KANDULA SRINIVASA REDDY MEMORIAL COLLEGE OF ENGINEERING (AUTONOMOUS)

KADAPA-516005, AP

(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC)

(An ISO 9001-2015 Certified Institution)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING



VALUE ADDED COURSE

ON

"MODERN CONTROL SYSTEMS"

Resource Person : Mr. K.KALYAN KUMAR, Asst. Professor, Dept. of EEE, KSRMCE

Mr. N.SIDDHIK, Asst. Professor, Dept. of EEE, KSRMCE

Course Coordinator: Mr. T.KISHORE KUMAR, Assistant Professor, Dept. of ME, KSRMCE

Duration: 24/11/2022 to 16/12/2022



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India-516 003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

An ISO 14001:2004 & 9001: 2015 Certified Institution



Lr./KSRMCE/EEE/2022-23/

Date: 18-11-2022

To The Principal, KSRMCE. Kadapa.

Respected Sir,

Sub: Permission to Conduct Value added Course on "MODERN CONTROL SYSTEMS" from 24/11/2022-Request- Reg.

The Department of Electrical & Electronics Engineering is planning to offer a Value Added Course on "MODERN CONTROL SYSTEMS" to B. Tech. students. The course will be conducted from 24/11/2022 to 16/12/2022. In this regard, I kindly request you to grant permission to conduct Value Added Course.

Thanking you sir,

Yours faithfully

(T.Kishore Kumar, Asst.Professor in EEE)

Panilled muty (L) /ksrmce.ac.in Follow Us: 🛐 🚳 🐩 /ksrmceofficial



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India-516 003



An ISO 14001:2004 & 9001: 2015 Certified Institution



Cr./KSRMCE/EEE/2022-23/

Date: 19/11/2022

Circular

The Department of Electrical & Electronics Engineering is offering a Value Added Course on "MODERN CONTROL SYSTEMS" from 24/11/2022 to 16/12/2022 to B.Tech students. In this regard, interested students are instructed to register their names for the Value Added Course with Course Coordinator.

For further information contact Course Coordinator.

Course Coordinator: Mr. T.KISHORE KUMAR, Asst.professor, Dept. of EEE.-KSRMCE.

Contact No: 7013122231

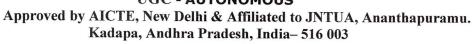
(O. Fio Pry Carling Ac Dept. of EEE

Cc to: **IQAC-KSRMCE**

HEAD Department of Electrical & Electronics Engineering K.S.R.M. College of Engineering Kadapa -516003,



UGC - AUTONOMOUS





Department of Electrical and Electronics Engineering

List of Registered Participants

Name of the Event	Value Added Course
Name of the Course	MODERN CONTROL SYSTEMS
Date(s)	24.11.2022 to 16.12.2022
Timings	03:00 PM to 5:00 PM
Resource persons	Mr. K. KALYAN KUMAR, Asst. Prof. in EEE, KSRMCE Mr. N. SIDDHIK, Asst. Prof. in EEE, KSRMCE
Venue	SJ – 106
Faculty Coordinator	Mr. T. KISHORE KUMAR, Assistant Professor in EEE, KSRMCE

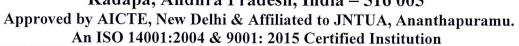
S.No	Roll Number	Name of the Student	Signature
1	209Y1A0201	A.Gopi Charan	A Gopi charas
2	209Y1A0202	A.Gangadhar	A-Gangadhas
3	209Y1A0203	A Sanjana	Allanjana
4	209Y1A0204	B Neeraja Reddy	B. Nperaja Roddy
5	209Y1A0206	C.Ramadevi	C. Ramadevi
6	209Y1A0207	D Sai Pavan	Dsai Pavan
7	209Y1A0209	D.Dharani	D. Dharani
8	209Y1A0210	D Tejaswini	D. Telaswini
9	209Y1A0211	G Harika	G.Harika
10	209Y1A0213	G.V.Sunil Kumar	a.v. sunil
11	209Y1A0216	K Sai Rahul	4. Sairahul
12	209Y1A0217	K.Likhitha	k. likhitha

/ksrmce.ac.in



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India – 516 005





S.No	Roll Number	Name of the Student	Signature
13	209Y1A0218	K.Md.Kaif Ali	(k)
14	209Y1A0220	K Venkata Sai	K. ventus, sai.
15	209Y1A0221	K Hemanth Kumar	41107
16	209Y1A0222	L N Sai Pavan	John
17	209y1A0223	Madireddy Gowri	M. Govori
18	209Y1A0225	M Chandra Bharath Kumar Reddy	M-CRION
19	209Y1A0226	M.Charan Kumar	M. Choodurkung
20	209Y1A0227	M. Mahalakshmi	ellalahe.
21	209Y1A0228	M Pavan Kumar	M. Paradul
22	209Y1A0229	N.Sasi Rekha	N. Sasi Rekto
23	209Y1A0230	N Naveen Kumar	A lace of Marco
24	209Y1A0231	P.Yogna	P. Yogue.
25	209Y1A0233	P.Ravi Shankar	P. Ravi Thankor. Boe lignerely
26	209Y1A0235	Pothuraju Sai Vignesh	Soe ligneselv
27	209Y1A0236	R.Madhukrishna	R. Machin
28	209Y1A0241	Shaik Alisha Sameera	Alm
29	209Y1A0242	S Faiz Rehman	S. J Religion
30	209Y1A0244	S. Md. Sameer	(Roy) Canul
31	209Y1A0245	S.Parvez	Slame
32	209Y1A0246	S.Sudharshan	s sudharshan
33	209Y1A0247	S. Shashikala	Shud
34	209Y1A0248	S Naveed	Silared
35	209Y1A0249	T.Pallavi	T. Pallavi
36	209Y1A0252	V Jagadeesh	T. Pallavi V. Jagadeeth



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India – 516 005 Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu. An ISO 14001:2004 & 9001: 2015 Certified Institution



S.No	Roll Number	Name of the Student	Signature
37	219Y5A020 1	A.Nagarjuna	A. Nagassuna
38	219Y5A0202	A. Venkata Yaswanth	A. Varkata Yawanth
39	219Y5A0203	Busagani Chandra Kumar	K. Chandra Komas
40	219Y5A0204	M.Srinidhi	Misrindhi
41	219Y5A0205	M.Lakshmi Devi	M. Larghmidevi

Coordinator

Head of the Department

Department of Electrical & **Electronics Engineering** K.S.R.M. College of Engineering Kadapa -516003.

Syllabus of Value Added Course

Course Name: Modern Control Systems

Course Objectives: Students are able to learn the State Space, Describing function, phase plane and stability analysis including controllability and observability.

Course Outcomes: On successful completion of this course, the students will be able to,

- 1. Understand the concept of State Space Techniques.
- 2. Analyze the stability of linear and nonlinear Systems
- **3.** Construct the state model of Linear Time Invariant systems and Lyapunov functions for nonlinear systems
- **4.** Determine Eigen values state transition matrix and examine the controllability and observability of linear time invariant systems
- **5.** Design state feedback controller and observer

UNIT-I

State variable descriptions: Concepts of state, state variables, state vector, state space model, representation in state variable form, phase variable representation.

UNIT-II

Solution of State Equations: diagonalization – state transition matrix – properties – solution of state equations of homogeneous and non-homogeneous systems.

UNIT-III

Controllability and Observability: Definition of controllability – controllability tests for continuous linear time invariant systems – Definition of observability – observability tests for continuous linear time invariant systems.

UNIT-IV

Design of Control Systems: Introduction. Pole placement by state feedback, Full order and reduced order observers.

<u>UNIT-V</u>

Stability: Introduction, equilibrium points – stability concepts and definitions – stability in the sense of Lyapunov - stability of linear system – methods of constructing Lyapunov functions for non-linear system: Krasovskii's method.

Text Books/Reference Books:

- 1. Control System Engineering by I. J. Nagarath and M. Gopal, New Age International (P) Ltd.
- 2. Modern Control Engineering by K. Ogata, Prentice Hall of India. 3 rd Edition. 1998.
- 3. Systems and Control by Stainslaw, H. Zak, Oxford Press, 2003.
- 4. Digital Control and State Variable Methods by M. Gopal, TMH, 1997.



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India-516 003



An ISO 14001:2004 & 9001: 2015 Certified Institution



SCHEDULE

Department of Electrical & Electronics Engineering Engineering

Value Added Course

"Engine Combustion" From 24/11/2022 to 16/12/2022

Date	Timing	Resource Person	Topic to be covered
24/11/2022	4pm to 5pm	K.Kalyan Kumar	State variable description- concepts
			of state
25/11/2022	4pm to 5pm	K.Kalyan Kumar	State variable, state vectors
26/11/2022	1pm to 4pm	K.Kalyan Kumar	state space model, representation in
			state variable form, phase variable
			representation.
28/11/2022	4pm to 6pm	N.Siddhik	Diagonalization
29/11/2022	4pm to 6pm	N.Siddhik	State Transition Matrix: Properties
			and determination
30/11/2022	4pm to 5pm	N.Siddhik	Solution of State Equation of
			homogeneous system
01/12/2022	4pm to 6pm	N.Siddhik	Solution of State Equation of non-
			homogeneous system
02/12/2022	4pm to 5pm	K.Kalyan Kumar	Controllability & Observability
8			concepts
03/12/2022	1pm to 4pm	K.Kalyan Kumar	Controllability tests for LTI systems
05/12/2022	4pm to 5pm	K.Kalyan Kumar	Observability tests for LTI systems
06/12/2022	4pm to 5pm	K.Kalyan Kumar	Observability tests for LTI systems
07/12/2022	4pm to 6pm	N.Siddhik	Introduction to design
08/12/2022	4pm to 5pm	N.Siddhik	Pole placement by state feedback
09/12/2022	4pm to 5pm	N.Siddhik	Problem on pole placement

10/12/2022	10am to 12pm	N.Siddhik	Full order observer design
10/12/2022	2pm to 4pm	N.Siddhik	Reduced order observer design
12/12/2022	4pm to 6pm	K.Kalyan Kumar	Stability Introduction
13/12/2022	4pm to 5pm	K.Kalyan Kumar	Equilibrium points; stability
			concepts
14/12/2022	4pm to 5pm	K.Kalyan Kumar	Lyapunov Stability Theorems
15/12/2022	4pm to 6pm	K.Kalyan Kumar	Stability of Linear systems
16/12/2022	1pm to 3pm	K.Kalyan Kumar	Construction of Lyapunov Functions

K. Kalian Kumar

Resource Person(s)

Coordinator(s)

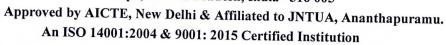
(O) - S. Pry Columbia

HEAD
Department of Electrical &
Electronics Engineering
K.S.R.M. College of Engineering
Kadapa -516003.



