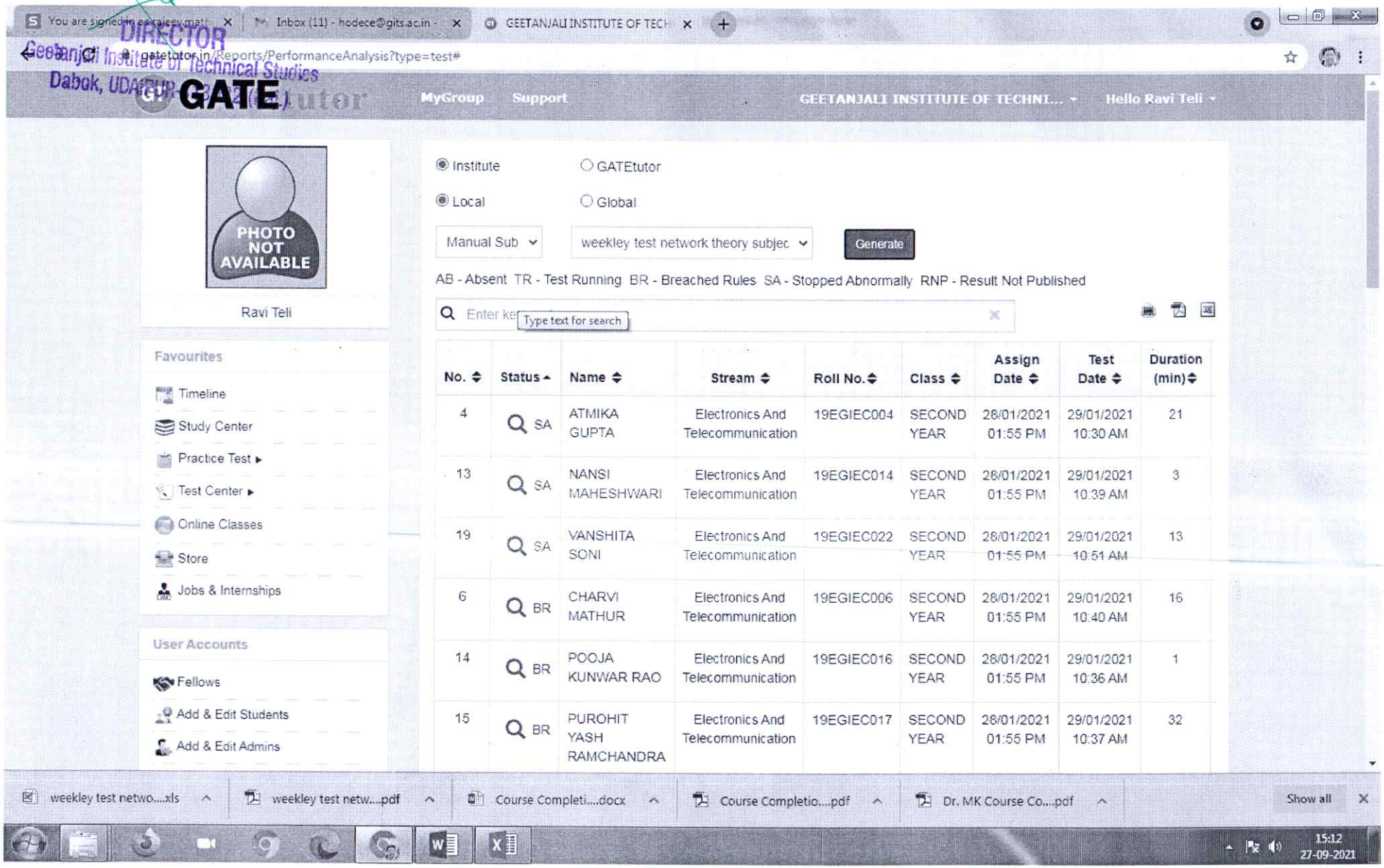
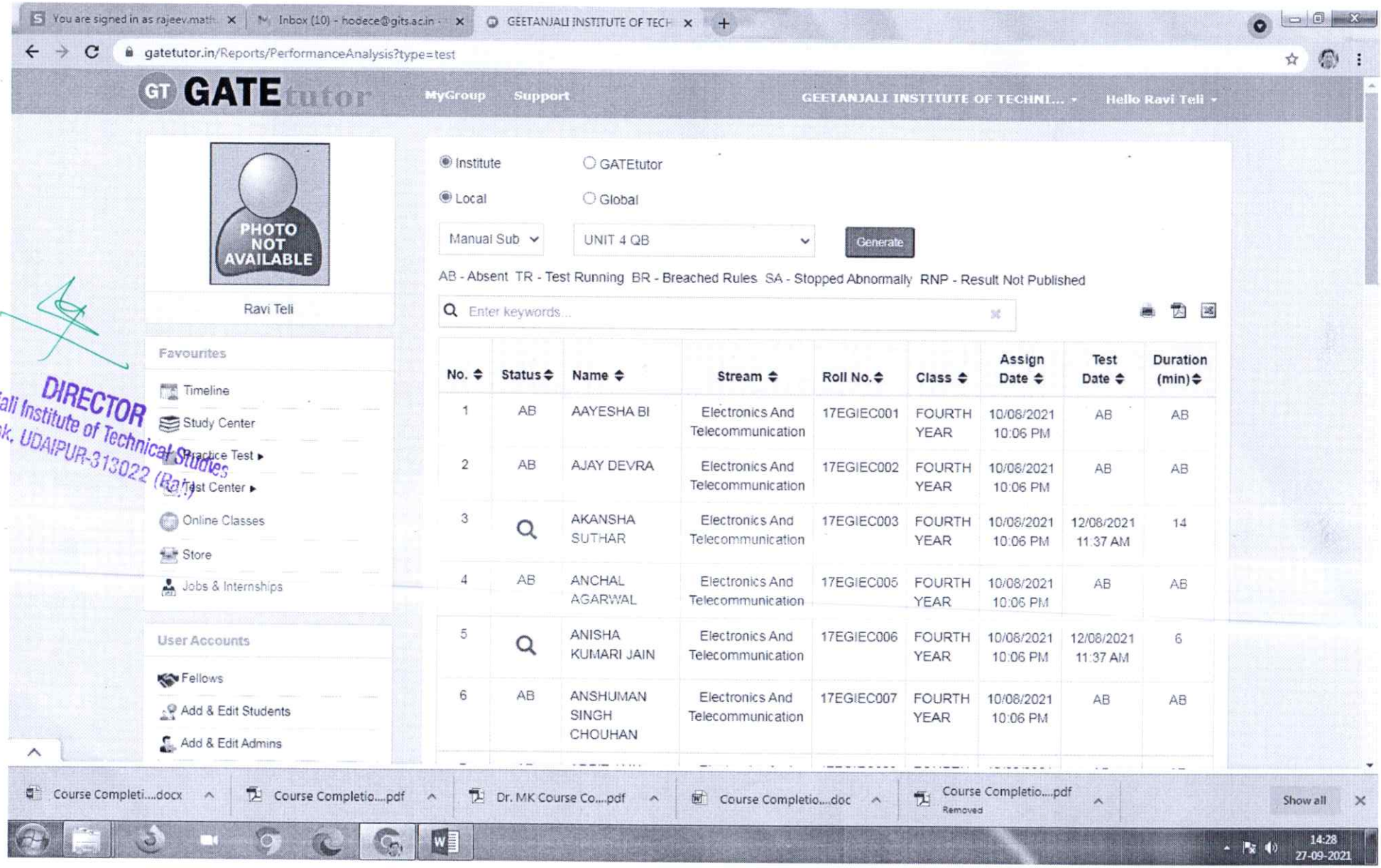
For Advance Learners

Screenshot of GATE Tutor Weekly Test



No.	Status	Name	Stream	Roll No.	Class	Assign Date	Test Date	Duration (min)
4	SA	ATMIKA GUPTA	Electronics And Telecommunication	19EGIEC004	SECOND YEAR	28/01/2021 01:55 PM	29/01/2021 10:30 AM	21
13	SA	NANSI MAHESHWARI	Electronics And Telecommunication	19EGIEC014	SECOND YEAR	28/01/2021 01:55 PM	29/01/2021 10:39 AM	3
19	SA	VANSHITA SONI	Electronics And Telecommunication	19EGIEC022	SECOND YEAR	28/01/2021 01:55 PM	29/01/2021 10:51 AM	13
6	BR	CHARVI MATHUR	Electronics And Telecommunication	19EGIEC006	SECOND YEAR	28/01/2021 01:55 PM	29/01/2021 10:40 AM	16
14	BR	POOJA KUNWAR RAO	Electronics And Telecommunication	19EGIEC016	SECOND YEAR	28/01/2021 01:55 PM	29/01/2021 10:36 AM	1
15	BR	PUROHIT YASH RAMCHANDRA	Electronics And Telecommunication	19EGIEC017	SECOND YEAR	28/01/2021 01:55 PM	29/01/2021 10:37 AM	32



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Dabok, UDAIPUR-313022 (Raj.)

OFFICE OF DEAN STUDENTS AFFAIRS
GEETANJALI INSTITUTE OF TECHNICAL STUDIES
Airport Road, Dabok, Udaipur

Ref No: GITS/DEAN-SA/03-19-03-**60/2020** Date: 24-01-2020

CIRCULAR

FELICITATION CEREMONY OF GITS ACHIEVERS

This is to inform all the faculty & staff members that **GITS Felicitation Ceremony** is scheduled on 28th January 2020 in CSE Seminar hall at

11:00 AM – 12:00 Noon (For Academic & NPTEL Achievers) &
01:00 PM - 02:00 PM (For Sports Achievers).

Following committee is constituted for smooth conduction of the ceremony.

S.No	Name of Committee	Name of Faculty Members	Responsibility
1.	Comparing & Event execution.	Mrs Anjali Dhabai	• *Lamp Lightning.* • *Bouquet*
2.	Media & News	Mr V Maurya	• Preparing News for Paper.
3.	Award Distribution	Dr. Rajbeer Sharma Mr. Ronak Shrimal Dr. Manoj Singh	• To arrange for distribution of Certificates & Memento to Students.
4.	Print and Publicity Committee	Dr. Vishal Jain Mr. Ronak Shrimal Mr. Chintal Patel	• Flexes printing • Certificates printing • Memento/Troffees/Meda • Instagram Live streaming
5.	Discipline	Mr. Zuber Khan Dr Manoj Singh *All NPTEL coordinators.*	
6.	Certificate Preparation	Dr. Charu Khamesra Dr. Vishal Jain	• To prepare certificates.
7.	Transport	Mr Gaurav Agarwal	Buses for all the students.

Dean-SA

Director

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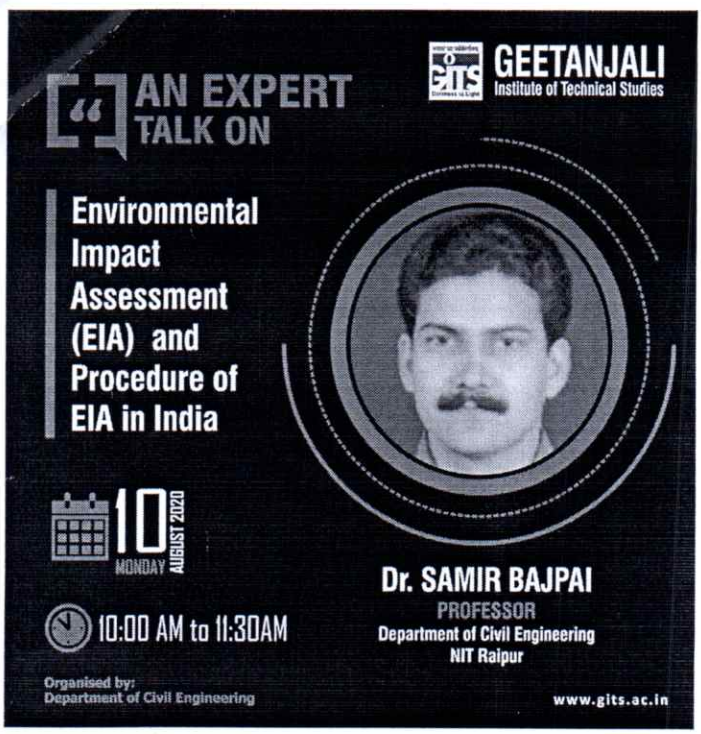
Copy to :

1. The Director MBA
2. The Finance controller
3. All HoDs & Faculty members for Circulation.
4. Proctor
5. Sports Officer
6. Security Incharge
7. All the Concerned


GEETANJALI INSTITUTE OF TECHNICAL STUDIES
Darkness to Light
Since 2002
FELICITATION CEREMONY OF

Report
on
WEBINAR held on 10th Aug. 2020
"Environmental Impact Assessment and Procedure of EIA in India"



*A webinar has been conducted on **"Environmental Impact Assessment and Procedure of EIA in India"** for the students of Civil Engineering Branch by Dr. Samir Bajpai, Prof. Dept. of Civil Engineering NIT Raipur.*

This session has been conducted on Digital platform Google Meet and hosted by Mr Jagdish Lohar, Faculty CED.
The session was started with by a brief introduction of Dr. Samir Bajpai by Head of Department Dr Manish Varma to the attendees. More than 60 plus students have attended the webinar and learnt the technical know-how about Environmental Impact Assessment and it procedure.

