Whether questions are numbered correctly?	Yes	—
4	Whether marking scheme is attached?	Yes	—

Recommendation remarks of the module coordinator and approval status	Approved ✓
Modifications suggested by the module coordinator	Approved with following modifications - Nil -
Name and dated signature of the module coordinator	Rahul C G  12/4/23
Name and dated Signature of the Head of the Department	Janeb Thomas  12/4/23



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<i>TUTORIAL</i>	4	<i>Academic Year/Semester</i>	2022-23 / 8th Semester
<i>Subject name with code</i>	MET 466 TECHNOLOGY MANAGEMENT	<i>Branch</i>	ME
<i>Date of Issue</i>	11/04/2023	<i>Date of submission</i>	12/04/2023

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Describe the importance of technology generation and development.	10	II	2
2	Explain briefly planning and forecasting.	10	II	2

CO - Course Outcome [CO]

CO II: Explain the need of technology forecasting.

LEVEL - Bloom's Taxonomy Level

Level 1: Remember

Level 2: Understand

Level 3: Apply

Level 4: Analyze


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<i>TUTORIAL</i>	4	<i>Academic Year/Semester</i>	2022-23 / 8th Semester
<i>Subject name with code</i>	MET 466 TECHNOLOGY MANAGEMENT	<i>Branch</i>	ME
<i>Date of Issue</i>	11/04/2023	<i>Date of submission</i>	12/04/2023

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	Brief explanation on technology generation and development.	10	II	2
2	Short explanation on planning and forecasting.	10	II	2

CO - Course Outcome [CO]

CO II: Explain the need of technology forecasting.

LEVEL - Bloom's Taxonomy Level

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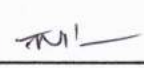
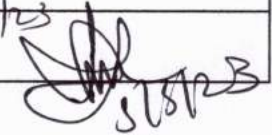
TUTORIAL FORMAT FOR IQAC APPROVAL

I. Details of Assignment [to be filled by the faculty setting the question paper]

Sl No.	Particulars	Details
1	Course name with code	MET 466 TECHNOLOGY MANAGEMENT
2	Name of the faculty and department	RAHUL C G ME
3	Date of issue	02/05/2023
4	Date of submission	04/05/2023
5	Date of return	05/05/2023
6	Dated signature of the subject faculty	 5/5/23

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	-
2	Whether COs and Knowledge level have been provided at the end of the question paper?	Yes	-
3	Whether questions are numbered correctly?	Yes	-
4	Whether marking scheme is attached?	Yes	-

Recommendation remarks of the module coordinator and approval status	Approved 
Modifications suggested by the module coordinator	Approved with following modifications  - nil -
Name and dated signature of the module coordinator	Rahul A M  5/5/23
Name and dated Signature of the Head of the Department	Jacob Thomas  5/5/23



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<i>TUTORIAL</i>	5	<i>Academic Year/Semester</i>	2022-23 / 8th Semester
<i>Subject name with code</i>	MET 466 TECHNOLOGY MANAGEMENT	<i>Branch</i>	ME
<i>Date of Issue</i>	02/05/2023	<i>Date of submission</i>	04/05/2023

<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	(i) Explain the role of technology transfer in innovation. (ii) Describe the role of government in innovation.	10	IV	2
2	Write a short note on (i) Globalization and innovations. (ii) Technology and innovation management	10	IV	2

CO - Course Outcome [CO]

CO IV: Describe the elements of technology strategy.

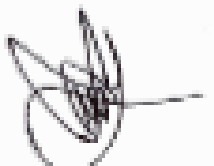
LEVEL - Bloom's Taxonomy Level

Level 1: Remember

Level 2: Understand

Level 3: Apply

Level 4: Analyze


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<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	i. Short points on technology transfer in innovation. ii. Description on role of govt. in innovation.	10	IV	2
2	i. 5 points on globalization and innovation. ii. 6-7 points on technology and innovation management.	10	IV	2

CO - Course Outcome [CO]

CO IV: Describe the elements of technology strategy.