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India-516 005





Name of the Event: Value Added

Course on "Modern Control Systems"

Venue:SJ 106

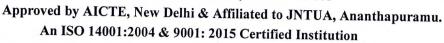
Attendance

SNo	Reg.No	24/11	25/11	26/11	28/11	2911	20/11	1/12	0.	- l	
1.	209Y1A0201	Ace	Acc	AGC	AGC	ABC	Acc	AGE	2/12 AG	2/12	1-
2.	209Y1A0202	Afsar	Alsean	A		Alon		AG	Λ.	Acc	Ace
3.	209Y1A0203		73				1	-	AG	Ale	Alex
4.	209Y1A0204	Shuga		U	9			Saycon	0	lanjar	· Jan Crue
5.	209Y1A0206	B.D.	Bay	1	0	0			BOy	-	(-)
6.	209Y1A0207		CKES	C. Roud	GRI PANE	CRY	C.Roy	CROL	C.Ken	C. Ray	C.Red
7	209Y1A0209	Dham	Shaeui'	aneur'	1	1	1	1	-	1	. Jeana
8	209Y1A0210	1 1	macui	0	Product	Alsen!	Phodeir	Bleeni	Dooni	Dani	thaer
9	209Y1A0211	Day	Doy	Day			Day	Dity	Dhy	D. 2	Day
10	209Y1A0213	Gilter	Chrodie		G. Havik	-				A	G. Haxika
11	209Y1A0216	Pahul	4. V3	9.48		1	ή.	1	9.4.8	A	A
12	209Y1A0217		4 ,	Paral	Rahul	Rahul	Rahul	Palul	Ralul	Rahul	Rahu
13	209Y1A0218	K-JE	K.l.	Kls	K-LEL		KUL	K-LIJ	Kilot.	KLL	KU
14	209Y1A0220	K. Kein		1	A	Kari	Kellin	(K)	Kin	Wi (Daire
15	209Y1A0221	1 A	Km	KIL	101	Ken	Ku	Kus	-Kn	-KM	Ks
16	209Y1A0222	Color		Chem				Chen		lahores	lahoto
17	209Y1A0223	Soipar	saipava	salpan.	zarpara	Scripavan	salparan	scupour	son bon	Solipaval	seli pou.
18	209Y1A0225	bowei	brassi	क्रिकार	הסנטטים	potesi	victorii	browsi	บางเกา	bowsi	irevori
19	209Y1A0226	Math	. 0	A COLOR	MEDIDA	Mayo	AU CARD	Mysa	Marie	PATIMON	1 cm
20	209Y1A0227		1 Chen 4	drewy	chonon	dunn	dann	chemus	Ohenry	dienai	dienson
21	209Y1A0228		Make	Maha	Mala	Malu	Maler	Male	Mahen	Maha	A
41	209 Y 1A0228	Paver	Pavan	paran	Panan	Pavar	paran	pavar	Pavar	pavan	Pavar



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India-516 005





Name of the Event:

Course on "Modern Control Systems"

Venue:SJ 106

Attendance

SNo	Reg.No	612	7/12-	8/12	10110	1	1.0110	1.	1 115		
22	209Y1A0229	0112	1112	8/12	9112	10/12	12/12	13/12	14/12	1215	16/12
		NosasR	Nalaske	N. Sasac	Nosain	NSas,	NI ANI	NSOS	NSasia	11.01.	- 10 - B L
23	209Y1A0230	Walen p	v.plen	N-Aller	Nalon	Nila	whilen			1	NSasin Miller
24	209Y1A0231	P. Yogus	P. Yoquo	p. yoguo					p. yours	P. Yogus	
25	209Y1A0233	Plane	P. Pouf	Pag	A	P. Roug	Play	0.00	A	Play	Pal
26	209Y1A0235	Coelign	as liguerd	e gigad	2 rigner	1 Jugar	a giguent	gi gura	gi great	aigun	a i guar
27	209Y1A0236	radlu	mode	moder	mad hi	madru tristy	madh	mader	nach	mado	nas
28	209Y1A0241	Du	Alu	Alu	A	Alu	-Non-	Nar	Mar	Alie	Ala
29	209Y1A0242	A	A	Doug	Java -	Java.	1 14	1 de	A	Java.	र्वाप्त
30	209Y1A0244	shore.	laile.	Sak.	galic	Mark.	Shale:	Honk.	Sparic :	Male.	John
31	209Y1A0245	b. Jamy	Same	y Grey	Basel	1 Charl	James	brew	Verical	Sorre	Sovery
32	209Y1A0246	s-sudhar s	Sudhas	s sudha.	5. Sudhar	S'Sudhers	5. Sudher	5'Sudha	s. Sulha	5. Suaha	SSUCHAS
33	209Y1A0247	5. Sherit s	Shein	shan shahill	Shan	Shan Si Shofithe	selil	and solar	cod is	≥Shan	Shan
34	209Y1A0248	Sulverd	4 ,	-			Salwer	CARNOL	e Davier	5-8level Splanced	Sishin
35	209Y1A0249	01	allai	Roudon	0 11		Jeller G	. 11	Δ Λ.	,	Salaweed
36	209Y1A0252	1	Joget .	-	_	Togel	Jagget	Jaget	falla	pallar	Rallan
37	219Y5A0201	'	rach	Vach	Nagu	Mach		0	magu	Made	Jager
38	219Y5A0202	A New 1	13 butes					Amerikate by	spukate	1 Newast	Alkey
39	219Y5A0203	auti	out	R.C.	B.CH.	R. Celel	r. Cha	241	South	Toqueth !	or CHA
10	219Y5A0204	Mosiny M	• • •	Josany,	H. soul	H. Sail	M.Sair	Mo sing	1. Soul	M. Soul	1. Saiy
11	219Y5A0205		-Laksh , ni devi		W.Laksh Miden	V. Laksh		Milakaho			Miloughm

Department of Electrical &

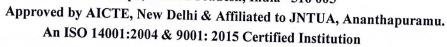
/ksrmce.ac.in Follow Us:

K.S.R.M. College of Engineering
Kadapa -516003.



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India-516 005





Name of the Event: Volue Added Course on "Modern Control Systems"

Venue: SJ 105

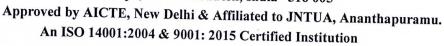
Attendance

SNo	Reg.No	6/12	7/12	8/12	10/12	1		1			
1.	209Y1A0201					10/12		1211-	1	1	1
2.	209Y1A0202	Ja	Aca	ABC	AGC	REL	AGC	ABC	AGL	AGE	AGE
		Alber	AGO	AGai	Acrai	Acra	A	Ala	Acr	Ala	Alu
3.	209Y1A0203	20	2 :	00	Saugar	· Sanfan	10	-	-		
4.	209Y1A0204	Safar Bag	B.Or	()		1 0	0	0	e Jawa	- 0	Sanferre
5.	209Y1A0206	-01	0			0	0			Bog	/
6.	209Y1A0207	CIS	CRU	CRI	CRI	· Copy	- 0/2	C-Red	CR	- C-B	GR
7		Debub	n Pavar	Panal	Paver	vain	Spana	n Javan	Seg va	Povar	Favan
/	209Y1A0209	Lacuri	Door	Dasmi	Doson	Accou	Doon	Doni	(showi	Moori	Bleen
8	209Y1A0210	09.1	D. Ly	O.du	0	Dhy		1	0	1	- 0
9	209Y1A0211	D. 624					10. Ly	Dong	Dofy	Diff	Day
10	209Y1A0213	Gitant	G. HO	Gilto	- 0	Gitter	GA	Gr-bla	12	GALLA	Gitter
11	209Y1A0216	9.43	G.V.S	G.N.S	9.43	9.48	g.vs	G.VS	G.19	9.48	9.18
		Rochel	Robert	Rahel	Rahal	Dolpul	Dehul	Palm	Palul	Blut	pahal
12	209Y1A0217	Kle	KL	kl	K.LL	Wit	le la	k.lpl	Klib	KLO	/
13	209Y1A0218	Bin	(Win	R.	W.	0					ky.
14	209Y1A0220	1/ 0	کوس	L	Jour	(Line	Pi	Lois	Wi	Din	Parie
15	209Y1A0221	A.A	- Kin	BM	KIN	IM	Kus	-KM	- 600	- Bul	- Kus
16		ok lieue	Kilhara	Kelou	Color	Cilen	When	pla	bilan	K-lun	Cilian
	209Y1A0222	Scipara	Saipara	schipaur,	sai para	gaipare a	ci paran	grapar	garen	saipama	zargone
17	209Y1A0223	Crowni	kusis	Graver	Garagi	In a s	A 4				
18	209Y1A0225					irosori		bowsi	<i>ज्रिक्स</i>	bocari	bowli
19	209Y1A0226	Cherran	ALIAN	MATERIAL C	AT AREZ	MINIO	MISSO			HOTEL	MIDA
20	209Y1A0227	0.6.1 0.0	Charran	alerror	chromou	charran	donau	drang	dranae	cherran	cherran
		Male	Mahr	Malre	Mahe	Maln	Mola	Maln	Noch	Make	Maha
21	209Y1A0228	Pavar	Pewar	Pavar	_	Pavar	Pavan	Pavar	Pavan	Pavan	Parar



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India-516 005





Name of the Event: Value Added. Course on "Modern Control Systems"

Venue:SJ 106

Attendance

SNo	Dog M.			-							
22	Reg.No	24/11	2011	26/11	28/11	29/11	70/11	1/12	2/12	712	din
	209Y1A0229	Noasi	A	NSasn	Nosayı	N'sasi	Nsali	Nsagu	Λ	Alica	3112
23	209Y1A0230	Nolan	Nala	Nalus		-	North		N. Alon	Nisasy. Niale	Msy,
24	209Y1A0231	P. Yogus	D. Yogho	P. YOHN				P. Yogho	PYOSHO	P. Yogha	
25	209Y1A0233	Plane	- Proup	Play	P. Par	Prop	P. Roy	De Roge	P. Coy	2 Ro-P	200
26	209Y1A0235	Ene wigner	e siquest	a rigual	- grignest	1 jugue	12 Migran	a jangt	a Day ar	1 grah	igner!
27	209Y1A0236	made	mader	madhe	inach	andh	crack	made	cigian	ners)	nadu
28	209Y1A0241	Ahr	Ahen	· Alaw	Alu	-Alre	Alm	M	. A0	10 A D	10
29	209Y1A0242	137	1 Sug	Java	A	A) ig	Sate	Jevz.	John	1 6
30	209Y1A0244	Mali.	Marie.	Phark.	Make	Rose	Challe	Male	Stol	hark s	Jale !
31	209Y1A0245	V. Namin	A Drawing	Savay .	- Canada	No Marie	D' JENORY	Markey	Sarcly	Sheely .	2 riel
32	209Y1A0246	s subhar	e Sodha 8 Shan	s.sudh a.oshan	S'SUH ha	5. Sudha	s. Sudha	5.50aha	5.5 Hhos		s, sudha
33	209Y1A0247		0 1	S. Sloyit	S.Slow	S. Shoyik:	Shen	s-Slosikl	shou	shan	oshan
34	209Y1A0248	- M.	1		^ /	1d	1	3 placed	C. Den	a A sed	S. Shasirly
35	209Y1A0249	O.Mar.	Valle	. 4	Palloui			10 11) / Mary		Splant
36	209Y1A0252	your	Jan.	Dalmy.	Tari	Pallari Fort		Pallei Togel	Lella:	Polla	Pollar
37	219Y5A0201	90	Nochu	Jack	Hacy	Magn	Word	Mar	moder 10d	Jagar Nagar	
38	219Y5A0202	Willy	Jak.	Ayoh	J. Vad	1. Ventor	X.24	AZDI	1.20	124	Moch.
39	219Y5A0203	B. Cht.	n. crast	1. chat	3. CHA	2/aguest	s. Met	a Not	a leti	a Charles	gage.
40	219Y5A0204	. a v.	Sory	1. Soul	M. Sony	M. Cour	M. Sou	M. Soul	M. Coul	15.0 m	y. soul
41	219Y5A0205	M Leusch	- 1011	4 larg	N. Largn	A			1	M. Lakdy	VILORGY

Department of Electrical &

/ksrmce.ac.in Follow Us:

ronics Engineering Inceofficial College of Engineering Kadapa -516003.