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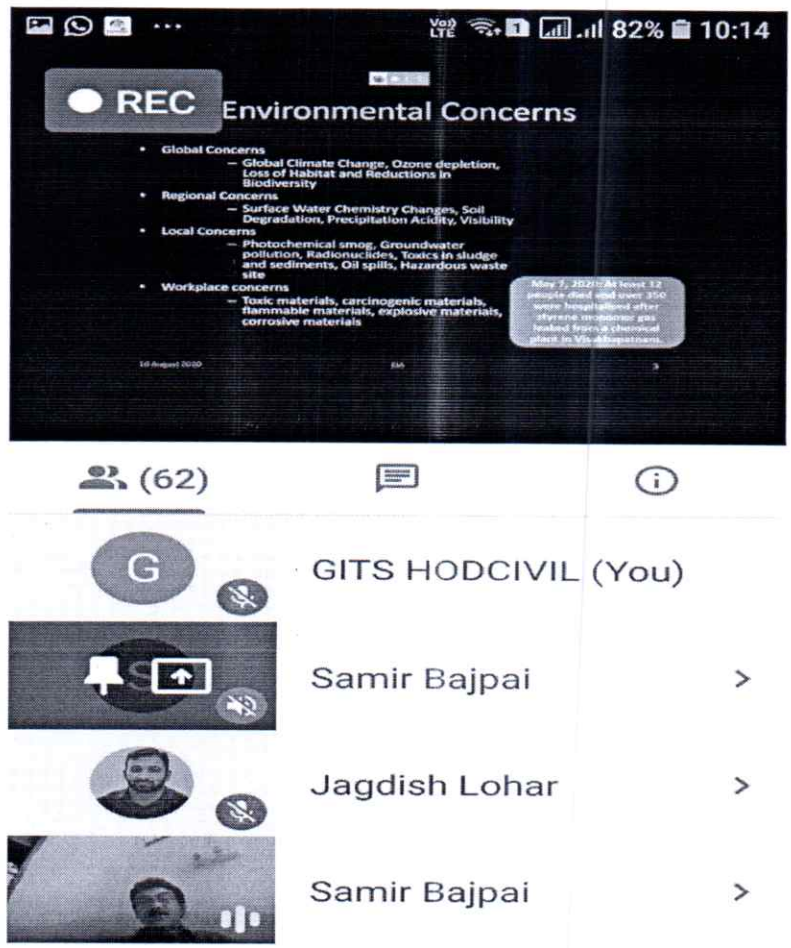

In this webinar, students were trained about the fundamentals of EIA. The role of EIA in our society is very crusial and it is the need of the time. Students were taught to give due concern to the nature all the time whenever they are starting a new idea of business.

Also the problems associated witht the EIA procedures had been clarified by Dr. Bajpai.

During this webinar, the students has also asked their doubt about the topic and these doubt has been cleared in lucid manner by Dr. Sameer Bajpai.

The webinar has ended with clappes from the attandees and vote of thanks to Dr. Samir Bajpai by HOD-CE, Dr. Manish Varma.

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An Expert Talk on HR Trends in COVID – 19

BY: Ms. Megha Gupta, HR Director, Finserv

Geetanjali Institute of Technical Studies has organized an An ExpertTalk on HR Trends in COVID - 19 with Ms. Megha Gupta, Human Resources Director, Finserv on 7th Aug 2020 at 11 AM.

Ms. Megha Gupta is the Human Resources Director at Fiserv where she leads the team of business partners and culture and change management supporting the transformation across the company.

Ms. Gupta in her interaction with students emphasised over flexibility of institutions and employees. She also suggested students for regular updating and enhancing their employability skills.

E- Certificate were given to all the participants.

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EXPERT WEBINAR

On

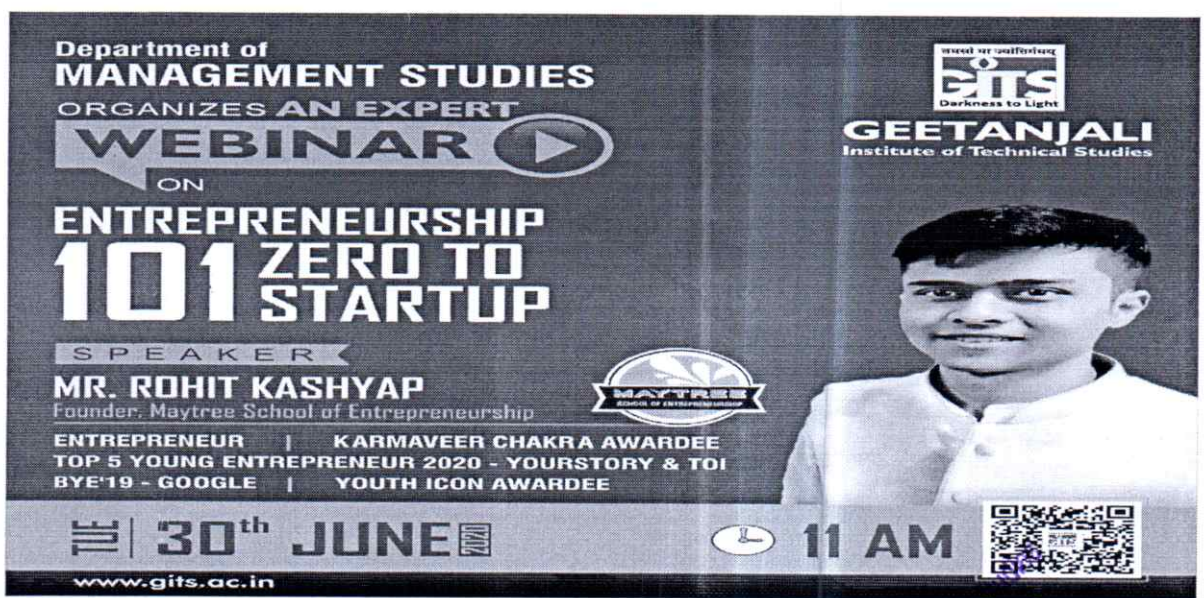
"Entrepreneurship 101: Zero to Startup"

BY: Mr. Rohit Kashyap Founder Maytree School of Entrepreneurship

Geetanjali Institute of Technical Studies (Department of Management Studies) is organizing an Expert Webinar with Mr. Rohit Kashyap, Founder, Maytree School of Entrepreneurship on "Entrepreneurship 101: Zero to Startup" on 30th June 2020 from 11:00 AM onwards.

Mr. Rohit Kashyap is a 18-year-old who chose the Larger Cause! Long luist of awards of Mr. Rohit is as follows-

Karmaveer Chakra Awardee By United Nations | Entrepreneur! Startup Advisor | Mentor | Social Media Strategist | Top 5 Youngest Entrepreneurs of India 2020 According to Yourstory & Times of India| Best Young Entrepreneur of 2019 According to Google (Top Featured Article)| Startup Mentor (Science & Tech Department, Govt of India) | Chief Of Tech Kreeda Bharti Bihar (A sports wing of RSS) | Chief of Tech Friends for Patna (A non for Profit Organization).



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NPTEL Online Certification

(Funded by the Ministry of HRD, Govt. of India)

This certificate is awarded to

MILIND JAIN

for successfully completing the course

Programming in C++

with a consolidated score of **75** %

Online Assignments	21.92/25	Proctored Exam	53.12/75

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Prof. Anupam Basu
NPTEL Coordinator
IIT Kharagpur

Total number of candidates certified in this course: **2394**

Aug-Sep 2018
(8 week course)

A. Goswami

Prof. Adrijit Goswami
Dean
Continuing Education, IIT Kharagpur

Indian Institute of Technology Kharagpur

FREE ONLINE EDUCATION swayam शिक्षित भारत, उन्नत भारत

Roll No: NPTEL18CS32S21900018

To validate and check scores: http://nptel.ac.in/noc

Duke
UNIVERSITY

Aayesha Bi

has successfully completed

Programming Foundations with JavaScript, HTML and CSS

an online non-credit course authorized by Duke University and offered through Coursera

Susan H. Rodger, Professor of the Practice, Computer Science
Robert Duvall, Lecturer, Computer Science
Owen Astrachan, Professor of the Practice, Computer Science
Andrew D. Hilton, Assistant Professor of the Practice, Electrical and Computer Engineering

Verif
Coursera h

VERIFIED
CERTIFICATE of ACHIEVEMENT

MITx

This is to certify that

Aayesha Bi

successfully completed and received a passing grade in

6.002.1x: Circuits and Electronics 1: Basic Circuit Analysis

a course of study offered by MITx, an online learning initiative of the Massachusetts Institute of Technology through edX.

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Anant Agarwal
Professor, Department of Electrical Engineering and Computer Science
Massachusetts Institute of Technology

Bonnie Lam
Graduate Instructor, Department of Electrical Engineering and Computer Science
Massachusetts Institute of Technology

Sanjay Sarma
Vice President for Open Learning
Massachusetts Institute of Technology

edX

VERIFIED CERTIFICATE
Issued August 2020

VALID CERTIFICATE ID
425fd4a677754a3dafd43cb2ebf2f2a7

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GEETANJALI
INSTITUTE OF TECHNICAL STUDIES

TEACHER'S ACADEMIC RECORD BOOK

Name of the Teacher:	Tina Bhati
Designation:	Assistant Professor
Department:	Electronics & Communication
Course:	B. Tech.
Subject with RTU Code:	5EC4-03
Department:	Electronics & Communication
NBA Code of Course	CO353
Class: (Year/Semester/Section)	III Year, V Semester
Academic Year and Term (Even/Odd)	2019-20 (Odd)

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INDEX - COURSE FILE

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4	Program Outcomes of Department (PO's)	4			
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Name of faculty: Tina Bhati
Subject with Code: 5EC3-04

NBA CODE: CO353

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VISSION & MISSION OF INSTITUTE

VISION

To achieve excellence in technical and management education through quality teaching research and innovations

MISSION

M1: To provide an excellent learning environment to produce socially responsible and productive technical professionals.

M2: To set up the state-of-the-art facilities for quality education and innovation.

M3: To impart knowledge & Skills leading to shaping a budding manager as a quality executive.

M4: To encourage for life-long learning and team-based problem solving through learning environment.

VISION & MISSION OF DEPARTMENT

VISION

To provide quality education through research & innovation to cater the need of industry & society.

MISSION

To nurture knowledge of students in theoretical and practical aspects in collaboration with industries.

To inculcate the students towards research and innovation to fulfill the need of industry & society.

To develop socially responsible professionals with values and ethics.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Programme Educational Objectives of the programme offered by the department are listed below:

PEO1: Deliver comprehensive knowledge and skills for successful career in the industries.

PEO2: To Provide conducive environment for becoming a successful entrepreneur and life-long learning.

PEO3: Inculcate research through innovative solution of the real life problems with help of industries.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO1: Professional Skills: The ability to understand, analyze and develop electronic systems in the areas related to hardware and software development, communication systems and networking for efficient design of electronic-based systems of varying complexity.

PSO2: Problem-Solving Skills: The ability to apply standard practices and strategies in electronic system project development on both hardware and software environments to deliver a quality product for business success.

PSO3: Successful Career and Entrepreneurship: The ability to employ modern electronic solutions on different platforms, in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

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PROGRAMME OUTCOMES (POs)

A student will develop:

PO1. ENGINEERING KNOWLEDGE: An ability to apply knowledge of Mathematics, Science and Engineering Fundamentals in Electronics and Communication Engineering.

PO2. PROBLEM ANALYSIS: An ability to analyze and interpret data by designing and conducting experiments. Develop the knowledge of developing algorithms, designing, implementation and testing applications in electronics and communication related areas.

PO3. DESIGN/ DEVELOPMENT OF SOLUTION: An ability to Design a system Component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

PO4. CONDUCTION OF INVESTIGATION OF COMPLEX PROBLEMS: An ability to Identify, formulate and solve engineering problems.

PO5. MODERN TOOL USAGE: An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

PO6. THE ENGINEERING AND SOCIETY: Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.

PO7. ENVIRONMENT & SUSTAINABILITY: Understand the impact of professional engineering solution in societal and environmental contexts, and demonstrate the knowledge of, and need of sustainable development.

PO8. ETHICS: An ability to understand the professional, social and ethical responsibility.

PO9. INDIVIDUAL AND TEAM WORK: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. COMMUNICATION: An ability to Communicate effectively in order to succeed in their profession such as, being able to write effective reports and design documentation, make effective presentations.

PO11. PROJECT MANAGEMENT & FINANCE: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environment.

PO12. LIFE-LONG LEARNING: Recognize the need and an ability to engage in life-long learning.

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COURSE OUTCOMES (COs)

CO353.1	Identify the concept of open and closed loop control systems and implement the mathematical models of physical systems and tools such as SFG and block diagram to analyze the system.
CO353.2	Evaluate the time response of the system and stability in time by using Routh-Hurwitz criterion, Root Locus.
CO353.3	Analyze the system in frequency domain and hence predict the system stability in frequency domain using Bode plot, polar plots and Nyquist plot and also design compensator in time and frequency domain.
CO353.4	Analyze the response and stability of the system represented by state space models
CO353.5	Understand the concept of optimal control and nonlinear control.

COS MAPPING WITH POs AND PSOs

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO353.1	3	3	1	1	1	0	0	0	0	0	0	1	3	1	0
CO353.2	3	3	2	2	1	0	0	0	0	0	0	1	3	1	0
CO353.3	3	3	2	2	1	0	0	0	0	0	0	1	3	1	0
CO353.4	3	3	2	2	1	0	0	0	0	0	0	1	3	1	0
CO353.5	2	2	1	1	1	0	0	0	0	0	0	1	2	1	0
CO353 (AVG)	3	3	2	2	1	0	0	0	0	0	0	1	3	1	0
Final Mapping of CO353	3	3	2	2	1	0	0	0	0	0	0	1	3	1	0

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Name of faculty: Tina Bhati
Subject with Code: 5EC3-04

NBA CODE: CO353

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UNIVERSITY ACADEMIC CALENDAR

GEETANJALI INSTITUTE OF TECHNICAL STUDIES, UDAIPUR				
RTU ACADEMIC CALANDER FOR ODD SEM (2019-20)				
PARTICULARS	B.TECH. I	B.TECH. III	B.TECH. V	B.TECH. VII
Induction Program	01.08.2019 - 15.08.2019			
Commencement of Classes	16.08.2019	2.07.2019	13.7.2019	2.7.2019
First Mid Term	30.09.2019	19.08.2019	26.08.2019	19.08.2019
Second Mid Term	14.11.2019	04.11.2019	16.10.2019	21.10.2019
Last Working Day	18.11.2019	16.11.2019	31.10.2019	30.10.2019
Commencement of Practical Exams	19.11.2019	18.11.2019	25.11.2019	23.11.2019
Commencement of Theory Exams	05.12.2019	04.12.2019	07.11.2019	06.11.2019
Winter Break	25.12.2019 to 31.12.2019			
Commencement of Classes for next Even Semesters (2019-20)	II	IV	VI	VIII
	01.01.2020	01.01.2020	09.12.2019	09.12.2019

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EVALUATION SCHEME

FACULTY DETAILS:

Name of the Faculty: Tina Bhati
Designation: Assistant Professor
Department: ECE

1. TARGET

a) Percentage Pass: 100%
b) Percentage I class: 80 %

2. COURSE PLAN

The course has both lectures and problems. During the lectures, the students are taught the basic principles of control system. During the problem sessions, fundamental problems are introduced and solved.