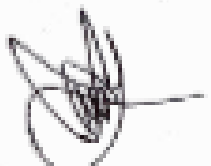
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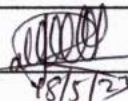

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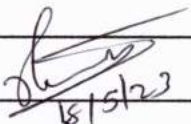
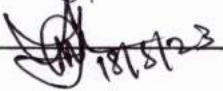
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3	Date of issue	15/05/2023
4	Date of submission	17/05/2023
5	Date of return	18/05/2023
6	Dated signature of the subject faculty	 18/5/23

II. CHECK -LIST [to be filled by the module coordinator]

Sl No.	Particulars	YES/NO	REMARKS (IF ANY)
1	Whether question paper is in the prescribed format?	yes	—
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Recommendation remarks of the module coordinator and approval status	Approved ✓
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Name and dated signature of the module coordinator	Rahul A M  15/5/23
Name and dated Signature of the Head of the Department	Jacob Thomas  18/5/23


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<i>TUTORIAL</i>	6	<i>Academic Year/Semester</i>	2022-23 / 8th Semester
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<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	(i) Explain the human factors to be considered in technology management. (ii) Short note on human resource management issues in R&D and innovation.	10	V	2
2	Write a short note on technology assessment and environmental impact analysis.	10	V	2

CO - Course Outcome [CO]

CO IV: Outline the basics of innovation.

LEVEL - Bloom's Taxonomy Level

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<i>Q.No</i>	<i>QUESTIONS</i>	<i>Marks</i>	<i>CO</i>	<i>Level</i>
1	i. Brief description ii. 5-6 points in brief.	10	V	2
2	5-6 points with explanation.	10	V	2

CO - Course Outcome [CO]

CO V: Outline the basics of innovation.

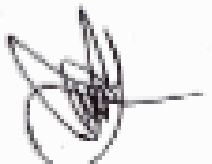
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Tutorial-1

- ① Evaluation and growth of technology
- ② Forms of technology - Process and product technology

① Technology evaluation

It is a theory of radical transformation of society through technological development. This theory originated with Czech philosopher Karel Rychlik. Technology (which Rychlik defines as "a material entity created by the application of mental and physical effort to nature in order to achieve some value.") evolves in three stages: tools, machine, automation. This evolution, he says, follows two trends.

The pre-technology, in which all other animal species remain today, was a non-rational period of the early prehistoric man. The emergence of technology, made possible by the development of the rational faculty, paved the way for the first stage: the tool. A tool provides a mechanical advantage in accomplishing a physical task, such as an arrow.

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plow, or hammer that augments physical labor to more efficiently achieve his objective. Later animal-powered tools such as the plow and the horse increased the productivity of food production about tenfold over the technology of the hunter-gatherer. Tools allow one to do things impossible to accomplish with one's body alone, such as seeing minute visual detail with a microscope, manipulating heavy object with a pulley and cart, or carrying volumes of water in a bucket.

The second technology stage was the creation of the machine. A machine (a powered machine) to be more precise is a tool that substitutes part or all of the entire element of human physical effort, requiring only the control of its functions. Machines became widespread with the industrial revolution, though windmills, a type of machine, are much older.

~~Example~~ Examples of this include cars, trains, computers and light. Machines allow human to tremendously exceed the limitations of their bodies. Putting a machine on the farm, a tractor, increased food productivity at least tenfold over the technology of the plow and the horse.

The third and final stage of technology evolution is the automation. The automation is a machine that removes the element of human control with an automatic algorithm. Examples of machines that exhibit this characteristic are digital watches, automatic telephone switches, pacemakers and computer programs.

It is crucial to understand that the three stages outline the introduction of the fundamental types of technology, and so all three continues to be widely used today. A spoon, a plow, a pen, a knife, a glue and an optical microscope ^{are} all examples of tools.