KSRM

COLLEGE OF ENGINEERING

(UGC · Autonomous)

Kadapa, Andhra Prodech, India- 515 005

Approved by AICTE, New Delhi & Affiliated to INTUA, Ananchagonomic



Value Added Course on

Modern Control Systems

Department of EEE









Resource Persons

Coordinator

SJ106

24/11/2022 to 16/12/2022

Sri. K. Kalyan Kumar & Sri. N. Siddhik

Sri. T. Kishore Kumar

District Manager II Contract & Hody

Dr. V.S.S. Months (fore earl)

Dr. Kandula Chandra Obul Reddy

Smt. K.Rajeswari (Correspondent,Secretary,Treasurer)

Sri K. Madan Mohan Reddy (Vice - Citaliman)

Sri K. Raja Mohan Reddy (Chalman)







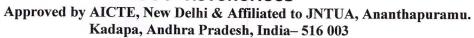
🕮 www.ksrmce.ac.in



(Q) 8143731980, 8575697569



UGC - AUTONOMOUS





Department of Electrical and Electronics Engineering **Activity Report**

Name of the Event	Value Added Course
Name of the Course	MODERN CONTROL SYSTEMS
Date(s)	24.11.2022 to 16.12.2022
Target Audience	B.Tech V Semester EEE Students
Number of Students Participated	41 .
Resource Persons	Mr. K. KALYAN KUMAR, Asst. Prof. in EEE, KSRMCE Mr. N. SIDDHIK, Asst. Prof. in EEE, KSRMCE
Organizer/Supporting Team	Mr. T. KISHORE KUMAR, Asst. Prof. in EEE, KSRMCE
Report	A total of 41 students registered from V Semester EEE and Mr. K. KALYAN KUMAR, Mr. N. SIDDHIK acted as resource persons. During the course the main topics covered are: • State space representation of a system. • Solution of state equations. • Controllability. • Observability. • Pole placement by state feedback. • State observers. • Liapunov Stability. The course was carried out for total 34hrs apart from the tentative schedule. At the end, Exam was conducted for the participants and at the valedictory ceremony they were awarded with the Course completion certificates.

Photos



HoD Addressing at valedictory of the course



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India – 516 005 Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu. An ISO 14001:2004 & 9001: 2015 Certified Institution





Distributing Course completion certificates to the students



Distributing Course completion certificates to the students



Distributing Course completion certificates to the students







(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India – 516 005 Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu. An ISO 14001:2004 & 9001: 2015 Certified Institution







Resource person Taking Classes



Exam Conducted to the Students

of the Department HEAD

Department of Electrical & Electronics Engineering K.S.R.M. College of Engineering Kadapa -516003.





(UGC-Autonomous)

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu. Kadapa, Andhra Pradesh, Indai-516003

Certificate of Completion

This is to certify that

KOVenkata Sai

has successfully Completed the certification course on "Modern Control Systems" organized by the Department of Electrical & Electronics Engineering, KSRM College of Engineering (Autonomous), Kadapa from 24.11.2022 to 16.12.2022.

(D)-S. Myc Owhen

HOD



KSNR lives on.. V.s.s. muly



(UGC-Autonomous)

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu. Kadapa, Andhra Pradesh, Indai-516003

Certificate of Completion

This is to certify that

LM Sai Pavan

has successfully Completed the certification course on "Modern Control Systems" organized by the Department of Electrical & Electronics Engineering, KSRM College of Engineering (Autonomous), Kadapa from 24.11.2022 to 16.12.2022.

O.S. May Calls

HOD



KSNR lives on..

V. s. s. muly



(UGC-Autonomous)

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu. Kadapa, Andhra Pradesh, Indai-516003

Certificate of Completion

This is to certify that

S Sudharshan

has successfully Completed the certification course on "Modern Control Systems" organized by the Department of Electrical & Electronics Engineering, KSRM College of Engineering (Autonomous), Kadapa from 24.11.2022 to 16.12.2022.

O-S. My Paul



KSNR lives on. V. s. s muly



(UGC-Autonomous)

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu. Kadapa, Andhra Pradesh, Indai-516003

Certificate of Completion

This is to certify that

K Hemanth Kumar

has successfully Completed the certification course on "Modern Control Systems" organized by the Department of Electrical & Electronics Engineering, KSRM College of Engineering (Autonomous), Kadapa from 24.11.2022 to 16.12.2022.

Q-5- flag Conher

HOD

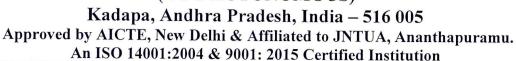


KSNR lives on..

V s.s. muly



(UGC-AUTONOMOUS)





Department of Electrical and Electronics Engineering

Date: 16.12.2022

_				-
- 4	'ee	dЬ	0	0 2
Т,		uIJ	all	CH

Name of the Student:	m. Chandra	Bhar odh	kumoon	Reddy
----------------------	------------	----------	--------	-------

Roll Number:

2094110825

E-Mail ID:

Mcbks 26 (a smail. com

Provide the following information:

1. O	rganization of	Course and	session	planning	by	instructor?
------	----------------	------------	---------	----------	----	-------------

Excellent

Very Good

Good

Average

Poor

2. Clarity in content delivery?

Excellent

Very Good

Good

Average

Poor

3. Content is relevant and useful?

Excellent

Very Good

Good

Average

Poor

4. Adequate opportunity to interact with Resource Person?

Excellent

Very Good

Good

Average

Poor

5. Overall rating?

Excellent

Very Good

Good

Average

Poor

6. Any other Suggestions

Nothing



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India – 516 005 Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu. An ISO 14001:2004 & 9001: 2015 Certified Institution



Department of Electrical and Electronics Engineering

Date: 16.12.2022

Poor

T 1	
Feed	hack
recu	Dacis

Name of the Student: G. Havika

Roll Number: 20941A0211

E-Mail ID: 2094/A021/ @ KBRMCE.ac.in

Provide the following information:

1.	Organization of Cour	rse and session plannin	g by instructor?		
	Excellent	Very Good	Good	Average	Poor
2.	Clarity in content deli	-			
	Excellent	Very Good	Good	Average	Poor
3.	Content is relevant ar				
	Excellent	Very Good	Good	Average	Poor
4.		to interact with Resor	arce Person?		
	Excellent	Very Good	Good	Average	Poor
5	Overall rating?				

Good

6. Any other Suggestions

Excellent

No suggestions

Very Good

Signature of the Student

Average



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India – 516 005 Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu. An ISO 14001:2004 & 9001: 2015 Certified Institution



Department of Electrical and Electronics Engineering

Date: 16.12.2022

н	00	1	he	ick

Name of the Student: K. Likhitha

Roll Number: 209 VI-A0217

E-Mail ID: 2097/A0217 @ remce-ac-in

Provide the following information:

1.	Organization of Cour	se and session plannin	g by instructor?		
	Excellent	Very Good	Good	Average	Poor
2.	Clarity in content del	ivery?			
	Excellent	Very Good	Good	Average	Poor
3.	Content is relevant ar	nd useful?	-		
	Excellent	Very Good	Good	Average	Poor
4.	Adequate opportunity	to interact with Resou	arce Person?		
	Excellent	Very Good	Good	Average	Poor
5.	Overall rating?				
	Excellent	Very Good	Good	Average	Poor

6. Any other Suggestions

No suggestions



(UGC-AUTONOMOUS)





Department of Electrical and Electronics Engineering

Date: 16.12.2022

T	eed	IL.	1.
r	eec	lDa	ıck

Name of the Student: T. Pallavi	
Roll Number: 20941A0249	
E-Mail ID: 2094/ A0249 @ KSRMc E. ac. in	
Provide the following information:	

1	. Organization of Cou	rse and session plann	ing by instructor?		
	Excellent	Very Good	Good	Average	Poor
2	. Clarity in content de	livery?			
	Excellent	Very Good	Good	Average	Poor
3	. Content is relevant a	and useful?			
	Excellent	Very Good	Good	Average	Poor
4	. Adequate opportunit	ty to interact with Res	source Person?		
	Excellent	Very Good	Good	Average	Poor
5	. Overall rating?				
	Excellent	Very Good	Good	Average	Poor

6. Any other Suggestions

No suggestions

T. Pal

Signature of the Student



(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India – 516 005 Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu. An ISO 14001:2004 & 9001: 2015 Certified Institution



Department of Electrical and Electronics Engineering

Date: 16.12.2022

Feedback

Name of the Student:	P.	Rauishankop
----------------------	----	-------------

Roll Number: 20941A0233

E-Mail ID: 20941A0233@KSIMCE.OC.M

Provide the following information:

1.	Organization	of Course	and	session p	lanning	by instructor?
----	--------------	-----------	-----	-----------	---------	----------------

Excellent Very Good ✓ Good Average Poor

2. Clarity in content delivery?

Excellent Very Good Good ✓ Average Poor

3. Content is relevant and useful?

Very Good V Excellent Good Poor Average

4. Adequate opportunity to interact with Resource Person?

Excellent Very Good ✓ Good Average Poor

5. Overall rating?

Excellent Very Good Good Average Poor

6. Any other Suggestions

P. Roui Shulcop Signature of the Student

K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS)

Department of Electrical & Electronics Engineering Feedback of students on Certification Course on "Printed Circuit Board"

S.No	Roll Number	Name of the Student	Organization of Course and session planning by instructor.	Clarity in content delivery.	Content is relevant and useful	Adequate opportunity to interact with Resource Person	Overall rating
1	209Y1A0201	A.Gopi Charan	Excellent	Excellent	Very good	Very good	Excellent
2	209Y1A0202	A.Gangadhar	Excellent	Very good	Excellent	Very good	Excellent
3	209Y1A0203	A Sanjana	Very good	Very good	Good	Very good	Excellent
4	209Y1A0207	D Sai Pavan	Excellent	Very good	Very good	Excellent	Excellent
5	209Y1A0204	B Neeraja Reddy	Good	Excellent	Very good	Very good	Excellent
6	209Y1A0206	C.Ramadevi	Good	Good	Very good	Good	Very good
7	209Y1A0209	D.Dharani	Very good	Very good	Excellent	Good	Good
8	209Y1A0210	D Tejaswini	Excellent	Excellent	Excellent	Excellent	Excellent
9	209Y1A0211	G Harika	Very good	Very good	Very good	Very good	Very good
10	209Y1A0213	G.V.Sunil Kumar	Very good	Very good	Very good	Very good	Very good
11	209Y1A0216	K Sai Rahul	Very good	Excellent	Excellent	Excellent	Excellent
12	209Y1A0217	K.Likhitha	Good	Good	Good	Good	Good
13	209Y1A0218	K.Md.Kaif Ali	Excellent	Excellent	Excellent	Excellent	Excellent
14	209Y1A0220	K Venkata Sai	Very good	Very good	Excellent	Very good	Excellent
15	209Y1A0221	K Hemanth Kumar	Fair	Excellent	Excellent	Excellent	Excellent
16	209Y1A0222	L N Sai Pavan	Excellent	Excellent	Excellent	Excellent	Excellent
17	209y1A0223	Madireddy Gowri	Very good	Very good	Excellent	Excellent	Excellent
18	209Y1A0225	Reddy	Very good	Excellent	Excellent	Very good	Excellent
19	209Y1A0226	M.Charan Kumar	Very good	Good	Very good	Very good	Excellent
20	209Y1A0227	M. Mahalakshmi	Excellent	Very good	Excellent	Very good	Excellent