3. METHOD OF EVALUATION

3.1.	☑	Continuous Assessment Examinations (Mid-Term 1, Mid-Term 2)
3.2.	☑	Assignments / Seminars
3.3.	☐	Mini Projects
3.4.	☑	Quiz
3.5.	☐	Others_____

_____

4. List out any new topic(s) or any innovation you would like to introduce in teaching the subject in this Semester.

NIL

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Signature of Faculty:

Signature of HOD

Name of faculty: Tina Bhati
Subject with Code: 5EC3-04

NBA CODE: CO353

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UNIVERSITY SYLLABUS

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

SYLLABUS

III Year - V Semester: B.Tech. (Electronics & Communication Engineering)

5EC4-03: Control system

Credit: 3
3L+0T+0P

Max. Marks: 150(IA:30, ETE:120)
End Term Exam: 3 Hours

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Introduction to control problem- Industrial Control examples. Transfer function. System with dead-time. System response. Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho-generators, electro hydraulic valves, hydraulicservomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems. Block diagram and signal flow graph analysis.	8
3	Feedback control systems- Stability, steady-state accuracy,transient accuracy, disturbance rejection, insensitivity and robustness. proportional, integral and derivative systems. Feedforward and multi-loop control configurations. stability concept, relative stability, Routhstability criterion.	7
4	Time response of second-order systems- steady-state errors and error constants. Performance specifications in time-domain. Root locus method of design. Lead and lag compensation.	6
5	Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquistplots. Nyquist stability criterion. Performance specifications in frequency-domain. Frequency domain methods of design. Compensation & their realization in time & frequency domain. Lead and Lag compensation. Op-amp based and digital implementation of compensators. Tuning of process controllers. State variable formulation and solution.	8
6	State variable Analysis- Concepts of state, state variable, state model, state modelsfor linearcontinuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability &observability.	6
7	Introduction to Optimal control & Nonlinear control, Optimal Control problem, Regulator problem, Output regulator, treking problem. Nonlinear system – Basic concept & analysis.	6
	Total	42

PRESCRIBED BOOKS

1. Ogata, Modern Control System, Pearson Education, 2009.
2. Nise's, Rajeev Gupta, Control System Engineering, Wiley (2011)

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WEEKLY TIME TABLE OF THE TEACHER

First Time Table: with effect from (Date): 15h July 2019

Day	1	2	3	4	5	6	7	8	9
Monday			CS						
Tuesday									
Wednesday	CS								
Thursday					CS				
Friday									
Saturday	CS								

Revision: 1 with effect from (Date):

Day	1	2	3	4	5	6	7	8	9
Monday									
Tuesday									
Wednesday									
Thursday									
Friday									
Saturday									

Revision: 2 with effect from (Date):

Day	1	2	Lunch Break	3	4	Tea Break	5	6	7	Remedial Classes
Monday										
Tuesday										
Wednesday										
Thursday										
Friday										
Saturday										

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Name of faculty: Tina Bhati
Subject with Code: 5EC3-04

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COURSE-PLAN

UNIT	Lect. No.	TOPICS	Teaching Methods/ Teaching Aids	Date of Plan	Actual Date of Delivery
I	1	Objective, scope and outcome of the course	WB	15-07-2019	22-07-2019
	2	Introduction to control problem- Industrial Control examples, Transfer function. System with dead-time, System response. Closed-loop systems and open loop system	WB	17-07-2019	22-07-2019
	3	Control hardware and their models: potentiometers, synchros, LVDT,	WB	18-07-2019	23-07-2019
	4	dc and ac servomotors, tacho generators	WB	20-07-2019	24-07-2019
	5	Electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators.	WB	22-07-2019	25-07-2019
	6	Block diagram analysis	WB	24-07-2019	26-07-2019
	7	Block diagram analysis	WB	25-07-2019	27-07-2019
	8	Signal flow graph analysis	WB	27-07-2019	30-07-2019
	9	Signal flow graph analysis	WB	29-07-2019	**31-07-2019**
II	10	Feedback control systems- Stability, steady-state accuracy, transient accuracy	WB	31-07-2019	01-08-2019
	11	Insensitivity and robustness.	WB	01-08-2019	06-08-2019
	12	Feed forward and multi-loop control configurations, disturbance rejection	WB	03-08-2019	08-08-2019
	13	Proportional, integral and derivative systems.	WB	05-08-2019	09-08-2019
	14	Stability concept, relative stability, Routh stability criterion.	WB	07-08-2019	19-08-2019
	15	Routh stability criterion.	WB	08-08-2019	21-08-2019
	16	Routh stability criterion.	WB	14-08-2019	**22-08-2019**
III	17	Time response of second-order systems	WB	17-08-2019	26-08-2019
	18	Time response of second-order systems	WB	19-08-2019	04-09-2019
	19	steady-state errors	WB	21-08-2019	09-09-2019
	20	Dynamic errors, Performance specifications in time-domain.	WB	22-08-2019	14-09-2019
	21	Performance specifications in time-domain, Root locus method of design.	WB	26-08-2019	16-09-2019
	22	Root locus method of design.	WB	31-08-2019	**18-09-2019**
IV	23	Frequency-response analysis- Performance specifications in frequency-domain	WB	04-09-2019	19-09-2019
	24	Polar plots	WB	09-09-2019	23-09-2019
	25	Nyquist plots, Nyquist stability criterion	WB	11-09-2019	25-09-2019
	26	Bode plot	WB	12-09-2019	21-09-2019
	27	Bode plot.	WB	14-09-2019	26-09-2019
	28	Lead and Lag compensation	WB	16-09-2019	28-09-2019
	29	Compensation & their realization in time & frequency domain.	WB	18-09-2019	30-09-2019
	30	Op-amp based and digital implementation of compensators, Tuning of process controllers	WB	19-09-2019	**04-10-2019**
V	31	State variable Analysis- Concepts of state, state variable, state model,	WB	21-09-2019	05-10-2019
	32	state models for linear continuous time functions	WB	23-09-2019	09-10-2019
	33	state models for linear continuous time functions	WB	25-09-2019	10-10-2019
	34	solution of state equations	WB	26-09-2019	10-10-2019
	35	observability, diagonalization of transfer function	WB	28-09-2019	11-10-2019
	36	State variable formulation and solution	WB	30-09-2019	**14-10-2019**
IV	37	Introduction to Optimal control & Nonlinear control	WB	03-10-2019	16-10-2019
	38	Optimal Control problem	WB	05-10-2019	Notes Provided
	39	Regulator problem	WB	07-10-2019	
	40	Output regulator	WB	09-10-2019	
	41	tracking problem	WB	10-10-2019	
	42	Nonlinear system – Basic concept & analysis	WB	12-10-2019	

Signature of Faculty:

Signature of HOD

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Subject with Code: 5EC3-04

NBA CODE: CO353

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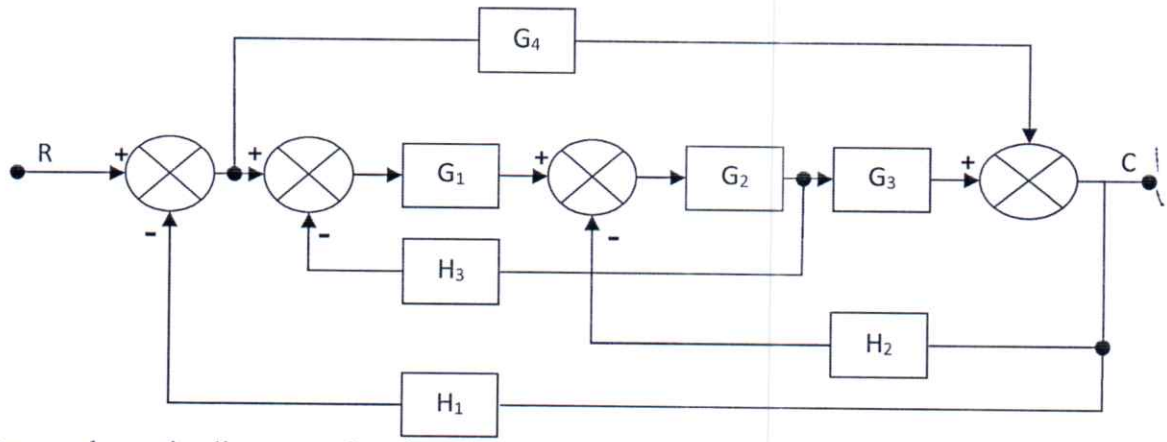
ASSIGNMENT I

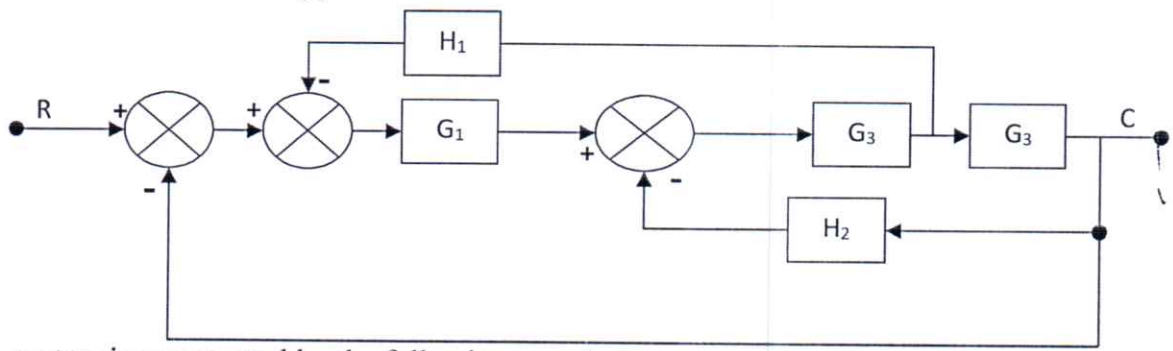
Date of Assignment: 31/07/19 Date of Submission: 07/08/19

Q.1. For the system represented by block diagram shown below, obtain the transfer function by using block diagram reduction technique. Verify the result using signal flow graphs.



Q.2. Draw schematic diagram of a closed loop control system of your choice. Draw its block diagram also.

Q.3. Determine the ratio $\frac{C(s)}{R(s)}$ for the system shown in the following diagram



Q.4. A system is represented by the following equations:

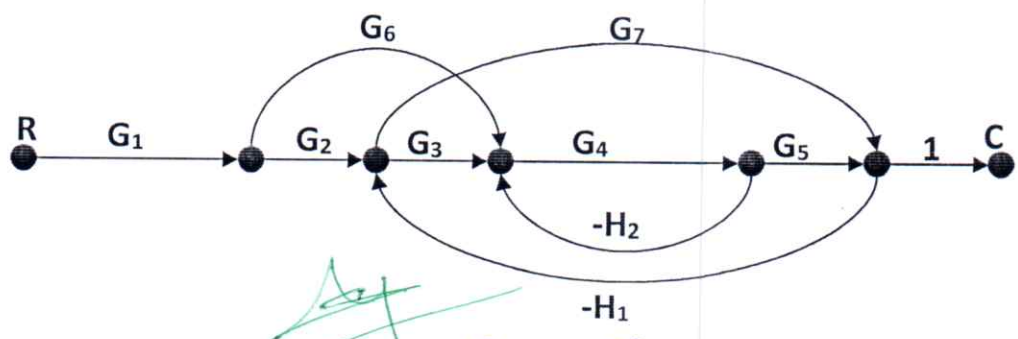
a. $x = x_1 + 3\mu$

b. $\frac{dx_1}{dt} = -3x_1 + x_2 + 2\mu$

c. $\frac{dx_2}{dt} = -2x_1 + \mu$

Find the transfer function **X(s)/μ(s)** by signal flow graph technique.

Q.5. Find the transfer function of the system whose signal flow graph is as below.



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ASSIGNMENT UNIT –II

Date of Assignment: 18/09/19 Date of Submission: 25/09/19

Q.1. The open loop transfer function of a unity feedback ac position control system is

$$G(s) = \frac{10K}{s(1+0.1s)}$$

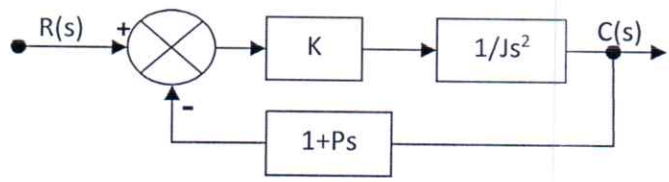
Find the minimum value of amplifier gain K so that when the input shaft rotates at ½ revolutions per second the steady state velocity error is 0.2°. With that value of K, what will be the value of damping factor and natural frequency?

Q.2. A unity feedback control system has an open loop transfer function.

$$G(s) = \frac{5}{s(s+1)}$$

Find rise time, percentage peak over shoot, peak time and settling time for a step input of 10 units.

Q.3. Determine the value of K and P of the closed loop system shown below so that maximum over shoot in unit step response is 25% and peak time is 2 seconds. Assume J = 1Kgm^2.