② Process technology is the software and tool including digital platforms and intelligent process automation used to efficiently and intelligently create and deliver products and service, as well as improve speed and agility of processes across the enterprise. Process technology can be used to automate and simplify some flows and accelerate business processes. It can also improve accuracy, quality and reliability of those processes, helping companies operate with

greater agility so they can be more flexible and adaptable to shifting business and market priorities.

Product technology means with respect to each seller, the following information owned by or to the extent licensed to such seller, as in existence and in the possession of such seller as of the closing date, the manufacturing technology proprietary or confidential information, processes, techniques, protocols, methods, improvements and know how that are necessary to manufacture the product in accordance with the current applicable product ANDA, as the case maybe, including, but not limited to, the manufacturing processes approved in the applicable product ANDAs, specifications on test methods, raw materials, packaging, stability, and other applicable specifications.

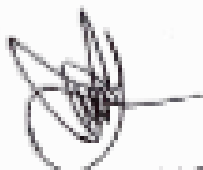
It means all intangibles owned or controlled by author and necessary for the exploitation of the product in the territory in which without limitation, the data package package and the product trademarks.

Tutorial - 2

- ① Describe the impact of technology on society and business.
- ② Describe "Technology and competition".

Answer

① One aspect of technology that has had a great impact on society is how it affects learning. It's made learning more interactive and collaborative, this helps people better engage with the material that they are learning and have trouble with. Also, it gets you better access to resource. With the creation of the internet, it gives us access to information at a twenty-four-hour rate and you have access to almost anything online. In addition, it allows students to get work done easier. Students can take quizzes and exams more easily and teachers being able to hold online classes can be very effective. It also expands the boundaries of the classroom encouraging self-paced learning. People can access learning through youtube and social media. This helps students learn better than sitting down for lectures and reading from textbooks. These technological advancements made learning more fun and convenient.



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Technology has revolutionized business as all big and companies across numerous industries are looking to harness it to improve their workforce, build brand recognition and bolster the bottom line. Some areas in which technology has transformed business include accounting, data collection, sales and digital promotion.

Let's have a look at some specific ways in which technology has influenced business.

- Globalization → Information technology has enabled business to attain a greater reach.
- Collaboration and access → Communication networks enable managers to access and share data with their department as well as through their organization.
- Cyber security → Every organization has information that they want to be protected from competitors, hackers, and others trying to damage the company, which is why cybersecurity is a major priority of business.

Storage → The thought of organization and storing paper work makes most employees cringe. Fortunately, much data is stored electronically now, making it easier for retrieval when the information is needed.

② Technological competition occurs only when ~~innovation~~ one technology substitutes for another, for a given market. When innovator generates new users - new market - it does not result in technology competition. The competition experienced between the innovating firm is considered as a distinct "competitive scenario" to that between innovators and established firms. In some cases innovating firms may perceive a greater potential threat from technologically similar rivals than from established firms. ~~It is argued that there is no reason to move~~

The promotion in technology competition have many ~~data~~ advantages like, the best way to reduce cost, encourage innovation and expand choices of consumers. Technology market can

present some unique issues and challenges for policy
makers, manufacturers, distributors and consumers. Innovation
is a central aspect of rivalry among technology
firms and the markets are dynamic. New ideas topple
formerly dominant technologies and consumers line up
to buy products that are simpler, faster, and better.

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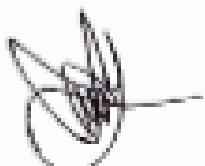
Tutorial-3

- ① Describe the alternatives for acquiring new technologies.
- ② Write a short note on management of acquired technology.

① Acquiring a technology is important since every business out there relies on some or the other technology. In this competitive business landscape, it is important to either develop or acquire a technology you need since you don't want to lag behind just because of your technological lag or weakness. In addition, we live in a world filled with technological products and services, so technology management is highly important. Any enterprise can either develop its technological product/service and process or acquire from externally. Here are the 5 ways in which you can acquire a new technology for your business and harness the benefits from it.

Internal R&D

The R&D department does research to generate new knowledge of technology ideas aimed at solving the problems your business faces. The goals should be shared with R&D department when the strategy is development phase.