21	209Y1A0228		Very good	Very good	Good	Excellent	Excellent
22	209Y1A0229		Excellent	Excellent	Excellent	Excellent	Excellent
23	209Y1A0230	N Naveen Kumar	Excellent	Excellent	Excellent	Excellent	Excellent
24	209Y1A0231	P. Yogna	Excellent	Very good	Excellent	Excellent	Excellent
25	209Y1A0233	P.Ravi Shankar	Very good	Fair	Very good	Very good	Very good
26	209Y1A0235	Pothuraju Sai Vignesh	Good	Good	Good	Good	Good
27	209Y1A0236	R.Madhukrishna	Excellent	Excellent	Excellent	Excellent	Excellent
28	209Y1A0241	Shaik Alisha Sameera	Excellent	Excellent	Excellent	Excellent	Excellent
29	209Y1A0242	S Faiz Rehman	Excellent	Excellent	Very good	Very good	Excellent
30	209Y1A0244	S. Md. Sameer	Excellent	Very good	Excellent	Very good	Excellent
31	209Y1A0245	S.Parvez	Very good	Very good	Good	Very good	Excellent
32	209Y1A0246	S.Sudharshan	Excellent	Very good	Very good	Excellent	Excellent
33	209Y1A0247	S. Shashikala	Good	Excellent	Very good	Very good	Excellent
34	209Y1A0248	S Naveed	Good	Good	Very good	Good	Very good
35	209Y1A0249	T.Pallavi	Very good	Very good	Excellent	Good	Good
36	209Y1A0252	V Jagadeesh	Excellent	Excellent	Excellent	Excellent	Excellent
37	219Y5A020 2	A.Nagarjuna	Very good				
38	219Y5A0202	A. Venkata Yaswanth	Very good				
39	219Y5A0203	Busagani Chandra Kumar	Excellent	Excellent	Excellent	Excellent	Excellent
40	219Y5A0204	M.Srinidhi	Very good				
41	219Y5A0205	M.Lakshmi Devi	Very good				
				, , ,	7 8-24	, J 500a	, or j good

Coordinater

Department of Electrical & K.S.R.M. College of Engineering Kadapa -516003.

K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516005 DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING VALUE ADDED/CERTIFICATE COURSE ON MODERN CONTROL SYSTEMS FROM 24/11/2022 TO 16/12/2022 AWARD LIST

2 209Y1A0202 Adimulam Gangadhar 18 3 209Y1A0203 Ambavaram Sanjana (W) 17 4 209Y1A0204 Bandi Neeraja Reddy (W) 16 5 209Y1A0206 C Rama Devi (W) 18 6 209Y1A0207 Dasari Sai Pavan 17 7 209Y1A0209 Duggireddy Dharani (W) 16 8 209Y1A0210 Duggireddy Tejaswini (W) 18 9 209Y1A0211 Gaddam Harika (W) 19 10 209Y1A0213 G. Venkata Sunil Kumar 17 11 209Y1A0216 K. Sai Rahul 15 12 209Y1A0216 K. Sai Rahul 15 12 209Y1A0217 K. Likhitha (W) 19 13 209Y1A0221 K. Venkata Sai 17 14 209Y1A0223 K. Venkata Sai 17 15 209Y1A0222 L. Narasimha Sai Pavan 17 16 209Y1A0223 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 20 209Y1A0227 M.	S.No	Roll Number	Name of the Student	Marks Obtained
3 209Y1A0203 Ambavaram Sanjana (W) 17 4 209Y1A0204 Bandi Neeraja Reddy (W) 16 5 209Y1A0206 C Rama Devi (W) 18 6 209Y1A0207 Dasari Sai Pavan 17 7 209Y1A0209 Duggireddy Dharani (W) 16 8 209Y1A0210 Duggireddy Tejaswini (W) 19 10 209Y1A0211 Gaddam Harika (W) 19 10 209Y1A0213 G. Venkata Sunil Kumar 17 11 209Y1A0216 K. Sai Rahul 15 12 209Y1A0217 K. Likhitha (W) 19 13 209Y1A0218 K. Mohammed Kaif Ali 16 14 209Y1A0220 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0225 M. Charan Kumar 16 20 209Y1A0226 M. Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 16 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	1	209Y1A0201	Abbarathi Gopi Charan	15
4 209Y1A0204 Bandi Neeraja Reddy (W) 16 5 209Y1A0206 C Rama Devi (W) 18 6 209Y1A0207 Dasari Sai Pavan 17 7 209Y1A0209 Duggireddy Dharani (W) 16 8 209Y1A0210 Duggireddy Tejaswini (W) 18 9 209Y1A0211 Gaddam Harika (W) 19 10 209Y1A0213 G. Venkata Sunil Kumar 17 11 209Y1A0216 K. Sai Rahul 15 12 209Y1A0217 K. Likhitha (W) 19 13 209Y1A0218 K. Mohammed Kaif Ali 16 14 209Y1A0220 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 20 209Y1A0226 M. Charan Kumar 16 20 209Y1A0228 M. Pavan Kumar 17 21 209Y1A0229 N	2	209Y1A0202	Adimulam Gangadhar	18
5 209Y1A0206 C Rama Devi (W) 18 6 209Y1A0207 Dasari Sai Pavan 17 7 209Y1A0209 Duggireddy Dharani (W) 16 8 209Y1A0210 Duggireddy Tejaswini (W) 18 9 209Y1A0211 Gaddam Harika (W) 19 10 209Y1A0213 G. Venkata Sunil Kumar 17 11 209Y1A0216 K. Sai Rahul 15 12 209Y1A0217 K. Likhitha (W) 19 13 209Y1A0218 K. Mohammed Kaif Ali 16 14 209Y1A0221 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0223 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0225 M. Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0230 N. Naveen Kumar	3	209Y1A0203	Ambavaram Sanjana (W)	17
6 209Y1A0207 Dasari Sai Pavan 17 7 209Y1A0209 Duggireddy Dharani (W) 16 8 209Y1A0210 Duggireddy Tejaswini (W) 18 9 209Y1A0211 Gaddam Harika (W) 19 10 209Y1A0213 G. Venkata Sunil Kumar 17 11 209Y1A0216 K. Sai Rahul 15 12 209Y1A0217 K. Likhitha (W) 19 13 209Y1A0218 K. Mohammed Kaif Ali 16 14 209Y1A0220 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0223 M. Chardra Bharath Kumar Reddy 19 20 209Y1A0225 M. Charan Kumar 16 20 209Y1A0226 M. Pavan Kumar 17 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) <t< td=""><td>4</td><td>209Y1A0204</td><td>Bandi Neeraja Reddy (W)</td><td>16</td></t<>	4	209Y1A0204	Bandi Neeraja Reddy (W)	16
7 209Y1A0209 Duggireddy Dharani (W) 16 8 209Y1A0210 Duggireddy Tejaswini (W) 18 9 209Y1A0211 Gaddam Harika (W) 19 10 209Y1A0213 G. Venkata Sunil Kumar 17 11 209Y1A0216 K. Sai Rahul 15 12 209Y1A0217 K. Likhitha (W) 19 13 209Y1A0218 K. Mohammed Kaif Ali 16 14 209Y1A0220 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0223 M. Chardara Bharath Kumar Reddy 19 20 209Y1A0225 M. Charan Kumar 16 20 209Y1A0226 M. Pavan Kumar 17 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0235 P. Sai Vignesh <t< td=""><td>5</td><td>209Y1A0206</td><td>C Rama Devi (W)</td><td>18</td></t<>	5	209Y1A0206	C Rama Devi (W)	18
8 209Y1A0210 Duggireddy Tejaswini (W) 18 9 209Y1A0211 Gaddam Harika (W) 19 10 209Y1A0213 G. Venkata Sunil Kumar 17 11 209Y1A0216 K. Sai Rahul 15 12 209Y1A0217 K. Likhitha (W) 19 13 209Y1A0218 K. Mohammed Kaif Ali 16 14 209Y1A0220 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	6	209Y1A0207	Dasari Sai Pavan	17
9 209Y1A0211 Gaddam Harika (W) 19 10 209Y1A0213 G. Venkata Sunil Kumar 17 11 209Y1A0216 K. Sai Rahul 15 12 209Y1A0217 K. Likhitha (W) 19 13 209Y1A0218 K. Mohammed Kaif Ali 16 14 209Y1A0220 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0221 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	7	209Y1A0209	Duggireddy Dharani (W)	16
10 209Y1A0213 G. Venkata Sunil Kumar 17 11 209Y1A0216 K. Sai Rahul 15 12 209Y1A0217 K. Likhitha (W) 19 13 209Y1A0218 K. Mohammed Kaif Ali 16 14 209Y1A0220 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0223 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0235 P. Sai Vignesh 18	8	209Y1A0210	Duggireddy Tejaswini (W)	18
11 209Y1A0216 K. Sai Rahul 15 12 209Y1A0217 K. Likhitha (W) 19 13 209Y1A0218 K. Mohammed Kaif Ali 16 14 209Y1A0220 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0235 P. Sai Vignesh 18	9	209Y1A0211	Gaddam Harika (W)	19
12 209Y1A0217 K. Likhitha (W) 19 13 209Y1A0218 K. Mohammed Kaif Ali 16 14 209Y1A0220 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	10	209Y1A0213	G. Venkata Sunil Kumar	17
13 209Y1A0218 K. Mohammed Kaif Ali 16 14 209Y1A0220 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	11	209Y1A0216	K. Sai Rahul	15
14 209Y1A0220 K. Venkata Sai 17 15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	12	209Y1A0217	K. Likhitha (W)	19
15 209Y1A0221 K. Hemanth Kumar 15 16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	13	209Y1A0218	K. Mohammed Kaif Ali	16
16 209Y1A0222 L. Narasimha Sai Pavan 17 17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	14	209Y1A0220	K. Venkata Sai	17
17 209Y1A0223 M. Gowri (W) 17 18 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	15	209Y1A0221	K. Hemanth Kumar	15
18 209Y1A0225 M. Chandra Bharath Kumar Reddy 19 19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	16	209Y1A0222	L. Narasimha Sai Pavan	17
19 209Y1A0226 M.Charan Kumar 16 20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	17	209Y1A0223	M. Gowri (W)	17
20 209Y1A0227 M. Maha Lakshmi (W) 19 21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	18	209Y1A0225	M. Chandra Bharath Kumar Reddy	19
21 209Y1A0228 M. Pavan Kumar 17 22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	19	209Y1A0226	M.Charan Kumar	16
22 209Y1A0229 N. Sasi Rekha (W) 18 23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	20	209Y1A0227	M. Maha Lakshmi (W)	19
23 209Y1A0230 N. Naveen Kumar 17 24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	21	209Y1A0228	M. Pavan Kumar	17
24 209Y1A0231 P. Yogna (W) 16 25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	22	209Y1A0229	N. Sasi Rekha (W)	18
25 209Y1A0233 P. Ravi Shankar 19 26 209Y1A0235 P. Sai Vignesh 18	23	209Y1A0230	N. Naveen Kumar	17
26 209Y1A0235 P. Sai Vignesh 18	24	209Y1A0231	P. Yogna (W)	16
	25	209Y1A0233	P. Ravi Shankar	19
27 209Y1A0236 R. Madhu Krishna 16	26	209Y1A0235	P. Sai Vignesh	18
	27	209Y1A0236	R. Madhu Krishna	16