Q.4. A unity feedback system has the forward path transfer function

$$G(s) = \frac{K_1(2s+1)}{s(5s+1)(s+1)^2}$$

The input r(t) = 1+6t is applied to the system. Determine the minimum value of K_1 if the steady error is to be less than 0.1.

Q.5. Comment on the stability of a system whose characteristic equation is given below

$$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$$

Q.6. The characteristic equation of feedback control system is

$$s^4 + 20s^3 + 15s^2 + 2s + K = 0$$

i. Determine the range of K for the system to be stable.

ii. Can the system be marginally stable? If so, find the required value of K and the frequency of sustained oscillation.

Q.7. Plot the root locus for a system whose forward path transfer function is

$$(s)H(s) = \frac{K(s+1)}{s(s+2)(s^2+2s+5)}$$

Q.8. Consider a unity feedback control system with the following feed forward transfer function as:

$$G(s) = \frac{K}{s(s^2+4s+8)}$$

Plot the root loci for the system.

ASSIGNMENT UNIT –III

Date of Assignment: 04/10/19 Date of Submission: 10/10/19

Q. 1 Derive expression for

a. M_r (resonant peak)

b. W_r (resonant frequency)

c. W_b (bandwidth) for a second order system.

Discuss the merits and demerits of frequency response analysis.

Q. 2 State Nyquist criterion of stability. Construct the complete Nyquist plot for a unity feedback control system whose open loop transfer function is

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$$G(s)H(s) = \frac{K}{s(s^2 + 2s + 2)}$$

Find the maximum value of K for which the system is stable.

Q. 3 Sketch the Bode plot showing magnitude in dB and phase angle in degrees as a function of log frequency for the transfer function shown below.

$$G(s)H(s) = \frac{2000}{s(s+2)(s+100)}$$

Determine gain cross over frequency, phase crossover frequency, gain margin and phase margin.

Q. 4 Consider the unity feedback control system, whose open loop transfer function is given by:

$$G(s) = \frac{as+1}{s^2}$$

Determine the value of **a**, so that the phase margin is 45°.

Q. 5 Define the followings:

i. Gain Margin
ii. Phase Margin
iii. Phase crossover frequency

Q. 6 A unity step input is applied to a unity feedback control system having open loop transfer function

$$G(s) = \frac{K}{s(1+sT)}$$

Determine the value of K and T to have M_p=20% and resonant frequency W_r = 6 rad/sec. Calculate the resonant peak M_r.

ASSIGNMENT UNIT –IV

Date of Assignment: 11/10/19 Date of Submission: 18/10/19

Q. 1 Obtain a state model of the system described by the transfer function

$$\frac{Y(s)}{U(s)} = \frac{6(s+3)(s+2.5)}{(s+2)(s^2+4s+5)}$$

Q. 2 Obtain STM for the state model whose A matrix is given by

$$A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$$

Q. 3 Determine the controllability and observability of the system described by state equations given below.

$$\begin{bmatrix} x_1^0 \\ x_2^0 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ -3 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = [1 \;\; 0] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Q. 4 The system equations are given by:

$$x(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$

$$y = [1 \;\; 0]\, x(t)$$

i. Find the transfer function of the system.
ii. How, the solution of the state equation can be found?

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Q. 5 Test for the controllability and observability for the following system:

$$x(t) = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} u$$

$$y = [1\; 0\; 2]x(t)$$

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ASSIGNMENT UNIT –V

Date of Assignment: 16/10/19 Date of Submission: 30/10/19

Q. 1 What is optimal control?

Q. 2 What is non linear control system?

Q. 3 Explain the following in detail: tracking problem and regulator problem.

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QUIZ QUESTIONS

UNIT I

1. An advantage of open loop system is/are?
   i. simple and economical
   ii. accurate
   iii. reliable
   iv. all of the above
2. Which system is also known as automatic control system?
   i. open loop control system
   ii. closed loop control system
   iii. either 1 or 2
   iv. nether 1 nor 2
3. Which of the following are the disadvantages of a closed loop control system?
   i. reduces the overall gain
   ii. complex and costly
   iii. oscillatory response
   iv. all of the above
4. By using which of the following elements, mechanical translational systems are obtained?
   i. mass element
   ii. spring element
   iii. dash-pot
   iv. all of the above
5. Force balancing equation of a mass elements is (where x = displacement)
   i. $M\ d^2x/dt^2$
   ii. M dx/dt
   iii. M *x
   iv. any of the above
6. Which of the following is the analogous quantity for mass element in force-voltage analogy?
   i. resistance
   ii. inductance
   iii. capacitance
   iv. all of the above

UNIT II

1. Transient state analysis deals with ----------
   i. magnitude of error
   ii. nature of response
   iii. both 1 and 2
   iv. none of the above
2. When compared a 1^{st} order LPF with a 2^{nd} order LPF has
   i. lower voltage gain.
   ii. higher voltage gain.
   iii. higher cut off frequency.
   iv. faster drop in filter response.
3. The impulse response of the system described by the differential equation

$$\frac{dy}{dx} + 6y = x(t)$$

will be
   i. $e^{-3t}u(t)$.
   ii. e^{-6t}.
   iii. none of above.

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4. A second order control system is defined by the following equation: $4\ d^2c(t)/dt^2 + 8\ dc(t)/dt + 16\ c(t) = 16\ u(t)$ The damping ratio and natural frequency for this system are respectively
   i. 0.25 and 2 rad/s
   ii. 0.25 and 4 rad/s
   iii. 0.50 and 2 rad/s
   iv. 0.50 and 4 rad/s
5. The steady state error due to ramp input for a type two system is equal to
   i. zero
   ii. infinite
   iii. non zero number
   iv. constant
6. The characteristic equation of a feedback control is $2s^4 + s^3 + 3s^2 + 5s + 10 = 0$. The no of roots in the right half of the s-plane is
   i. 2.
   ii. 3.
   iii. 4.
   iv. 0.
7. The angle condition is used for checking whether any point lies on root locus or not is.....
   i. $\pm (2q + 1)\ 180°$
   ii. $\pm (2q)\ 180°$
   iii. $\pm (2q + 1)\ 360°$
   iv. $\pm (2q)\ 360°$
8. The magnitude condition for root locus is .....
   i. $|G(s)H(s)| = 0$
   ii. $G(s)H(s)| = 2$
   iii. $|G(s)H(s)| = 1$
   iv. $|G(s)H(s)| = \infty$
9. A unity feedback control system has an open loop transfer function $G(s) = k/(s(s^2 + 7s + 12)$ The gain k for which $s = -1 + j1$ will lie on the root locus of the system is
   i. 4
   ii. 6.5
   iii. 5
   iv. 10
10. Which of the following statements is/are true?
    i. Centroid may be a part of root locus
    ii. Centroid may not be a part of root locus
    iii. both 1 and 2
    iv. nether 1 nor 2

UNIT III

1. None of the poles of a linear control system lie in the right half of s plane. For a bounded input, the output of this system
   i. always bounded.
   ii. could be unbounded.
   iii. tends to zero.
   iv. none of these.
2. In polar plots if the critical point '-1+j0' is enclosed then the system is --------
   i. stable
   ii. unstable
   iii. marginally stable
   iv. critical stable

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3. Find the corner frequency for the following transfer function? G(s) = 1/(s+2)
   i. 2 rad/s
   ii. 1/2 rad/s
   iii. 4 rad/s
   iv. 1/4 rad/s
4. Which plots in frequency domain represent the two separate plots of magnitude and phase against frequency in logarithmic value?
   i. Polar plots
   ii. Bode plots
   iii. Nyquist plots
   iv. All of the above
5. How is the sinusoidal transfer function obtained from the system transfer function in frequency domain?
   i. Replacement of 'jω' by 's'
   ii. Replacement of 's' by 'ω'
   iii. Replacement of 's' by 'jω'
   iv. Replacement of 'ω' by 's'
6. According to the principle of log-scales, if the ratio between two points is same, then the two points get _____equally.
   i. United
   ii. Separated
   iii. Multiplexed
   iv. Mixed
7. If a pole is located at origin, how does it get represented on the magnitude plot?
   i. -10 log (ω) dB
   ii. -20 log (ω) dB
   iii. -40 log (ω) dB
   iv. -60 log (ω) dB
8. Lead compensator is used to improve ----------
   i. transient response
   ii. steady state response
   iii. both 1 and 2
   iv. none of the above
9. Adding a pole to a system transfer function in terms of compensator represents a ---------- compensator?
   i. Lead
   ii. Lag
   iii. Lead-Lag
   iv. Lag-lead
10. The transfer function of two compensator are given below $C_1 = \frac{10(s+1)}{s+10}$ and $C_2 = \frac{s+10}{10(s+1)}$ which one is correct?
    i. C_1 is a lag compensator and C_2 is a lead compensator.
    ii. C_1 is a lead compensator and C_2 is a lag compensator.
    iii. Both C_1 and C_2 are lead compensator.
    iv. Both C_1 and C_2 are lag compensator.

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UNIT IV

1. A transfer function of a control system does not have pole-zero cancellation. Which one of the following statement is true?
   i. system is neither controllable nor observable
   ii. system is completely controllable and observable

iii. system is observable but uncontrollable
iv. system is controllable but unobservable

2. The transfer function approach is applicable to :
   i. only linear time-invariant systems
   ii. linear time-invariant as well as time-varying systems
   iii. linear as well as nonlinear systems
   iv. all systems
3. The number of state variables of a system is equal to :
   i. the number of integrators present in the system
   ii. the number of differentiators present in the system
   iii. the sum of the number of integrators and differentiators present in the system
   iv. none of these
4. $x(t) = Ax(t) + Bu(t)$ is called the :
   i. system equation
   ii. state equation
   iii. state transition equation
   iv. none of these
5. The number of canonical forms is :
   i. 2
   ii. 3
   iii. 4
   iv. 5
6. Direct decomposition is applicable to transfer functions in which :
   i. denominator is in factored form
   ii. both numerator and denominator are in factored form
   iii. both numerator and denominator are not in factored form
   iv. all the above
7. Direct decomposition is applicable to transfer functions in which :
   i. denominator is in factored form
   ii. both numerator and denominator are in factored form
   iii. both numerator and denominator are not in factored form
   iv. all the above
8. The eigen values of the state model are the same as the :
   i. open-loop poles
   ii. closed-loop poles
   iii. both the open-loop and closed-loop poles
   iv. none of these
9. State space analysis is applicable even if the initial conditions are _____
   i. Zero
   ii. Non-zero
   iii. Equal
   iv. Not equal
10. Which among the following are the interconnected units of state diagram representation?
    i. Scalars
    ii. Adders
    iii. Integrators
    iv. All of the above
11. Which among the following plays a crucial role in determining the state of dynamic system?
    i. State variables
    ii. State vector
    iii. State space
    iv. State scalar

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UNIT V

1. The main step for solving the optimal control problem:
   i. Transfer function of system which is optimal with respect to the given performance criterion
   ii. Compensators for the system
   iii. Minimizing the quadratic function
   iv. All of the mentioned
2. For the stability in optimal control poles of the transfer function must be :
   i. Located on the right half of s plane
   ii. Left half of s plane
   iii. On the s plane
   iv. None of the mentioned
3. The special case of the tracking problem with input equal to zero:
   i. Free response
   ii. Regulator problem
   iii. Forced response
   iv. Output regulator problem
4. The method of choosing compensator is the configuration must be:
   i. Forward path
   ii. Cascade and feedback compensation
   iii. Feed forward configuration
   iv. All of the mentioned
5. The primary objective of the output regulator problem is to damp out:
   i. Initial conditions quickly
   ii. Reducing the effect of excessive oscillations
   iii. Reducing the effect of excessive overshoot
   iv. All of the mentioned
6. Asymptotic stability is concerned with…
   i. A system not under the influence of
   ii. A system under influence of input
   iii. A system under influence of the output
   iv. A system not under influence of input
7. The term backlash is…
   i. Gear trains
   ii. Tacho generator
   iii. Servomotors
   iv. Induction relays
8. Practically all the elements are:
   i. Linear
   ii. Non-linear
   iii. Exponential
   iv. None of the mentioned

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Mid Term Exam – I

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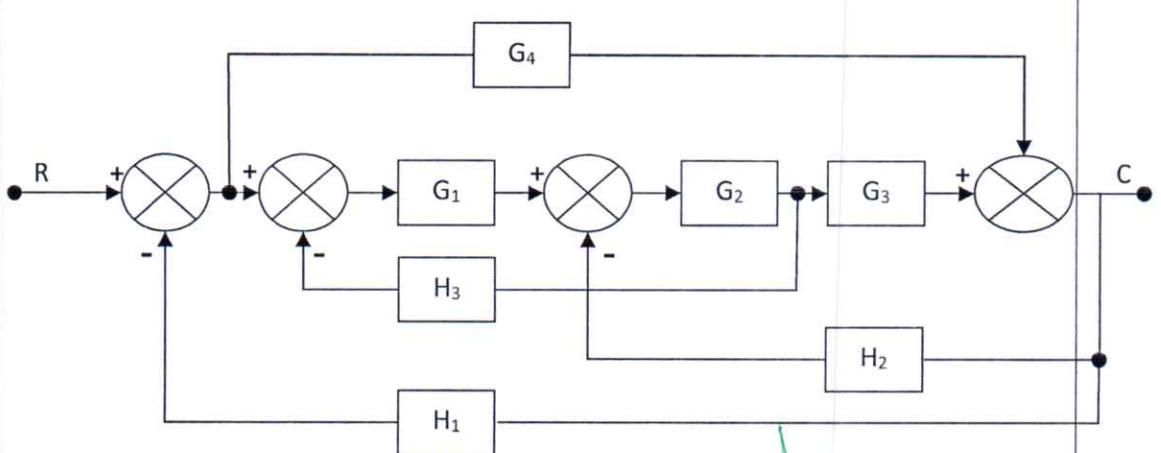
I[st] Internal Examination 2018-19