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Contracted out R&D

The outsourced third party may be contract research organization, teams or consultant, researchers or experts. In some cases, we also outsource the research works to universities.

Licensing

A license is a legal binding document which allows a third party to use the invented technology that owns the technology and is ready to license it is the licensor.

Strategic alliances

Complex alliances and joint ventures are formed to complete equations. These alliances are flexible and are normally used to develop a technology that is critical to two or more businesses.

Mergers and Acquisitions

Two companies are or roughly equal size a merger may be appropriate. The goal in all M & A activity is to acquire and integrate an external entity into the existing company.

② Generally, it is divided into seven areas that are explained below:

- Future technology development
- Contracts and relationships
- Ownership of intellectual property (IP)
- Technology exploitation
- Rights to use a technology
- Exchange & currency
- IP protection

Future technology development

In most technology transactions, the technology is still immature and needs to be enhanced and developed to fit the needs of the firm. Knowledge has to pass between one party and the other at some point during this development. There are three main approaches to do this.

- Internal development
- External development
- ~~can~~ co. development

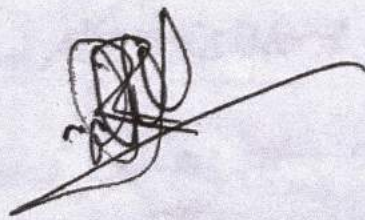
Contracts and relationships.

Another dimension or acquisition to consider concerns the relationships between the parties involved. The ~~form to~~ ^{form of} the relationship, take will vary according to the nature of the technology transfer. This may range from a simple contractor for R&D services at one end of the scale, to a joint venture or even take-over by one by one company or another.

Developing good relationships.

A formal contract is not only the ~~means~~ ^{means} or achieving a successful partnership or alliance. The less formal aspects, for a relationships are also very important as these emerge from the social norms and level of trust that exist between parties.

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Tutorial - 4

- ① Describe the importance of technology generation and development.
- ② Explain briefly planning and forecasting.

① Technology generation and development is often synonymous with the term "R&D", however technology generation involves R&D efforts while technology development involves further stages of fashioning R&D efforts into marketable products and services. Basically, one can consider the R&D process as having four distinct stages. Recognition of need for innovation is one of the motivations for R&D. The other primary motivation for R&D is to find potential applications for advances in knowledge.

The 'D' of R&D covers Technology development. The letter has much wider connotation. Determining technology development is called for the letter has much wider connotation. For better understanding, more elaboration or various factors that determine technology development is called for. The demand side factors include market potential, venture capital and enterprise profitability.

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The ~~technical~~ coordinating organizations, supporting facilities and government policies and systems have a major role to play in the success of the technology development process.

- ② Technology forecasting is a planning tool to be used in dynamic environments which undergo rapid changes. The technological backwardness of developing countries is primarily due to lack of planned attention to the maintenance, development of technology capabilities and utilizing resources efficiently. Rapid technological progress and the increased rate of obsolescence of technology necessitate technology forecasting for any planning process. Since technologies play a major role in planning of business, industry, government and society's growth, it becomes essential to determine its direction and magnitude by systematic analysis and study. Technology forecasting can be defined as a probabilistic prediction of technological changes in terms of future characteristics of useful machines, systems or procedures. In other words, technology forecasting attempts to predict rate of technology advance. It attempts to bring potential future technology into focus.

Tutorial - 5

- Explain the role of technology transfer in innovation.

Technology transfer plays a critical role in innovation enabling the transfer of knowledge skills and technology from one organization or country to another. It allows for the share of ideas and experience, which can lead to the development of new products, services and processes.

- Facilitating the adoption of new technology :- Technology transfer can help organizations adopt new technology that may not have the expertise to develop on their own.
- Encouraging collaboration :- Technology transfer can facilitate collaboration between organizations, leading to the exchange of ideas and the development of new technology.
- Accelerating innovation :- By transferring technology organizations can avoid the time and expense of developing new technology's from scratch.
- Expanding markets :- Technology transfer can enable organizations to expand their markets providing them with new technology that allows them to offer new products or services.