28	209Y1A0241	Shaik Alisha Sameera (W)	19
29	209Y1A0242	Shaik Faiz Rehman	15
30	209Y1A0244	Shaik Mohammed Sameer	15
31	209Y1A0245	Shaik Parvez	16
32	209Y1A0246	S. Sudharshan	16
33	209Y1A0247	S. Shashikala (W)	19
34	209Y1A0248	Syed Naveed	15
35	209Y1A0249	T. Pallavi (W)	16
36	209Y1A0252	Vema Jagadeesh	15
37	219Y5A0201	A. Nagarjuna	16
38	219Y5A0202	A.V. V. Yaswanth	17
39	219Y5A0203	B. Chandra Kumar	19
40	219Y5A0204	M. Srinidhi (W)	16
41	219Y5A0205	M. Lakshmi Devi (W)	17

Orsola Colo

HEAD

Department of Electrical &
Electronics Engineering
K.S.R.M. College of Engineering
Kadapa -516003.

K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516005 DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING VALUE ADDED / CERTIFICATE COURSE ON MODERN CONTROL SYSTEMS FROM 24/11/2022 TO 16/12/2022

ASSESSMENT TEST

Roll Number	Name of the Student:		
Time: 20 Mir	(Objective Questions)	lax.Mar	ks: 20
Note: Answer	ne following Questions and each question carries one mark.	Tux.iii ai	KS. 20
A) Only lin B) linear tii	approach of system analysis and design is applicable to r time invariant (ETI) systems invariant as well as time varying systems ell as nonlinear systems.	[]
A) n number B) 2n number C) n/2 numb	tate variables, an n ^{il} order differential equation can be decomposed into of first order differential equations umber of first order differential equations	[
A) The phase B) The phase C) Phase van	Howing statement is true regarding the phase variables? cariables, in general, are the physical variables of the system ariables are readily available for measurement bles are simple to realize mathematically bles are practical set of state variables from control point of view	i	
A) All poles a	real and distinct B) All poles are complex and distinct poles are real and some are repeated D) State model is not square	1	!
5. In which of th A) Observable	following state space representations decoupling of the state equations occur "anonical B) Diagonal canonical C) Controllable canonical D) none o	[If these]
6. A non-singula matrices [A] ar A) ½,1/3, 1/5 a C) both will ha		alues of the	
7. The system matrix A can be A) State Transit			
8. State Transitio A) Cayley Ham	Matrix can be computed by on theorem —B) Laplace Transform Method —C) Expansion method —D) All of	[[these]	!

9, kank of matrix $A \begin{bmatrix} 5 & 0 & 0 \\ 2 & 1 & 0 \\ 0 & 2 & 3 \end{bmatrix}$ is 10) ()

10. For the LTI system given by $\dot{x} = Ax$, the solution is given by

 $A : X = e^{+At} X_0$, $B : X = e^{At} X_0$ $\longleftrightarrow X_0 = e^{At} X$

The name of these

11. For pole placement by state feedback, the system should be

A) Complete State controllable

Ba Complete State observable

(*) have same eigen values

Dyhave distinct eigen values

12. For the LH system given by $\dot{x} = Ax + Ba$, y = Cx, if the desired to les vector is do then the feedback gain matrix is given by

A) K. ackert A.C.dp) B) K. acker(B.C.dp) C) K. tackert A.B.dp)

Dy None of these

13. For the system $\hat{x} = Ax + Ru$; $\hat{y} = Cx$, if 1 is the desired full state of server sole transforms then full state observer design, the required MATLAB command is

ALK nekeri A.C.I.) B. K. nekeri A.J. E. C. K. nekeri A.J. 1977 Density of these

14 Matrix [P]: 0 implies

A) positive definiteness. B) negative definiteness (C) indefiniteness. (D) negative semi-definiteness

15. Examine the controllability and observability of the ETE system given by

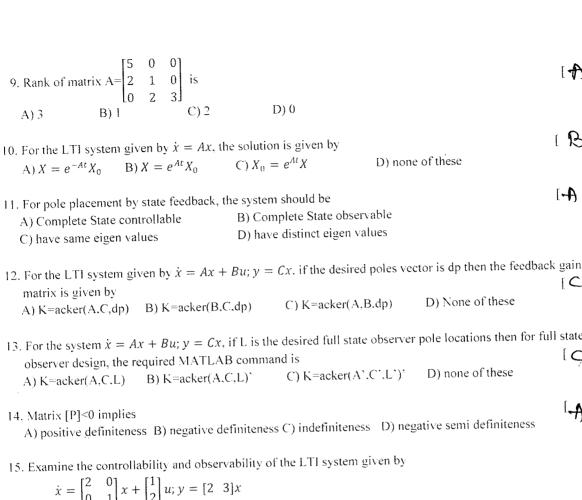
$$\dot{x} = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 2 \end{bmatrix} u; y = \begin{bmatrix} 2 & 3 \end{bmatrix} x$$



K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516005 DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING VALUE ADDED /CERTIFICATE COURSE ON MODERN CONTROL SYSTEMS FROM 24/11/2022 TO 16/12/2022

ASSESSMENT TEST	72022 10 10/12/2022
Roll Number: 209 Y 1-A0203 Name of the Student:	-A. Sandana
Time: 20 Min (Objective Questions)	0
Note: Answer the following Questions and each question carries	Max.Marks: 20
and each question carries	one mark.
1. State variable approach of system analysis and design is applicable to	
A) Only linear time invariant (LTI) systems	101
B) linear time invariant as well as time varying systems	•
C) linear as well as nonlinear systems.	
D) All systems	
2. By using the state variables, an n th order differential equation can be dec	composed into
A) n number of first order differential equations	
B) 2n number of first order differential equations C) n/2 number of first order differential equations	
D) unlimited number of first order differential equations	
and the state of this order differential equations	
3. Which of the following statement is true regarding the phase variables?	
A) The phase variables, in general, are the physical variables of the systematical variables of the systematical variables.	em I
B) The phase variables are readily available for measurement	
C) Phase variables are simple to realize mathematically	
D) Phase variables are practical set of state variables from control point of	of view
4. The Jordan canonical form of state model is applicable when	
A \ A 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	omplex and distinct
C) Some of the poles are real and some are repeated D) State model is	
5. In which of the following state space representations decoupling of the sta	tte equations occur [B]
A) Observable Canonical B) Diagonal canonical C) Controllable can	nonical D) none of these
6. A non-singular 3v3 matrix [Albac 2, 2, and 5 as matrix [Albac 2, 2, and	
6. A non-singular 3x3 matrix [A] has 2, 3, and 5 as roots of its characteristic matrices [A] and its inverse A ⁻¹ will be respectively	equation. The eigenvalues of the
A) ½,1/3, 1/5 and 2,3,5 B) 2,3,5 and ½,1/3,1/5	A.
C) both will have $2,3,5$ D) both will have $\frac{1}{2},\frac{1}{3}$	1/5
7. The system matrix A is in controllable canonical form, then the diagonaliz	ing or modal matrix of system
Matrix A can be called as	[D]
A) State Transition Matrix B) Resolvant Matrix C) System Matrix	D) Vander Monde Matrix
8. State Transition Matrix can be computed by	[n]

A) Cayley Hamilton theorem B) Laplace Transform Method C) Expansion method D) All of these



A = 20

8=[1]

9c=(B AB) = [1 2]

det(9c)=0 - rank=2 [:"n=2]

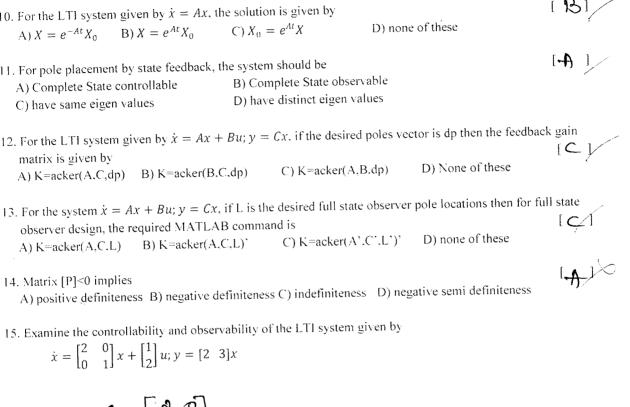
90=[CT oT cT] = [2 4]

det[0]=6

munt=0.

80, it is controllable

It is Observability



K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516005 DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING VALUE ADDED /CERTIFICATE COURSE ON MODERN CONTROL SYSTEMS FROM 24/11/2022 TO 16/12/2022

ASSESSMENT TEST Roll Number: 20911A0204 Name of the Student: B. Neckości Reddy. Time: 20 Min (Objective Questions) Max.Marks: 20 Note: Answer the following Questions and each question carries one mark. 1. State variable approach of system analysis and design is applicable to A) Only linear time invariant (LTI) systems B) linear time invariant as well as time varying systems C) linear as well as nonlinear systems. D) All systems 2. By using the state variables, an nth order differential equation can be decomposed into A) n number of first order differential equations B) 2n number of first order differential equations C) n/2 number of first order differential equations D) unlimited number of first order differential equations 3. Which of the following statement is true regarding the phase variables? A) The phase variables, in general, are the physical variables of the system B) The phase variables are readily available for measurement C) Phase variables are simple to realize mathematically D) Phase variables are practical set of state variables from control point of view 4. The Jordan canonical form of state model is applicable when A) All poles are real and distinct B) All poles are complex and distinct C) Some of the poles are real and some are repeated D) State model is not square 5. In which of the following state space representations decoupling of the state equations occur A) Observable Canonical B) Diagonal canonical C) Controllable canonical D) none of these 6. A non-singular 3x3 matrix [A] has 2, 3, and 5 as roots of its characteristic equation. The eigenvalues of the matrices [A] and its inverse A-1 will be respectively A) 1/2, 1/3, 1/5 and 2,3,5 B) 2,3,5 and 1/2,1/3,1/5 C) both will have 2,3,5 D) both will have 1/2, 1/3, 1/5 7. The system matrix A is in controllable canonical form, then the diagonalizing or modal matrix of system matrix A can be called as A) State Transition Matrix B) Resolvant Matrix C) System Matrix D) Vander Monde Matrix 8. State Transition Matrix can be computed by

A) Cayley Hamilton theorem B) Laplace Transform Method C) Expansion method D) All of these