B.Tech III Year, V Semester

Sub: Control System (Code: 5EC4-03)

Time: 1.30 Hr **Max Marks: 24**

Q. No.	Question	Marks	CO
	PART-A (Compulsory)		
Q.1 (a)	What is meant by a system?	1	CO246.1
(b)	What is meant by steady state error?	1	CO246.2
(c)	What are the three basic elements in electrical and mechanical system?	1	CO246.1
(d)	List out the advantages of open and closed loop control system.	2	CO246.1
	PART-B (Attempt only 3 out of 4)		
Q.2	The open loop transfer function of a unity feedback control system is given by $G(s) = \frac{k}{s(1+sT)}$ By what factor the amplifier gain k should be multiplied so that the damping ratio is increased from 0.3 to 0.9.	3	CO246.1
Q.3	A unity feedback system has an open loop transfer function, $G(s) = \frac{K(s+13)}{s(s+3)(s+7)}$ Using Routh's stability criterion, find the range of K for the system to be stable	3	CO246.1
Q.4	Find the position, velocity and acceleration error constants, for the following unity feedback system, whose open loop transfer function is given by: $G(s) = \frac{50}{(1+0.1s)(1+2s)}$	3	CO246.2
Q.5	Obtain the unit step response of a unity feedback system whose open loop transfer function is $G(s) = \frac{4}{s(s+5)}$	3	CO246.2
	PART-C (Attempt only 2 out of 3)		
Q.6	Explain the derivation of analogous network using force voltage analogy.	5	CO246.1
Q.7	The open loop transfer function of a unity feedback system is given by $G(s) = \frac{40}{[\emptyset(2\emptyset+1)]}$ Determine steady state error using error-series for input r(t)= (3+4t)t	5	CO246.2
Q.8	For the system represented by block diagram shown below, obtain the transfer function by using block diagram reduction technique. Verify the result using signal flow graphs. 	5	CO246.3

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Marks and Identification of Slow Learner of Mid-Term I

*(Y = Slow Learner, if obtained marks are <50%)

S.No.	UNIVERSITY ROLL NO.	Name of Student	Mid-Term 1 MM-24	Remark (Remedial Class need or not – Y/N)
1	17EGIEC001	Aayesha Bi	AB	Y
2	17EGIEC002	Ajay Devra	18	N
3	17EGIEC003	Akansha Suthar	23	N
4	17EGIEC005	Anchal Agarwal	13	N
5	17EGIEC006	Anisha Kumari Jain	24	N
6	17EGIEC007	Anshuman Singh Chouhan	12	N
7	17EGIEC008	Arpit Jain	AB	Y
8	17EGIEC009	Azhar Nawajpinjara	15	N
9	17EGIEC012	Deepesh Meena	20	N
10	17EGIEC013	Deepika Choudhari	18	N
11	17EGIEC014	Dhruv Sharma	AB	Y
12	17EGIEC015	Divyaraj Singh Dahiya	21	N
13	17EGIEC016	Diya Pushkarna	18	N
14	17EGIEC017	Faiz Alam	16	N
15	17EGIEC018	Gunjan Joshi	12	N
16	17EGIEC019	Harshita Banshal	24	N
17	17EGIEC020	Himanshi Jain	18	N
18	17EGIEC021	Iffat Mazhar	19	N
19	17EGIEC022	Kapil Joshi	AB	Y
20	17EGIEC023	Khushi Bhatnagar	AB	Y
21	17EGIEC024	Manish Sain	AB	Y
22	17EGIEC025	Manoj Dadheech	18	N
23	17EGIEC026	Manthan Chaturvedi	AB	Y
24	17EGIEC027	Mitali Dawar	20	N
25	17EGIEC029	Mohammed Ujjer Tak	19	N
26	17EGIEC032	Parth Jain	AB	Y
27	17EGIEC033	Piyush Ramawat	AB	Y
28	17EGIEC034	Pratyusha Rathore	20	N
29	17EGIEC035	Rajnish Vaishnav Vairagi	AB	N
30	17EGIEC036	Riya Tyagi	18	N
31	17EGIEC040	Shoaib Akhtar	AB	Y
32	17EGIEC041	Soniya Mali	AB	Y
33	17EGIEC044	Vaibhav Harit	17	N
34	17EGIEC045	Vaibhav Sharma	19	N
35	17EGIEC300	Riddhi Jain	23	N
36	18EGIEC200	Arpit Joshi	14	N

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Signature of Faculty:

Signature of HOD

Name of faculty: Tina Bhati
Subject with Code: 5EC3-04

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Remedial Action Taken for Slow Learner (After Mid- Term I)

S.no.	University Roll no.	Name of Student	Topics to be discussed in Remedial Class	Schedule Date of Remedial Class	Outcome
1	17EGIEC001	Aayesha Bi	root locus, signal flow graph, time response analysis	04/09/19	CO353.1 & CO353.2
2	17EGIEC008	Arpit Jain	root locus, signal flow graph, time response analysis	04/09/19	CO353.1 & CO353.2
3	17EGIEC014	Dhruv Sharma	root locus, signal flow graph, time response analysis	AB	CO353.1 & CO353.2
4	17EGIEC022	Kapil Joshi	root locus, signal flow graph, time response analysis	04/09/19	CO353.1 & CO353.2
5	17EGIEC023	Khushi Bhatnagar	root locus, signal flow graph, time response analysis	16/09/19	CO353.1 & CO353.2
6	17EGIEC024	Manish Sain	root locus, signal flow graph, time response analysis	04/09/19	CO353.1 & CO353.2
7	17EGIEC026	Manthan Chaturvedi	root locus, signal flow graph, time response analysis	AB	CO353.1 & CO353.2
8	17EGIEC032	Parth Jain	root locus, signal flow graph, time response analysis	AB	CO353.1 & CO353.2
9	17EGIEC035	Rajnish Vaishnav Vairagi	root locus, signal flow graph, time response analysis	04/09/19	CO353.1 & CO353.2
10	17EGIEC040	Shoaib Akhtar	root locus, signal flow graph, time response analysis	04/09/19	CO353.1 & CO353.2
11	17EGIEC041	Soniya Mali	root locus, signal flow graph, time response analysis	16/09/19	CO353.1 & CO353.2

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Signature of Faculty:

Name of faculty: Tina Bhati

Subject with Code: 5EC3-04

Signature of HOD

NBA CODE: CO353

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Mid Term Exam – II

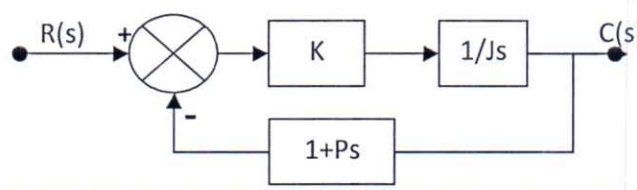
GEETANJALI INSTITUTE OF TECHNICAL STUDIES, UDAIPUR

II Internal Examination 2019-20

B.Tech III Year, V Semester

Sub: Control System (Code: 5EC4-03)

Time: 1.30 Hr **Max Marks: 24**

Q. No.	Question	Marks	CO
	PART-A (Compulsory)		
Q.1 (a)	Define: Gain Cross over Frequency	1	CO354.3
(b)	State and State Variable	1	CO354.4
(c)	Peak Overshoot	1	CO354.2
(d)	Gain Margin and Phase Margin	2	CO354.3
	PART-B (Attempt only 3 out of 4)		
Q.2	Discuss the merits and demerits of frequency response analysis.	3	CO354.2
Q.3	Construct the state model for a system characterized by the differential equation $\frac{d^3y}{dt^3}+6\frac{d^2y}{dt^2}+11\frac{dy}{dt}+6y=u$ Give the block diagram representation of the state model.	3	CO354.4
Q.4	Obtain STM for the state model whose A matrix is given by $A=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}$	3	CO354.4
Q.5	Determine the value of K and P of the closed loop system shown below so that maximum over shoot in unit step response is 25% and peak time is 2 seconds. Assume J = 1Kgm^2. 	3	CO354.2
	PART-C (Attempt only 2 out of 3)		
Q.6	Plot the root locus for a system whose forward path transfer function is $G(s)H(s)=\frac{K(s+1)}{s(s+2)(s^2+2s+5)}$	5	CO354.2
Q.7	The open loop transfer function of a unity feedback system is $G(s)=\frac{50K}{(s+10)(s+5)(s+1)}$ a. Gain margin and phase margin The value of steady-state error co-efficient for a gain of 10 dB and the value which will make the closed-loop system marginally stable.	5	CO354.3
Q.8	State Nyquist criterion of stability. Construct the complete Nyquist plot for a unity feedback control system whose open loop transfer function is $G(s)H(s)=\frac{K}{s(s^2+2s+2)}$	5	CO354.3

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Marks and Identification of Slow Learner of Mid-Term II

S.No.	UNIVERSITY ROLL NO.	Name of Student	Mid-Term 2 MM-24	Remark (Remedial Class need or not – Y/N)
1	17EGIEC001	Aayesha Bi	18	N
2	17EGIEC002	Ajay Devra	15	N
3	17EGIEC003	Akansha Suthar	24	N
4	17EGIEC005	Anchal Agarwal	18	N
5	17EGIEC006	Anisha Kumari Jain	24	N
6	17EGIEC007	Anshuman Singh Chouhan	19	N
7	17EGIEC008	Arpit Jain	**19**	N
8	17EGIEC009	Azhar Nawajpinjara	20	N
9	17EGIEC012	Deepesh Meena	17	N
10	17EGIEC013	Deepika Choudhari	19	N
11	17EGIEC014	Dhruv Sharma	**12**	N
12	17EGIEC015	Divyaraj Singh Dahiya	23	N
13	17EGIEC016	Diya Pushkarna	21	N
14	17EGIEC017	Faiz Alam	17	N
15	17EGIEC018	Gunjan Joshi	19	N
16	17EGIEC019	Harshita Banshal	24	N
17	17EGIEC020	Himanshi Jain	24	N
18	17EGIEC021	Iffat Mazhar	20	N
19	17EGIEC022	Kapil Joshi	**15**	N
20	17EGIEC023	Khushi Bhatnagar	**19**	N
21	17EGIEC024	Manish Sain	**16**	N
22	17EGIEC025	Manoj Dadheech	18	N
23	17EGIEC026	Manthan Chaturvedi	13	N
24	17EGIEC027	Mitali Dawar	22	N
25	17EGIEC029	Mohammed Ujjer Tak	17	N
26	17EGIEC032	Parth Jain	**17**	N
27	17EGIEC033	Piyush Ramawat	AB	N
28	17EGIEC034	Pratyusha Rathore	19	N
29	17EGIEC035	Rajnish Vaishnav Vairagi	**15**	N
30	17EGIEC036	Riya Tyagi	18	N
31	17EGIEC040	Shoaib Akhtar	**15**	N
32	17EGIEC041	Soniya Mali	**15**	N
33	17EGIEC044	Vaibhav Harit	17	N
34	17EGIEC045	Vaibhav Sharma	23	N
35	17EGIEC300	Riddhi Jain	23	N
36	18EGIEC200	Arpit Joshi	15	N

*(Y, if obtained marks are <50%)

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Remedial Action Taken to for Slow Learner (After Mid- Term II)

S.No.	University Roll no.	Name of Student	Topics to be discussed in Remedial Class	Schedule Date of Remedial Class	Outcome
NIL	NIL	NIL	NIL	NIL	NIL

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Model Question Paper with Key Solution

GEETANJALI INSTITUTE OF TECHNICAL STUDIES, UDAIPUR
Model paper 2019-20
Sub: Control System (Code: 5EC4-03)

Time: 3 Hr | Max Marks: 120

Q. No.	Question	Marks
	PART-A (Compulsory)	
(a)	*Define:* Gain Cross over Frequency	2
	The gain crossover frequency, Ω_{gc}, is the frequency where the amplitude ratio is 1, or when log modulus is equal to 0.	
(b)	State and State Variable	2
	• State: The state of a dynamic system is the smallest set of variables and the knowledge of these variables at $t = t_0$ together with inputs for $t \geq t_0$ completely determines the behaviour of the system at $t \geq t_0$. A compact and concise representation of the past history of the system can be termed as the state of the system. • State Variables: The smallest sets of variables that determine the state of the system are known as state variables.	
(c)	Peak Overshoot	2
	Maximum overshoot (M_p) is straight way difference between the magnitude of the highest peak of time response and magnitude of its steady state. Maximum overshoot is expressed in term of percentage of steady-state value of the response. As the first peak of response is normally maximum in magnitude, maximum overshoot is simply normalized difference between first peak and steady-state value of a response. $Maximum\ \%\ Overshoot = \frac{c(t_p) - c(\infty)}{c(\infty)} \times 100\%$	
(d)	Gain Margin and Phase Margin	2
	• The gain margin refers to the amount of gain, which can be increased or decreased without making the system unstable. It is usually expressed as a magnitude in dB. • The phase margin refers to the amount of phase, which can be increased or decreased without making the system unstable. It is usually expressed as a phase in degrees.	
(e)	Calculate the angle of asymptotes for unity feedback system whose $G(s) = \frac{K}{s(s^2 + 4s + 8)}$	2
	$Angle\ of\ asymptotes\ \theta = \frac{(2q+1)180°}{P-Z}$ $where\ q = 0,1,2,3, \ldots\ldots\ldots P - Z - 1$ No. of asymptotes=P-Z=3 $\theta_1 = \frac{(2.0+1)180°}{2} = 60°, \theta_2 = \frac{(2.1+1)180°}{2} = 180°, \theta_3 = \frac{(2.2+1)180°}{2} = 300°$	
(f)	What is LVDT?	2
	LVDT is a passive transducer that is used for linear displacement measurement.	
(g)	What is steady state error?	2
	Steady-state error is defined as the difference between the input (command) and the output of a system in the limit as time goes to infinity (i.e. when the response has reached **steady state**).	
(h)	What is relative stability?	2
	it is measure of how fast the transient dies out in the system . **Relative stability** is related to settling time.	
(i)	What is optimal control?	2
	Optimal control is the process of determining control and state trajectories for a dynamic system over a period of time to minimise a performance index.	
	PART-B (Attempt only 5 out of 7)	
Q.1	Discuss the merits and demerits of frequency response analysis.	8
	Merits: 1. Transfer functions which are complicated to determine the behaviour of the experimentally can be determined using the frequency response analysis 2. Design of the system and adjusting the parameters of the system can be easily carried out. 3. Corrective measurement for noise disturbance generated in the system and parameters variation can be easily determined using frequency analysis 4. Absolute and Relative stability of the closed loop system can be estimated from the knowledge of the	