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* Role of Government in Innovation

- No. of different government policies can increase the interest in innovation, including, guaranteeing, Intellectual Property rights, government assistance with the help of research and development and cooperative research ventures between universities and companies. Government can foster innovation four basic ways:- By buying it, by reducing the risk, by collaborating on it, and by setting standards or regulations to encourage it.

In many instances, the government's key role in fostering innovation can be as a customer. The government itself acquires technology, systems, products, services generally after following a prescribed procurement procedure that provide free competition. The government can also help reduce the technical, commercial, financial risk associated with the industrial innovation.

- To reduce the technical risk the government funds pre-competitive and demonstration projects.

20 Globalization of Innovations

Technology globalization can be defined as the increasing speed of technology diffusion across the global economy. It refers to the spread of technology around the globe and particularly from developed to developing nations. As an effect of globalization, we can see that technology spread means ease of the political globalization and economic globalization. For example, free-trade agreements can make it easier to move technologies, innovations across borders, and manufacturing in the developing world can make it cheaper to produce these technologies. The global spread of technology has also enabled scientists and engineers around the world to engage in global competition. Each nation observes other nations' innovations and builds on them, enabling technology to be developed faster and better.

20 Technology and innovation management.

Technology innovation management is the process of controlling, guiding and managing the creation and execution of fresh corporate strategies and technological advances.

These strategies is meant to facilitate the expansion of current business. This integrated role is required in motivating every public and provide industries and by demand will continue to use as companies develop more innovative ~~technologies~~ solutions. The four ~~ways~~ key pillars of innovation management of the IIT protection a foundation that ~~develops~~ enables them to identify the ones in which a business may and should advance and create environment that supports innovation.

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* Technology assessment and environmental impact analysis.

Historians tell us that some forms of technology assessment and environmental impact analysis may date back more than 4000 years. ~~to ancient civilizations for example, pottery, metallurgy, etc.~~ Technology has caused enormous damage on human's living environment while benefiting human being. Thus it is necessary to expand the scope of environmental impact analysis to reduce or eliminate its negative impact on the environment. The uncertainty of technologies environmental impact makes it difficult to conduct environmental impact assessment. The system of technologies it consists of initial assessment, in-depth assessment and re-assessment. Environmental impact assessment methods include comparative assessment method of alternative technologies, technology's green factor classification assessment method and life cycle assessment method.

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Tutorial - 6

1. Explain the human factor to be considered in technology management.

- **User experience** :- The user experience is a central to the success of any technology. The system should be design with the end-user in mind, ensuring that it is easy to use and meets their needs. The success of a technology prepare is heavily dependent on how well it meets the needs of the user.
- **Training and education** :- Proper training and education and critical to ensure that users understand how to use the technology effectively.
- **Communication** :- Effective communication is critical to the success of technology management initiatives. It is essential to establish clear communication channel between stakeholders on same part or set expectations one another.
- **Human error** :- Even the most advanced technology is subject to human error. It is important to design system that minimize the risk of human error.
- **Change management**
- **Organizational culture**
- **Training and development** - opportunity to employees, content to ensure that they have the skill and knowledge required to own new technology efforts.

• Ethical considerations

• Culture

* Human Resource management issues in R and D innovation

• Recruiting and retaining top talents :- R and D and innovation requires highly skilled and specialised workers. Recruiting and retaining top talents is essential for the success of R and D and innovation initiatives.

• Developing a culture of innovation :- HR management needs to create an organizational culture that supports and promotes innovation.

• Talent acquisition :- Finding and attaining the right talent for R and D innovation is a challenge as these roles require specialised skills, knowledge and experience.

• Retention of employees :- Highly skilled employees in R and D innovation roles are in high demand and are constantly being sought after by competitors.

• Managing knowledge and expertise.

• Collaboration and knowledge sharing

• Encourage collaboration

• Intellectual property protection

• Incentives

• Performance measurement.

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