9. Rank of matrix
$$A = \begin{bmatrix} 5 & 0 & 0 \\ 2 & 1 & 0 \\ 0 & 2 & 3 \end{bmatrix}$$
 is
A) 3 B) 1 C) 2



10. For the LTI system given by $\dot{x} = Ax$, the solution is given by

A)
$$X = e^{-At}X_0$$
 B) $X = e^{At}X_0$

 $C) X_0 = e^{At} X$

D)0

D) none of these

[B]

11. For pole placement by state feedback, the system should be

A) Complete State controllable

B) Complete State observable

C) have same eigen values

D) have distinct eigen values

12. For the LTI system given by $\dot{x} = Ax + Bu$; y = Cx, if the desired poles vector is dp then the feedback gain matrix is given by

A) K=acker(A,C,dp)

B) K=acker(B,C,dp)

C) K=acker(A,B,dp)

D) None of these

13. For the system $\dot{x} = Ax + Bu$; y = Cx, if L is the desired full state observer pole locations then for full state observer design, the required MATLAB command is

A) K=acker(A,C.L)

B) K=acker(A,C,L)*

C) K=acker(A'.C'.L')'

D) none of these

14. Matrix [P]<0 implies

A) positive definiteness B) negative definiteness C) indefiniteness D) negative semi definiteness

15. Examine the controllability and observability of the LTI system given by

$$\dot{x} = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 2 \end{bmatrix} u; y = \begin{bmatrix} 2 & 3 \end{bmatrix} x$$

 $\Rightarrow @c = (B \cap B) = \begin{bmatrix} 1 & 2 \\ 2 & 2 \end{bmatrix} \Rightarrow det(@c) = -2$

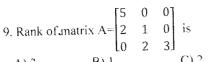
It is a contrapility

It is a obsessability.



K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516005 DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING VALUE ADDED /CERTIFICATE COURSE ON MODERN CONTROL SYSTEMS FROM 24/11/2022 TO 16/12/2022

ASSESSMENT TEST Roll Number: 2094180209 Time: 20 Min (Objective Questions) Max.Marks: 20 Note: Answer the following Questions and each question carries one mark. 1. State variable approach of system analysis and design is applicable to A) Only linear time invariant (LTI) systems B) linear time invariant as well as time varying systems C) linear as well as nonlinear systems. D) All systems 2. By using the state variables, an n^{th} order differential equation can be decomposed into A) n number of first order differential equations B) 2n number of first order differential equations C) n/2 number of first order differential equations D) unlimited number of first order differential equations 3. Which of the following statement is true regarding the phase variables? A) The phase variables, in general, are the physical variables of the system B) The phase variables are readily available for measurement C) Phase variables are simple to realize mathematically D) Phase variables are practical set of state variables from control point of view 4. The Jordan canonical form of state model is applicable when A) All poles are real and distinct B) All poles are complex and distinct C) Some of the poles are real and some are repeated D) State model is not square 5. In which of the following state space representations decoupling of the state equations occur A) Observable Canonical B) Diagonal canonical C) Controllable canonical D) none of these 6. A non-singular 3x3 matrix [A] has 2, 3, and 5 as roots of its characteristic equation. The eigenvalues of the matrices [A] and its inverse A-1 will be respectively A) ½,1/3, 1/5 and 2,3,5 B) 2,3,5 and 1/2,1/3,1/5 C) both will have 2,3,5 D) both will have 1/2, 1/3, 1/5 7. The system matrix A is in controllable canonical form, then the diagonalizing or modal matrix of system matrix A can be called as A) State Transition Matrix B) Resolvant Matrix C) System Matrix D) Vander Monde Matrix 8. State Transition Matrix can be computed by A) Cayley Hamilton theorem B) Laplace Transform Method C) Expansion method D) All of these





10. For the LTI system given by $\dot{x} = Ax$, the solution is given by

A)
$$X = e^{-At}X_0$$
 B) $X = e^{At}X_0$

B)
$$X = e^{\Lambda t} X_0$$

$$C) X_0 = e^{At} X$$

- A) Complete State controllable
- B) Complete State observable
- C) have same eigen values
- D) have distinct eigen values

12. For the LTI system given by
$$\dot{x} = Ax + Bu$$
; $y = Cx$. if the desired poles vector is dp then the feedback gain matrix is given by

- A) K=acker(A,C,dp)
- B) K=acker(B,C,dp)
- C) K=acker(A,B,dp)
- D) None of these

13. For the system $\dot{x} = Ax + Bu$; y = Cx, if L is the desired full state observer pole locations then for full state observer design, the required MATLAB command is

- A) K=acker(A,C,L)
- B) K=acker(A,C,L)
- C) K=acker(A'.C'.L')'
- D) none of these



15. Examine the controllability and observability of the LTI system given by

$$\dot{x} = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 2 \end{bmatrix} u; y = \begin{bmatrix} 2 & 3 \end{bmatrix} x$$

3001

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

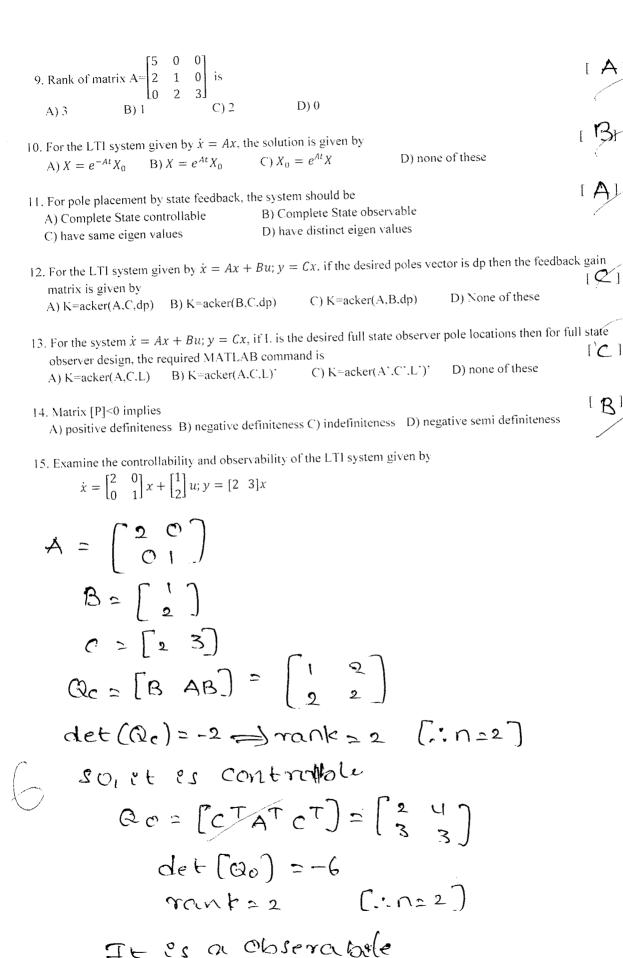


K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516005 DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING VALUE ADDED /CERTIFICATE COURSE ON MODERN CONTROL SYSTEMS FROM 24/11/2022 TO 16/12/2022

ASSESSMENT TEST Roll Number: 20941A0210 Name of the Student: D. Tegassor Time: 20 Min (Objective Questions) Max.Marks: 20 Note: Answer the following Questions and each question carries one mark. 1. State variable approach of system analysis and design is applicable to A) Only linear time invariant (LTI) systems B) linear time invariant as well as time varying systems C) linear as well as nonlinear systems. D) All systems 2. By using the state variables, an nth order differential equation can be decomposed into A) n number of first order differential equations B) 2n number of first order differential equations C) n/2 number of first order differential equations D) unlimited number of first order differential equations 3. Which of the following statement is true regarding the phase variables? A) The phase variables, in general, are the physical variables of the system B) The phase variables are readily available for measurement C) Phase variables are simple to realize mathematically D) Phase variables are practical set of state variables from control point of view 4. The Jordan canonical form of state model is applicable when A) All poles are real and distinct B) All poles are complex and distinct C) Some of the poles are real and some are repeated D) State model is not square 5. In which of the following state space representations decoupling of the state equations occur A) Observable Canonical B) Diagonal canonical C) Controllable canonical D) none of these 6. A non-singular 3x3 matrix [A] has 2, 3, and 5 as roots of its characteristic equation. The eigenvalues of the matrices [A] and its inverse A-1 will be respectively A) ½,1/3, 1/5 and 2,3,5 B) 2,3,5 and ½,1/3,1/5 C) both will have 2,3,5 D) both will have 1/2, 1/3, 1/5 7. The system matrix A is in controllable canonical form, then the diagonalizing or modal matrix of system matrix A can be called as A) State Transition Matrix B) Resolvant Matrix C) System Matrix D) Vander Monde Matrix

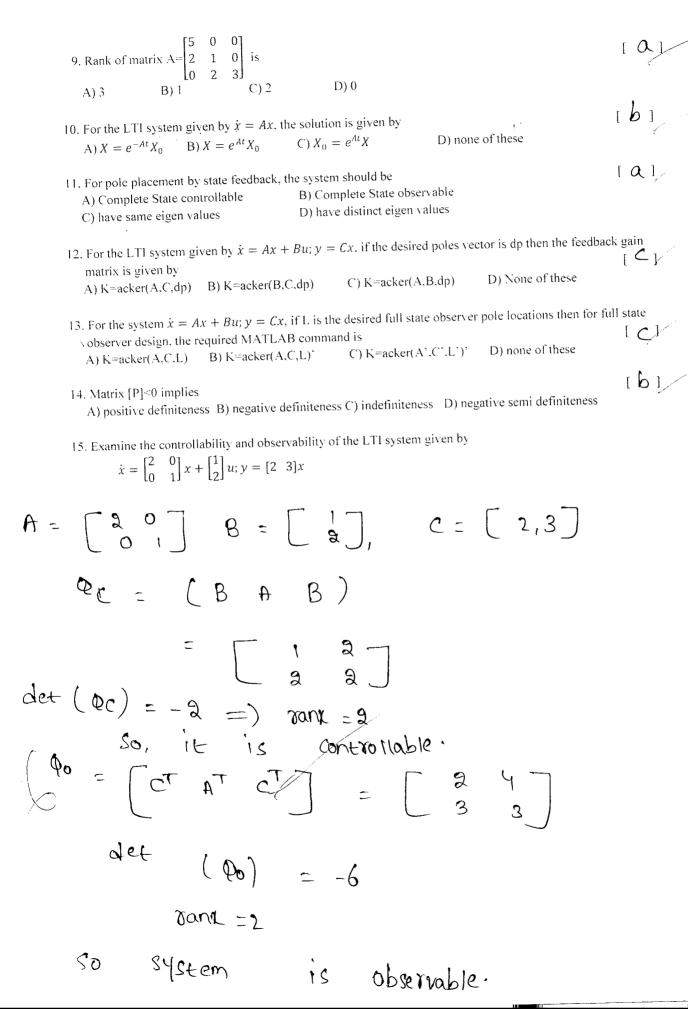
A) Cayley Hamilton theorem B) Laplace Transform Method C) Expansion method D) All of these

8. State Transition Matrix can be computed by



K.S.R.M. COLLEGE OF ENGINEERING (AUTONOMOUS), KADAPA-516005 DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING VALUE ADDED /CERTIFICATE COURSE ON MODERN CONTROL SYSTEMS FROM 24/11/2022 TO 16/12/2022 ASSESSMENT TEST