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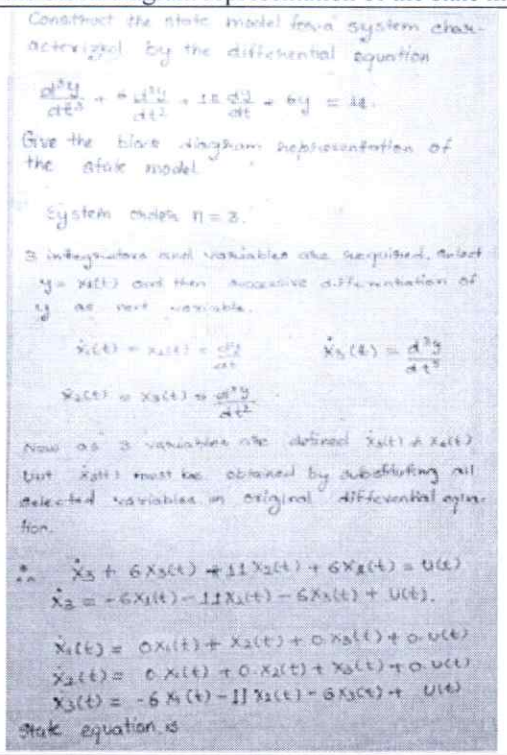
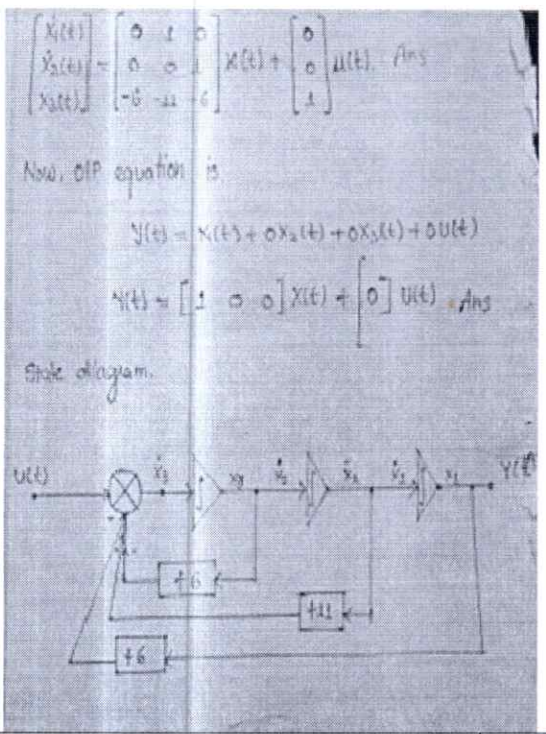
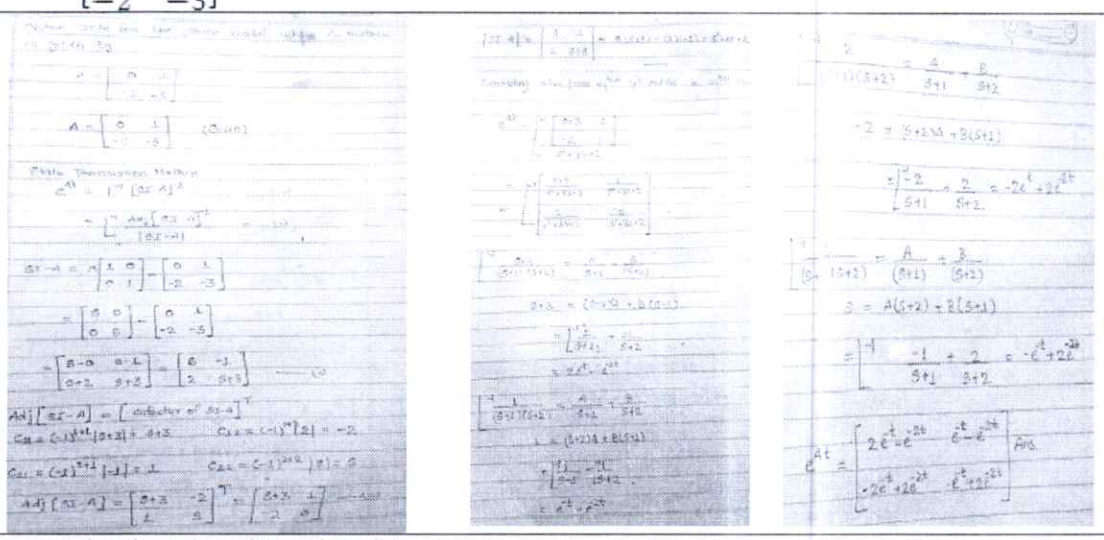
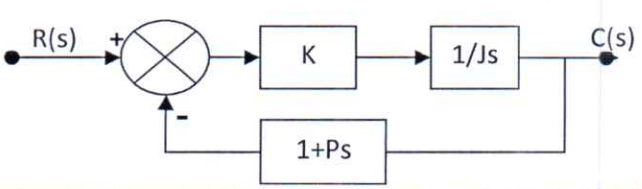
	open loop frequency system 5. Frequency domain analysis can also be carried out for the non linear control systems. Demerits: 1. The analysis can be applied to linear systems. 2. Obtaining frequency response practically is.	
Q.2	Construct the state model for a system characterized by the differential equation $\frac{d^3y}{dt^3}+6\frac{d^2y}{dt^2}+11\frac{dy}{dt}+6y=u$ Give the block diagram representation of the state model.	**8**
	 Construct the state model for a system characterized by the differential equation $\frac{d^3y}{dt^3}+6\frac{d^2y}{dt^2}+11\frac{dy}{dt}+6y=u$. Give the block diagram representation of the state model. System order n = 3. 3 integrators and variables are required, select $y=x_1(t)$ and then successive differentiation of y as next variable. $\dot{x}_1(t)=x_2(t)=\frac{dy}{dt}$ $\dot{x}_2(t)=\frac{d^2y}{dt^2}$ $\dot{x}_2(t)=x_3(t)=\frac{d^2y}{dt^2}$ Now as 3 variables are defined $\dot{x}_3(t)$ & $x_3(t)$ but $\dot{x}_3(t)$ must be obtained by substituting all selected variables in original differential equation. $\dot{x}_3+6x_3(t)+11x_2(t)+6x_1(t)=u(t)$ $\dot{x}_3=-6x_1(t)-11x_2(t)-6x_3(t)+u(t)$. $\dot{x}_1(t)=0x_1(t)+x_2(t)+0x_3(t)+0u(t)$ $\dot{x}_2(t)=0x_1(t)+0x_2(t)+x_3(t)+0u(t)$ $\dot{x}_3(t)=-6x_1(t)-11x_2(t)-6x_3(t)+u(t)$ State equation is  $\begin{bmatrix}\dot{x}_1(t)\\ \dot{x}_2(t)\\ \dot{x}_3(t)\end{bmatrix}=\begin{bmatrix}0&1&0\\0&0&1\\-6&-11&-6\end{bmatrix}\begin{bmatrix}x_1(t)\\x_2(t)\\x_3(t)\end{bmatrix}+\begin{bmatrix}0\\0\\1\end{bmatrix}u(t)$ Ans Now, O/P equation is $y(t)=x_1(t)+0x_2(t)+0x_3(t)+0u(t)$ $y(t)=\begin{bmatrix}1&0&0\end{bmatrix}x(t)+\begin{bmatrix}0\end{bmatrix}u(t)$ Ans State diagram. u(t) Y(t) +6 +11 +6	
Q.3	Obtain STM for the state model whose A matrix is given by $A=\begin{bmatrix}0&1\\-2&-3\end{bmatrix}$	**8**
		
Q.4	Determine the value of K and P of the closed loop system shown below so that maximum over shoot in unit step response is 25% and peak time is 2 seconds. Assume J = 1Kgm^2.  	**8**

$$\frac{Q_0(s)}{T(s)} = \frac{\frac{1}{J}}{s^2 + \frac{F}{J}S + \frac{K}{J}}$$

comparing denominator with $s^2 + 2\xi\omega_n s + \omega_n^2$

$\omega_n = \sqrt{\frac{K}{J}} \frac{rad}{sec}$, $\xi = \frac{1}{2}\frac{F}{\sqrt{JK}} \ldots\ldots\ldots\ldots\ldots a$,

From $M_p = 6\%$, *calculate* ξ

$$M_p = e^{\frac{-\pi\xi}{\sqrt{1-\xi^2}}}$$

$$\frac{6}{100} = e^{\frac{-\pi\xi}{\sqrt{1-\xi^2}}}$$

$\xi = 0.8019$

From $T_p = 1sec$, *calculate* ω_n

$$T_p = \frac{\pi}{\omega_d}$$

$$1 = \frac{\pi}{\omega_n\sqrt{1-\xi^2}}$$

$\omega_n = 4.2104\ rad/sec$

Steady state error $e_{ss} = 0.5\ rad$, *Given*

$$e_{ss} = \lim_{s \to 0} \frac{sR(s)}{1 + G(s)H(s)} \ldots\ldots\ldots\ldots 1$$

$$\frac{C(s)}{R(s)} = \frac{G(s)}{1 + G(s)H(s)}$$ *Assume* $H(s) = 1$, $\frac{C(s)}{R(s)} = \frac{G(s)}{1 + G(s)} \ldots\ldots 2$

$$\frac{C(s)}{R(s)} = \frac{Q_0(s)}{T(s)} = \frac{1}{Js^2 + FS + K} = x \text{ say } \ldots\ldots 3$$

from equation 2 *and* 3 $\frac{G(s)}{1 + G(s)} = x$

$$G(s) = \frac{x}{1 - x}$$

on solving $G(s) = \frac{1}{Js^2 + FS + K - 1} \ldots\ldots\ldots\ldots\ldots 4$

$r(t) = 10$, $R(s) = \frac{10}{s} \ldots\ldots\ldots\ldots\ldots 5$

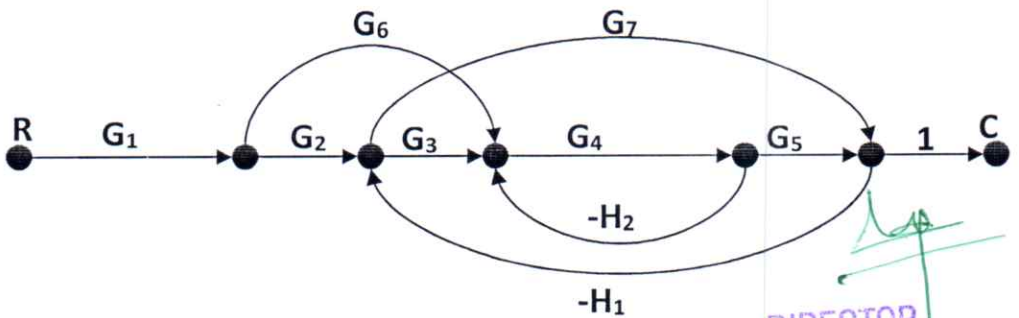
Now substitute the values of equation 4 and 5 in equation 1we get

$$e_{ss} = \frac{(K-1)10}{K}$$

$$0.5 = \frac{(K-1)10}{K}$$

$K = 1.05263\ rad$. On substitute value of K in equation a we get, J = 0.05937 and F = 0.3334

Q.5 Find the transfer function of the system whose signal flow graph is as below. **8**



Sol. Step 1: No. of Forward Path N=3

$$T.F = \frac{F_1\Delta_1 + F_2\Delta_2 + F_3\Delta_3}{\Delta}$$

Step 2:

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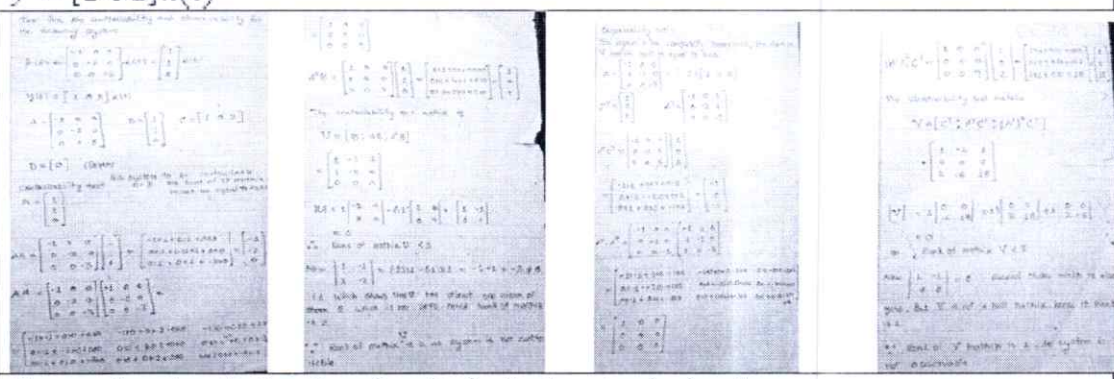
	$F_1 = G_1G_2G_3G_4G_5$, $\Delta_1 = 1$ $F_2 = G_1G_4G_5G_6$ $\Delta_2 = 1$ $F_3 = G_1G_2G_7$ $\Delta_3 = 1 + G_4H_2$ Step 3: Individual Loops $L_1 = -G_4H_2$ $L_2 = -G_3G_4G_5H_1$ $L_3 = -G_7H_1$ Step 4: Possible combinations of 2 non-touching loops $L_1L_3 = G_3G_7H_2H_1$ No possible combination of 3 non touching loops Step 5: $\Delta = 1 + G_4H_2 + G_3G_4G_5H_1 + G_7H_1 + G_3G_7H_2H_1$ $T.F = \frac{G_1G_2G_3G_4G_5 + G_1G_4G_5G_6 + G_1G_2G_7 + G_1G_2G_7G_4H_2}{1 + G_4H_2 + G_3G_4G_5H_1 + G_7H_1 + G_3G_7H_2H_1}$ *Ans*	
Q.6	Test for the controllability and observability for the following system: $\dot{x}(t) = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} u$ $y = [1\ 0\ 2]\,x(t)$	**8**
Sol.		
Q.7	The open loop transfer function of a unity feedback system is given by $G(s) = \frac{40}{s(2s+1)}$ Determine steady state error using error-series for input r(t)= (3+4t)t.	**8**
Sol.	$G(s) = \frac{40}{s(2s+1)}, H(s) = 1 \text{ and } r(t) = 3t + 4t^2$ *Given* now for dynamic coefficient method, $e_{ss}(t) = K_0r(t) + K_1\dot{r}(t) + K_2\ddot{r}(t) + \ldots$ $K_n = \lim_{s\to 0} \frac{d^nF_1(s)}{ds^n}$ where $F_1(s) = \frac{1}{1 + G(s)Hs)}$ $F_1(s) = \frac{s^2 + s}{2s^2 + s + 40}$ $K_0 = \lim_{s\to 0} \frac{s^2 + s}{2s^2 + s + 40} = 0$ $K_1 = \lim_{s\to 0} \frac{dF_1(s)}{ds} = \lim_{s\to 0} \frac{s^2 + s}{2s^2 + s + 40} = \lim_{s\to 0} \frac{160s + 40}{(2s^2 + s + 40)^2} = 0.025$	

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$$K_2 = \lim_{s\to 0}\frac{d^2F_1(s)}{ds^2} = \lim_{s\to 0}\frac{d}{ds}\frac{160s+40}{(2s^2+s+40)^2} == 0.09875$$

$r(t) = 3t + 4t^2$

$r'(t) = 3 + 8t$

$r''(t) = 8$

On substtutng value of $K_0 r(t), K_1 r'(t), K_2$ and $r''(t)$ in $e_{ss}(t)$.

$e_{ss}(t)$ =0.2t+0.865 Ans.

PART-C (Attempt only 4 out of 5)

Q.1 Plot the root locus for a system whose forward path transfer function is $G(s)H(s) = \frac{K(s+1)}{s(s+2)(s^2+2s+5)}$ **15**

Step 1: General information from G(s) H(s)

No. of open loop poles P=4

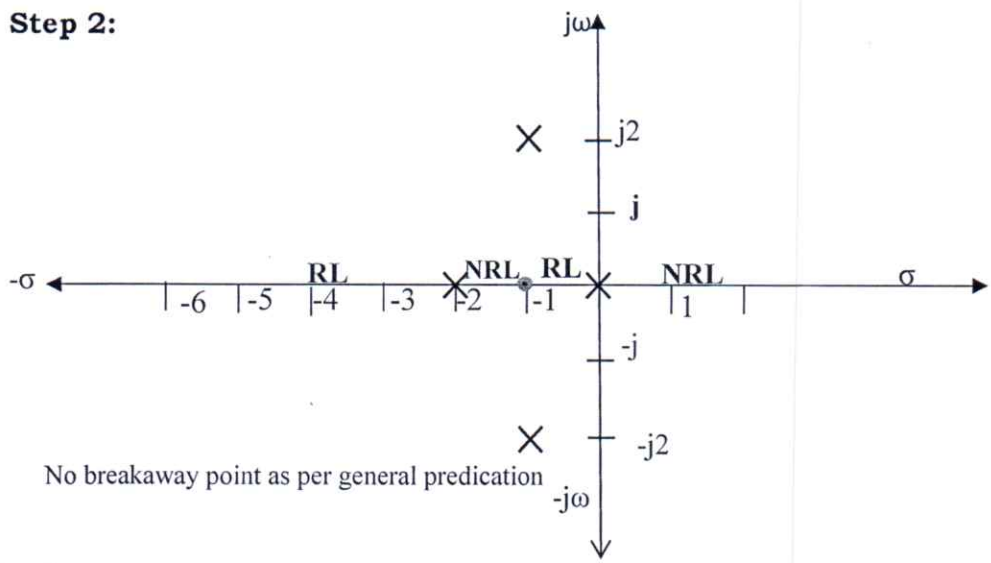
No. of open loop zeros Z=1

No. of root locus branches N=4 Since P>Z.

Starting Point: 0, -2, -1+j2, -1-j2

Terminating point: -1,∞, ∞, ∞

Step 2:



No breakaway point as per general predication

Step 3:

$$Angle\ of\ asymptotes\ \theta = \frac{(2q+1)180^\circ}{P-Z} \quad where\ q = 0,1,2,3,\ldots\ldots\ldots P-Z-1$$

No. of asymptotes=P-Z=3

$$\theta_1 = \frac{(2.0+1)180^\circ}{2} = 60^\circ, \theta_2 = \frac{(2.1+1)180^\circ}{2} = 180^\circ, \theta_3 = \frac{(2.2+1)180^\circ}{2} = 300^\circ$$

Step 4: The co-ordinates of centroid σ

$$\sigma = \frac{\sum Real\ part\ of\ poles\ of\ G(s)H(s) - \sum Real\ part\ of\ zeros\ of\ G(s)H(s)}{P-Z}$$

$$\sigma = \frac{(0)+(-2)+(-1)-(-1)-(-1)}{3}$$

$\sigma = -1$

Step 5: As per general prediction there is no breakaway point.

Step 6: Intersection of root locus with imaginary axis

- The characteristic equation $1 + G(s)H(s) = 0$

  $s^4 + 4s^3 + 9s^2 + (10+K)s + K = 0$

- Routh array in terms of K

s^4	1	9
s^3	4	10+K

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s^2	$\frac{26-K}{4}$	K
s^1	$\frac{(26-K)(10+K)}{4} - 4K$	
s^0	K	

$from\ row\ s^1 \quad \frac{(26-K)(10+K)}{4} - 4K = 0$

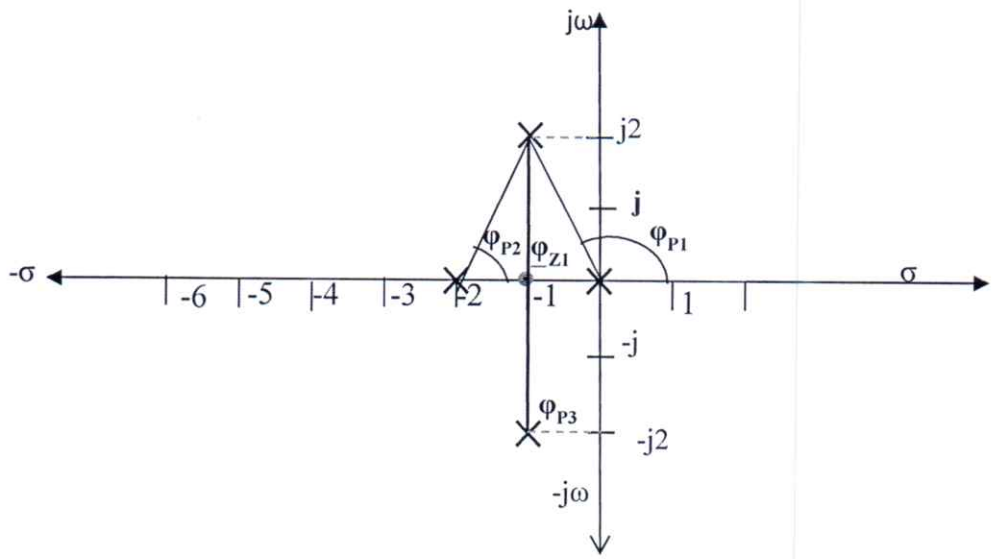
$K_{mar} = \pm 16.12$

$A(s) = \frac{26-K}{4}s^2 + K_{mar} = 0$

$A(s) = \frac{26-K}{4}s^2 + 16.12$

$s = \pm j2.55$

Step 7: Angle of departure from complex poles.
Consider pole -1+j2. Join all poles and zero to it.



$\varphi_d = 180° - \varphi, \quad \varphi_d = 180° - (\sum \varphi_p - \sum \varphi_Z)$

$\sum \varphi_p = \varphi_{P1} + \varphi_{P2} + \varphi_{P3}, \quad \sum \varphi_Z = \varphi_{Z1}$

$\varphi_{P1} = 180° - tan^{-1}\frac{2}{1} = 116.565°, \ \varphi_{P2} = tan^{-1}\frac{2}{1} = 63.43°, \ \varphi_{P3} = 90° \ and \ \varphi_{Z1} = 90°$

$\sum \varphi_p = 90° + 116.565° + 63.43° = 270°, \ \sum \varphi_Z = 90°$

$\varphi_d = 0° \ at -1 + j2$

$\varphi_d = 0° \ at -1 - j2$, As root locus is symmetrical about real axis

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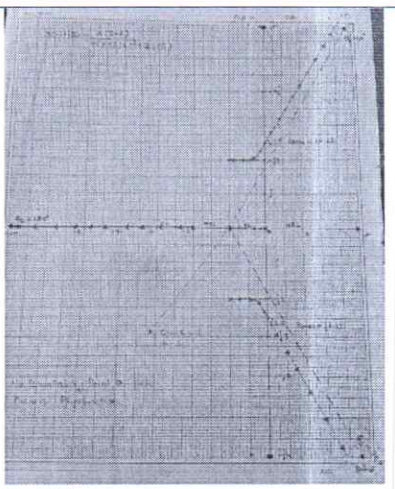


Step 8: from graph it is clear that,

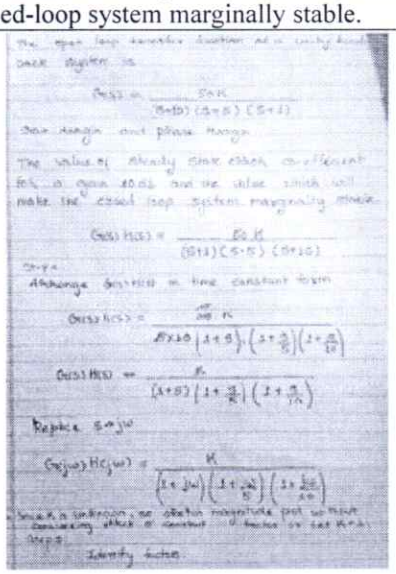
- For 0<K<16.12, all roots are in left half of s plane so, system is stable.
- For K=16.12, dominant roots are on imaginary axis so, system is marginally stable.
- For K>16.12, dominant roots are in right half of s plane so, system is unstable.

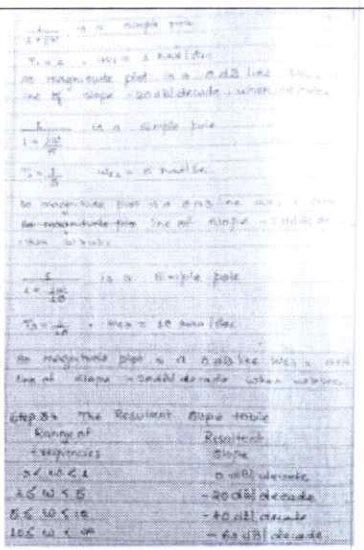
Q.2 The open loop transfer function of a unity feedback system is **15**

$$G(s) = \frac{50K}{(s+10)(s+5)(s+1)}$$

b. Gain margin and phase margin

The value of steady-state error co-efficient for a gain of 10 dB and the value which will make the closed-loop system marginally stable.