Roll Numbe	r: 20941A0		of the Student:	D. 40910	O4 1
Time: 20 M	in	(Objecti	ivo Quagtiana)	1 17	ax.Marks: 20
Note: Answe	r the following	Questions and eac	th question carries on	e mark.	da.ividirs. 20
 State varia A) Only I B) linear t 	ble approach of sys near time invariant ime invariant as we as well as nonlinear	tem analysis and des (LTI) systems all as time varying sys	ign is applicable to		[D]
B) 2n num C) n/2 num	er of first order diff ber of first order dif iber of first order di	erential equations	l equation can be decomp	oosed into	[0]
B) The pha C) Phase va	se variables, in geno se variables are reac riables are simple t	lily available for mea o realize mathematic:	variables of the system	ew	[b]
A) All poles C) Some of t	are real and distinc he poles are real an	d some are repeated	B) All poles are compl D) State model is not s	quare	[0]
5. In which of t A) Observab	he following state s le Canonical B)	pace representations Diagonal canonical	decoupling of the state ed C) Controllable canonic	quations occur cal D) none of	these [C]
6. A non-singul matrices [A] a A) ½,1/3, 1/5 C) both will h	and 2,3,5	B) 2	s of its characteristic equal $2.3.5$ and $\frac{1}{2}.\frac{1}{3}.\frac{1}{5}$ both will have $\frac{1}{2}.\frac{1}{3}.\frac{1}{5}$	ation. The eigenval	ues of the
7. The system n matrix A can I A) State Trans	be carred as	llable canonical form B) Resolvant Matrix	n, then the diagonalizing of C) System Matrix	or modal matrix of	[d]
8. State Transiti A) Cayley Han	on Matrix can be conilton theorem B)	omputed by Laplace Transform I	Method C) Expansion m	nethod D) All of t	hese [d]



UNIT-I

STATE VARIABLE DESCRIPTION

1.1 Limitations of conventional Control theory:

The main disadvantage of conventional control theory is that, it is applicable for the linear time invarient systems having single input and single output (SISO). It is poweeless for the time varing systems, non linear systems and milti input multi output systems (MIMO).

1.1.1 A New Approach To Control System Analysis and Design Modern Control Theory:

the Modern trend in engineering systems is towards greater comlexity due to the requirement of complex tasks and good accuracy. Complex systems may have MIMO and may be time varient because of the necessity of meeting the requirements of the control systems, the increase in system complexity and easy access to large scale computers leads to the modern control theory which is a new approach to the analysis and design of complex systems. This new approach is base on the concept of state.

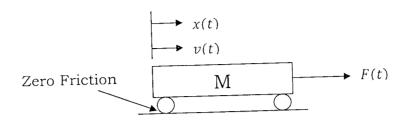
1.1.2 Modern Control Versus Conventional Control Theory:

- 1. Modern control theory is applicable for MIMO systems which may be a linear or nonlinear, time variant or time invariant.
- 2. Conventional control theory is applicable for only linear time invariant SISO systems.
- 3. MCT is essentially a time domain approach while convention control theory is complex frequency domain approach.
- 4. System design in classical control theory is based on trial and error procedures which in general will not yield optimal systems.
- 5. Design in MCT can be carried out for a class of the input, instead of a specific input function such as the impulse function, step function or sinusoidal function and includes initial conditions in the design concept.

1.2 Concept of State:

A mathematical idea to represent the dynamics of a system utilizes three types of variables called the input, output and state variables.

Consider the mechanical system as shown below with a mass element.



$$M \frac{d^2x}{dt^2} = F(t)$$

$$\frac{d^2x}{dt^2} = \frac{1}{M}F(t)$$

$$\frac{dv}{dt} = \frac{1}{M}F(t) \text{ since } \frac{dx}{dt} = v(t)$$

From this relatoion we get

$$v(t) = \frac{1}{M} \int_{-\infty}^{t} F(t) dt$$

$$= \frac{1}{M} \int_{-\infty}^{t_0} F(t) dt + \frac{1}{M} \int_{t_0}^{t} F(t) dt$$

$$v(t) = v(t_0) + \frac{1}{M} \int_{t_0}^{t} F(t) dt$$

$$x(t) = \int_{-\infty}^{t} v(t) dt$$

$$= \int_{-\infty}^{t_0} v(t) dt + \int_{t_0}^{t} v(t) dt$$

$$= x(t_0) + \int_{t_0}^{t} v(t_0) dt + \frac{1}{M} \int_{t_0}^{t} d\tau \int_{t_0}^{t} F(t) dt$$

$$x(t) = x(t_0) + (t - t_0) v(t_0) + \frac{1}{M} \int_{t_0}^{t} d\tau \int_{t_0}^{t} F(t) dt$$

The displacement x(t) at any time $t \ge t_0$ can be computed if we know the aplied force f(t) from F(t) from $t = t_0$ onwards, provided $v(t_0)$ the initial velcity and $x(t_0)$ the initial displacement are known. We may conceive of initial velocity and initial displacement as describeding the state of the system at $t = t_0$.

Let us look for the defination of state and state variables.

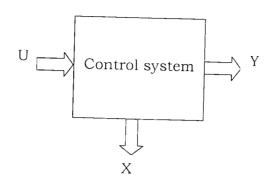
" The state of a dynamic system is a set of minimal set of state variables such that the knowledge of these variables at $t=t_0$ togeather with the knowledge of the input for $t \geq t_0$, completely determines the behaviour of the system for $t \ge t_0$."

In state variables formation of the system

The state variables are represented by $x_1(t), x_2(t), \dots, x_n(t)$. NEEDER SECTION PROTECTION TO THE SECTION OF THE SE The input variables are represented by $u_1(t), u_2(t), \dots, u_m(t)$.

The state variables are represented by $y_1(t), y_2(t), \dots, y_p(t)$.

The state space representation is represented in block diagram.



For this system the state representation can be arranged in the form of n first order differential equations.

$$\frac{dx_1}{dt} = \dot{x_1} = f_1(x_1(t), x_2(t), \dots, x_n(t); u_1(t), u_2(t), \dots, u_m(t))$$

$$\vdots \qquad \vdots \qquad \vdots \qquad \vdots \qquad \vdots$$

$$\frac{dx_n}{dt} = \dot{x_n} = f_n(x_1(t), x_2(t), \dots, x_n(t); u_1(t), u_2(t), \dots, u_m(t))$$

The n differential equations may be written in vector notation as

$$X(t) = f(X(t), U(t))$$

The above equation is called state equation

From the figure y(t) can be expressed in terms of state x(t) and y(t) as

$$Y(t) = g(X(t), U(t))$$

This equation is called output equation

This state equation and output equation combine called as state model of the system.

1.3 State Model:

State model of a linear time invariant system is given below as follow.

$$\dot{x_1} = a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n + b_{11}u_1 + b_{12}u_2 + \dots + b_{1m}u_m
\dot{x_2} = a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n + b_{21}u_1 + b_{22}u_2 + \dots + b_{2m}u_m
\dot{x_n} = a_{n1}x_1 + a_{n2}x_2 + \dots + a_{nn}x_n + b_{n1}u_1 + b_{n2}u_2 + \dots + b_{nm}u_n$$

In vector notation X(t) = AX(t) + BU(t)

$$X(t) = AX(t) + BU(t)$$

Where

$$\mathbf{A} = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}$$

Which is a $n \times n$ matrix

$$B = \begin{bmatrix} b_{11} & b_{12} & \dots & b_{1m} \\ b_{21} & b_{22} & \dots & b_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ b_{n1} & b_{n2} & \dots & b_{nm} \end{bmatrix}$$

Which is a $n \times m$ matrix

Similarly, the output variables

$$y_1 = c_{11}x_1 + c_{12}x_2 + \dots + c_{1n}x_n + d_{11}u_1 + d_{12}u_2 + \dots + d_{1m}u_m$$

$$y_2 = c_{21}x_1 + c_{22}x_2 + \dots + c_{2n}x_n + d_{21}u_1 + d_{22}u_2 + \dots + d_{2m}u_m$$

$$y_p = c_{p1}x_1 + c_{p2}x_2 + \dots + c_{pn}x_n + d_{p1}u_1 + d_{p2}u_2 + \dots + d_{pm}u_m$$

In vector notation Y(t) = CX(t) + DU(t)

Where

$$C = \begin{bmatrix} c_{11} & c_{12} & \dots & c_{1n} \\ c_{21} & c_{22} & \dots & c_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ c_{n1} & c_{n2} & \dots & c_{pn} \end{bmatrix} Wh$$

Which is a $p \times n$ matrix

$$D = \begin{bmatrix} d_{11} & d_{12} & \dots & d_{1m} \\ d_{21} & d_{22} & \dots & d_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ d_{n1} & d_{n2} & \dots & d_{pm} \end{bmatrix}$$
 Which is a $p \times m$ matrix

The state model of linear time- invariant system is thus given by

$$X(t) = AX(t) + BU(t)$$

$$Y(t) = CX(t) + DU(t)$$

For the system which is considered, let us define

$$x = x_1$$

$$v = \dot{x} = x_2$$

$$u = F$$

$$\dot{x_2} = \frac{1}{M} F = \frac{1}{M} u$$

$$\dot{x_1} = x_2$$

$$\begin{bmatrix} \dot{x_1} \\ \dot{x_2} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{M} \end{bmatrix} u$$
State equation
$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \quad \text{Output equation}$$

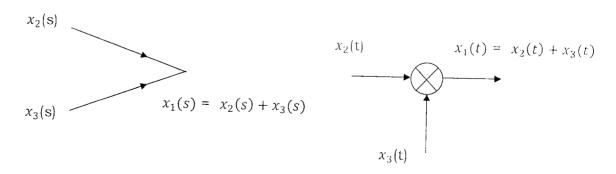
1.4 State Diagram:

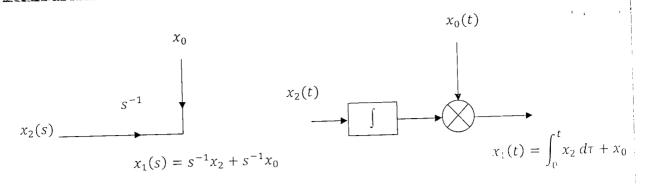
The pictorial representation of the state model of the system is called state diagram. The important significance of the state model of the state diagram is that it forms a closer relationship among the state models, differential equations and computer simulation.

The state diagram of a state model is constructed by using three basic units. Scalars, Adders and Integrators.