Now, Value of K which makes system critically stable is $\omega_{pc} = \omega_{gc}$

$$20 = 20\log K = 26\text{ dB}$$

$$\boxed{K = 19.95.}\ \text{Ans.}$$

Q.3 State Nyquist criterion of stability. Construct the complete Nyquist plot for a unity feedback control system whose open loop transfer function is **15**

$$G(s)H(s) = \frac{K}{s(s^2+2s+2)}$$

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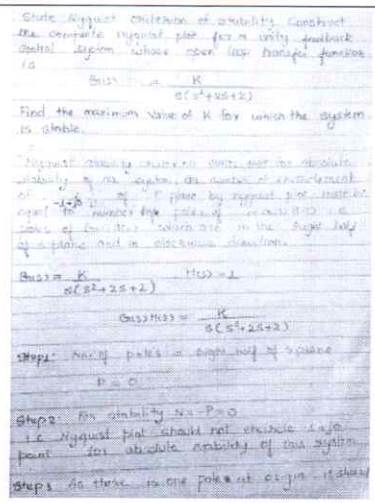

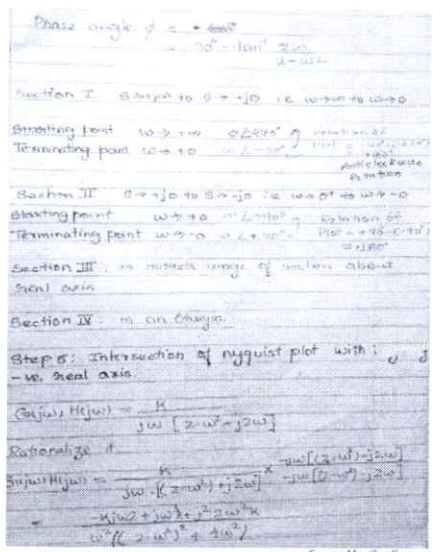

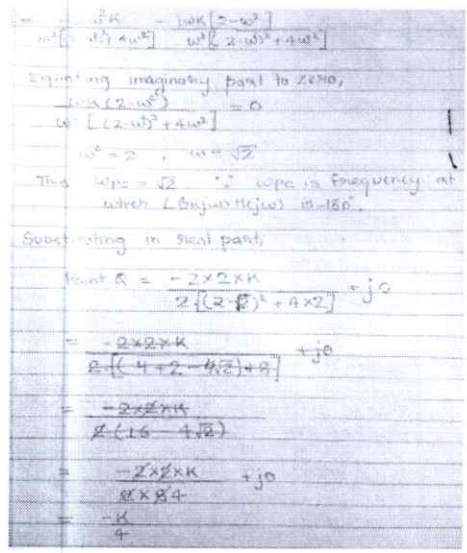

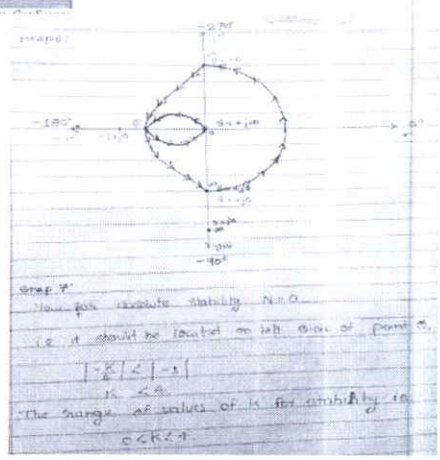

Q.4	The open loop transfer function of a unity feedback control system is given by $G(s) = \frac{k}{s(1+sT)}$ By what factor the amplifier gain k should be multiplied so that the damping ratio is increased from 0.3 to 0.9.	**15**
Sol.	$\frac{C(s)}{R(s)} = \frac{G(s)}{1+G(s)Hs)}$ $\frac{C(s)}{R(s)} = \frac{\frac{K}{T}}{s^2+\frac{s}{T}+\frac{K}{T}}$	

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comparing denominator with $s^2 + 2\xi\omega_n s + \omega_n^2$

$$\omega_n = \sqrt{\frac{K}{T}} \quad rad/\sec \quad , \xi = \frac{1}{2\sqrt{TK}} \quad \ldots\ldots A$$

Now T is constant, gain K is to be changed.

Let $K = K_1$ *for* $\xi_1 = 0.3$

$$\xi_1 = \frac{1}{2\sqrt{TK_1}} \quad \ldots\ldots B$$

Let $K = K_2$ *for* $\xi_2 = 0.9$

$$\xi_2 = \frac{1}{2\sqrt{TK_2}} \quad \ldots\ldots C$$

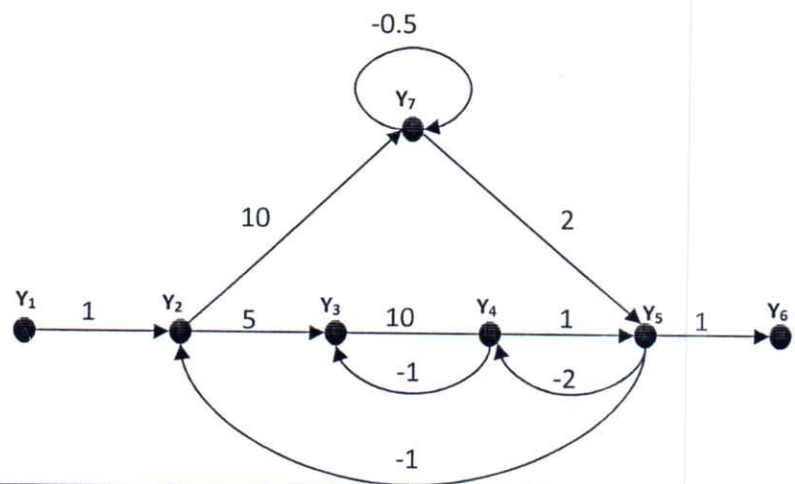
taking ratio of eqation B and C, we get

$$\frac{\xi_1}{\xi_2} = \sqrt{\frac{K_2}{K_1}}$$

$$\frac{K_2}{K_1} = \frac{1}{9}$$

Gain K_1 *must be multipled by* $\frac{1}{9}$ *to change damping ratio from* 0.3 *to* 0.9

Q.5 Find the transfer function for the system shown in diagram. **15**



Sol. Step 1: No. of Forward Path N=2

$$T.F = \frac{F_1 \Delta_1 + F_2 \Delta_2}{\Delta}$$

Step 2:

$F_1 = 50$

$\Delta_1 = 1.5$

$F_2 = 20$

$\Delta_2 = 11$

Step 3: Individual Loops

$L_1 = -0.5$

$L_2 = -10$

$L_3 = -2$

$L_4 = -50$

$L_5 = -20$

Step 4: Possible combinations of 2 non-touching loops

$L_1 L_2 = 5$

$L_2 L_5 = 200$

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	$L_1L_3 = 1$ $L_1L_4 = 25$ No possible combination of 3 non touching loops Step 5: $\Delta = 1 - (L_1 + L_2 + L_{3+}L_4 + L_5) + (L_1L_2 + L_2L_5 + L_1L_3 + L_1L_4)$ $\Delta = 314.5$ $T.F = \frac{50 \times 1.5 + 20 \times 11}{314.5} = 0.9388\ Ans$

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UNIVERSITY QUESTION PAPER (LAST ONE YEAR)

6E6055

Roll No. : _____ rtuonline.com Total Printed Pages : 4

6E6055

B. Tech. (Sem. VI) (Main / Back) Examination, April-May 2018
Electronics & Communication Engg.
6EC5A Control Systems

Time : 3 Hours rtuonline.com Maximum Marks : 80
Min. Passing Marks : 24

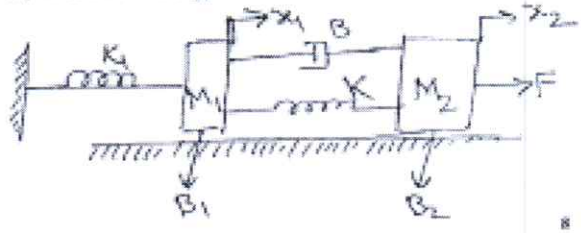
Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) Find the following for the given system (a) force-voltage analogy and (b) force current analogy.



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(b) Consider a dc shunt wounded generator shown below rotating at constant speed and single voltage applied to its field. If the generator is open circuited, find transfer function $V_0(s)/V_f(s)$

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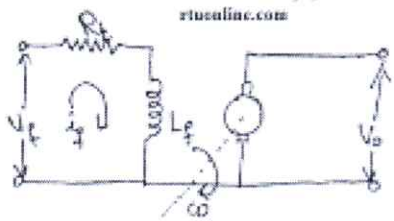

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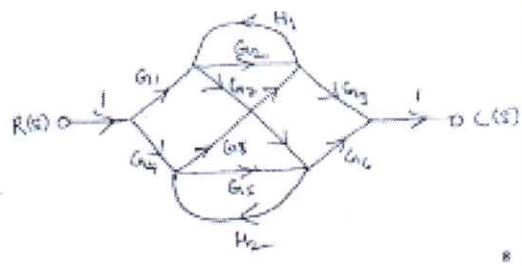
OR

(a) Explain the architecture of the closed loop control system with a neat block diagram with description of each block and signal. 8

(b) Using the Mason's Gain formula, find the transfer function for the signal flow graph shown below.



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Subject with Code: 5EC3-04

NBA CODE: CO353

UNIT - II

2 Determine the unit ramp response of the second order underdamped system and comment upon the obtained response. 16

OR

2 Determine the unit step response of the second order system for the

(a) underdamped case

(b) critically damped case

(c) undamped case 16

UNIT - III

3 State the Nyquist stability criteria and sketch the complete Nyquist plot of the following OLTF :

$G(s)H(s) = \dfrac{5}{s^2(s+2)}$ and comment upon the stability and relative stability of the corresponding OLTF. 16

OR

3 A simplified form of the OLTF of an airplane with an autopilot in the longitudinal mode is $G(s)H(s) = \dfrac{K(s+a)}{s(s+b)\left(s^2+2\zeta\omega_n s+\omega_n^2\right)}$; $a, b > 0$ such a system involving an open loop pole in the right half s-plane may be conditionally stable. Sketch the root loci when $a = b = 1$, $\zeta = 0.6$, $\omega_n = 4$. Find the range of K. 16

UNIT - IV

4 Sketch the Bode Plot of the following transfer function and find GM and PM and comment upon the stability of the system.

$$G(s) = \frac{64(s+2)}{s(s+0.5)\left(s^2+3.2s+64\right)}$$

16

OR

4 Write the short notes on the following : 16

(a) M & N Loci

(b) Nichols chart

UNIT - V

5 Derive the solution of the following state equation.

(a) Homogeneous State Equation and

(b) Non-homogeneous State Equation

OR

5 Explain all the canonical forms of the state equations and compare them. 16

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STUDENT PERFORMANCE REPORT

S. No.	University Roll No.	Student Name	Mid-Term -1 Marks	Mid-Term -2 Marks	Mid-Term Average Marks
			24	24	24
1	17EGIEC001	Aayesha Bi	AB	18	18
2	17EGIEC002	Ajay Devra	18	15	18
3	17EGIEC003	Akansha Suthar	23	24	24
4	17EGIEC005	Anchal Agarwal	13	18	18
5	17EGIEC006	Anisha Kumari Jain	24	24	24
6	17EGIEC007	Anshuman Singh Chouhan	12	19	19
7	17EGIEC008	Arpit Jain	AB	19	19
8	17EGIEC009	Azhar Nawajpinjara	15	20	20
9	17EGIEC012	Deepesh Meena	20	17	20
10	17EGIEC013	Deepika Choudhari	18	19	19
11	17EGIEC014	Dhruv Sharma	AB	12	12
12	17EGIEC015	Divyaraj Singh Dahiya	21	23	23
13	17EGIEC016	Diya Pushkarna	18	21	21
14	17EGIEC017	Faiz Alam	16	17	17
15	17EGIEC018	Gunjan Joshi	12	19	19
16	17EGIEC019	Harshita Banshal	24	24	24
17	17EGIEC020	Himanshi Jain	18	17	18
18	17EGIEC021	Iffat Mazhar	19	20	20
19	17EGIEC022	Kapil Joshi	AB	15	15
20	17EGIEC023	Khushi Bhatnagar	AB	19	19
21	17EGIEC024	Manish Sain	AB	16	16
22	17EGIEC025	Manoj Dadheech	18	18	18
23	17EGIEC026	Manthan Chaturvedi	AB	13	13
24	17EGIEC027	Mitali Dawar	20	22	22
25	17EGIEC029	Mohammed Ujjer Tak	19	17	19
26	17EGIEC032	Parth Jain	AB	17	17
27	17EGIEC033	Piyush Ramawat	AB	AB	AB
28	17EGIEC034	Pratyusha Rathore	20	19	20
29	17EGIEC035	Rajnish Vaishnav Vairagi	AB	15	15
30	17EGIEC036	Riya Tyagi	18	18	18
31	17EGIEC040	Shoaib Akhtar	AB	15	15
32	17EGIEC041	Soniya Mali	AB	15	15
33	17EGIEC044	Vaibhav Harit	17	17	17
34	17EGIEC045	Vaibhav Sharma	19	23	23
35	17EGIEC300	Riddhi Jain	23	23	23
36	18EGIEC200	Arpit Joshi	14	15	15

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Signature of Faculty:

Name of faculty: Tina Bhati

Subject with Code: 5EC3-04

Signature of HOD

NBA CODE: CO353

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RESULT ANALYSIS

Overall Pass % = 42.42%

Subject Code	Subject Name	Total Students	Student Appeared	Total Pass Student	Total Fail Student	Absent	Result Awaited	Pass %	Name of Faculty
5EC 3-01	Computer Architecture	35	32	24	8	3	0	75.00	Mr. Ravi Teli
5EC 4-02	Electromagnetics Waves	35	33	16	17	2	0	48.48	Mr. Rahul Moud
5EC 4-03	Control system	35	33	28	5	2	0	84.85	Ms. Tina Bhati
5EC 4-04	Digital Signal Processing	35	33	23	10	2	0	69.70	Mrs.Meena
5EC 4-05	Microwave Theory & Techniques	35	33	22	11	2	0	66.67	Mr. Md. Sabir
5EC 5-11	Bio-Medical Electronics	35	33	28	5	2	0	84.85	Mr. Anurag Paliwal

CO to PO & PSO Mapping (Target)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO353.1	3	3	1	1	1	0	0	0	0	0	0	1	3	1	0
CO353.2	3	3	2	2	1	0	0	0	0	0	0	1	3	1	0
CO353.3	3	3	2	2	1	0	0	0	0	0	0	1	3	1	0
CO353.4	3	3	2	2	1	0	0	0	0	0	0	1	3	1	0
CO353.5	2	2	1	1	1	0	0	0	0	0	0	1	2	1	0
C353 (AVG)	2.8	2.8	1.6	1.6	1	0	0	0	0	0	0	1	2.8	1	0
Final Mapping of C353	3	3	2	2	1	0	0	0	0	0	0	1	3	1	0

CO to PO & PSO Mapping (Target)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C353 (AVG)	0.67	0.67	0.4	0.4	0.267	0	0	0	0	0	0	0.267	0.67	0.267	0

CO Attainment Level

CO Attainment Calculation	% of students get >= Target %	CO Attainment Level
No. of Students Attained CO353.1	14	0
No. of Students Attained CO353.2	9	0
No. of Students Attained CO353.3	17	1
No. of Students Attained CO353.4	17	1
No. of Students Attained CO353.5	60	2

Rationale:
If 0-15% Students get >=Target % then Attainment Level=0
If 16-45% Students get >=Target % then Attainment Level=1
If 46-60% Students get >=Target % then Attainment Level=2
If 61-100% Students get >=Target % then Attainment Level=3

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Signature of Faculty:

Name of faculty: Tina Bhati

Subject with Code: 5EC3-04

Signature of HOD

NBA CODE: CO353