The signal flow graph and the block diagram representation with the use of the basic units are given below

$$x_2(s) \xrightarrow{\qquad \qquad } x_2(t) \xrightarrow{\qquad \qquad } x_1(t) = ax_2(t)$$





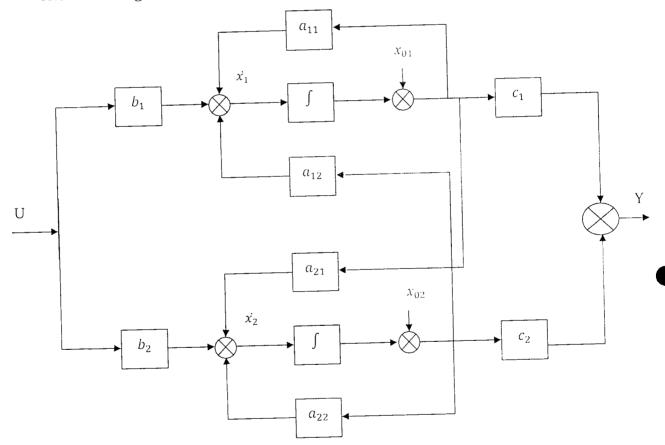
Consider the system with a single input u(t) single output y(t) and two state variables x_1 and x_2 . The system equations are

$$\dot{x_1} = a_{11}x_1 + a_{12}x_2 + b_1u \; ; \; x_1(0) = x_{01}$$

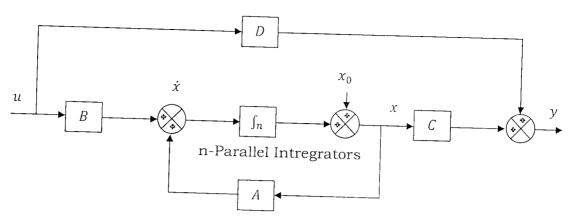
$$\dot{x_2} = a_{21}x_1 + a_{22}x_2 + b_2u \; ; \; x_2(0) = x_{02}$$

$$y = c_1x_1 + c_2x_2$$

The state diagram for this set of equations utilizing two integrators



This procedure can be easily extended for a MIMO system with n state variables. The general philosophy of the state diagram for the multivariable system can be expressed graphically as

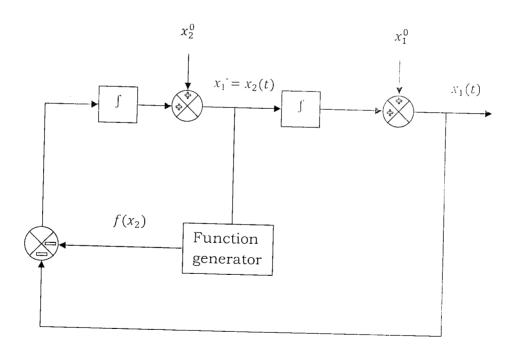


For nonlinear time varying state models, the state diagram cannot be obtained in terms of the three basic units-scalars, adders, integrators. In addition to these, we require non linear function generators and time dependent devices. Consider for example, the state model

$$\dot{x}_1(t) = x_2(t);$$
 $x_1(0) = x_1^0$

$$\dot{x}_2(t) = -x_1(t) - f(x_2(t));$$
 $x_2(0) = x_2^0$

Where $f(x_2)$ is a nonlinear function of x_2 , below figure shows the state diagram for this system



1.5 Solution of State Equations

The Solution of the state equation for which the system transient response can be obtained. Let us first review the classical method of solution by considering a first order scalar differential equation.

$$\frac{dx}{dt} = ax; x(0) = x_0$$

This equation has the solution

$$x(t) = e^{at} x_0$$

$$= \left(1 + at + \frac{1}{2!} a^2 t^2 + \dots + \frac{1}{i!} a^i t^i + \dots \right) x_0$$

Let us now consider the state equation

$$\dot{X}(t) = AX(t); X(0) = X_0$$
 (1)

Which represents the homogeneous linear system with constant coefficients. By analogy with the scalar case, we assume a solution of the form

$$X(t) = a_0 + a_1 t + a_2 t^2 + \dots + a_i t^i + \dots$$

Where are Vector coefficients.

By substituting the assumed solution in equation (1) we get

$$a_1 + 2a_2t^1 + 3a_3t^2 + \dots = A(a_0 + a_1t + a_2t^2 + \dots + a_it^i + \dots)$$

On comparing the coefficients

$$a_1 = Aa_0$$

$$a_2 = \frac{1}{2}Aa_1 = \frac{1}{2!}A^2a_0$$

$$a_i = \frac{1}{1!}A^ia_0$$

In the assumed solution, equating $X(t=0)=X_0$, we find that

$$a_0 = X_0$$

The solution X(t) is found to be

$$X(t) = (I + At + \frac{1}{2!}A^2t^2 + \dots + \frac{1}{i!}A^it^i + \dots)X_0$$

Each term inside the term bracket is an $n \times n$ matrix. We call it as **matrix** exponential method which my written as

$$e^{At} = I + At + \frac{1}{2!}A^2t^2 + \dots + \frac{1}{i!}A^it^i + \dots$$

The solution now can be written as

$$X(t) = e^{At}X_0$$

 e^{At} is known as **state transition matrix** and is denoted by $\varphi(t)$

Let us now determine the solution for the non-homogeneous state equation

$$\dot{X}(t) = AX(t) + Bu(t); X(0) = X_0$$

Rewriting the equation in the form

$$\dot{X}(t) - AX(t) = Bu(t)$$

Multiplying both sides by e^{-At} , we can write $e^{-At}|\dot{X}(t) - AX(t)| = \frac{d}{dt}e^{-At}x(t)$

Integrating both sides with respect to t between the limits 0 to t we get

$$\int_0^t e^{-At} x(t) dt = \int_0^t e^{-A\tau} B u(\tau) d\tau$$

$$e^{-At}\mathbf{x}(t) - \mathbf{x}(0) = \int_0^t e^{-A\tau}Bu(\tau)d\tau$$

Now pre multiplying both sides by e^{At} , we have

$$X(t) = e^{At}X_0 + \int_{t_0}^t e^{A(t-\tau)}Bu(\tau)d\tau$$

Properties of State Transition Matrix

In the above discussion the state Transition Matrix has been defined as

$$\varphi(t) = e^{At}$$

The useful properties of STM are as follows:

$$1. \ \boldsymbol{\varphi}(0) = e^{At} = \boldsymbol{I}$$

$$2. \ \varphi(t)^{-1} = \varphi(-t)$$

3.
$$\varphi(t_1 + t_2) = \varphi(t_1)\varphi(t_2)$$

1.6 Computation of STM

1.6.1 Computation by Laplace Transformation:

Let us consider the unforced equation whose state equation is

$$\dot{X}(t) = AX(t)$$

Taking the Laplace transformation of this equation, we obtain

$$sX(s) - X(0) = AX(s)$$

$$sX(s) - AX(s) = X(0)$$

$$[s\mathbf{I} - A]X(s) = X(0)$$

$$X(s) = [s\mathbf{I} - A]^{-1}X(0)$$
Asst professor

Taking inverse Laplace transformation, we get

$$X(t) = L^{-1}\{ [sI - A]^{-1} \} X(0)$$

The comparison yields a different approach to determine the STM which is given below:

$$\varphi(0) = e^{At} = L^{-1}\{ [sI - A]^{-1} \} = L^{-1}\{ \varphi(s) \}$$

Where $\varphi(s) = [sI - A]^{-1}$ is called **resolvent matrix**

Let us consider the force equation whose state equation is

$$\dot{X}(t) = AX(t) + Bu(t)$$

Performing the Laplace transformation gives

$$sX(s) - X(0) = AX(s) + BU(s)$$
$$[sI - A]X(s) = X(0) + BU(s)$$
$$X(s) = \{[sI - A]^{-1}\}X(0) + \{[sI - A]^{-1}BU(s)\}$$

By Inverse Laplace transformation

$$X(t) = L^{-1}\{[sI - A]^{-1}\}X(0) + L^{-1}\{[sI - A]^{-1}BU(s)\}$$

$$X(t) = \{\varphi(t)\}X(0) + L^{-1}\{\varphi(s)BU(s)\}$$

1.6.2 Computation by Cayley-Hamilton Therem:

The state transition matrix may be computed using the technique based on the Cayley-Hamilton Theorem. For large systems this method is more convenient computationally as compared to the other two methods advanced earlier. To begin with let us start the Cayley-Hamilton Theorem.

Every square matrix A satisfies its own characteristic equation. In other words, if

$$q(\lambda) = |\lambda I - A| = \lambda^n + a_1 \lambda^{n-1} + \dots + a_{n-1} \lambda^1 + a_n = 0$$
 (1)

Is the characteristic equation of A, then

$$q(A) = A^{n} + a_{1}A^{n-1} + \dots + a_{n-1}A^{1} + a_{n}I = 0$$
 (2)

This theorem provides a simple procedure for evaluating the function of the matrix. In the study of linear systems, we are mostly concerned which can be represented as a series of the power of a matrix. Given an $n \times n$ matrix A with the characteristic equation as in equation (1), let the Eigen values of A. The matrix polynomial

$$f(A) = k_0 I + k_1 A + k_2 A^2 + \dots + k_n A^n + k_{n+1} A^{n+1} + \dots$$
 (3)

Can be computed by considering the scalar polynomial

$$f(\lambda) = k_0 + k_1 \lambda + k_2 \lambda^2 + \dots + k_n \lambda^n + k_{n+1} \lambda^{n+1} + \dots$$
 (4)

If $f(\lambda)$ is divided by the characteristic polynomial $q(\lambda)$ then we have

$$\frac{f(\lambda)}{q(\lambda)} = Q(\lambda) + \frac{R(\lambda)}{q(\lambda)}$$

Or

$$f(\lambda) = Q(\lambda)q(\lambda) + R(\lambda) \tag{5}$$

Where $R(\lambda)$ is the remainder polynomial of the following form:

$$R(\lambda) = \alpha_0 + \alpha_1 \lambda + \alpha_2 \lambda^2 + \dots + \alpha_{n-1} \lambda^{n-1}$$
(6)

If we evaluate $f(\lambda)$ at the eigen values $\lambda_1, \lambda_2, \dots, \lambda_n$; then $q(\lambda) = 0$ and we have

$$f(\lambda_i) = R(\lambda_i) \ i = 1, 2, \dots, n \tag{7}$$

The coefficients $\alpha_0, \alpha_1, \dots, \alpha_{n-1}$ can be obtained by successively substituting $\lambda_1, \lambda_2, \dots, \lambda_n$ in equation (7) substituting A for the variable λ in equation (5), we get

$$f(A) = Q(A)q(A) + R(A)$$

Since q(A) is ideally zero, it follows that

$$f(A) = R(A)$$

$$= \alpha_0 I + \alpha_1 A + \dots + \alpha_{n-1} A^{n-1}$$
(8)

Which is the desired result.

Procedure to evaluate the matrix:

- 1. Find the eigenvalues
- 2. Write the polynomial $R(\lambda)$ and evaluate coefficients $\alpha_0, \alpha_1, \ldots, \alpha_{n-1}$ by substituting obtained eigenvalues in $R(\lambda)$
- 3. Find the f(A) by the equation $f(A) = \alpha_0 I + \alpha_1 A + \dots + \alpha_{n-1} A^{n-1}$.

PROBLEMS

1. Obtain The STM for the State Model whose A Matrix is given by

a)
$$A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$$

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

a)
$$A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$$
 b) $A = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}$ c) $A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$ d) $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$

$$d) A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$$

2. Obtain The STM for the State Model whose A Matrix is given by using Cayley-Hamilton theorem. $a) A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ $b) A = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}$ $c) A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$ 3. Find $f(A) = A^{10}$ for

a)
$$A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$$

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

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

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

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

4. Find $f(A) = e^{At}$ for

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