TE - VI - Elect - R-19

QP:- 20000375

(3 Hours) **Total Marks: 80**

N.B: (1) Question No. 1 is compulsory.
(2) Attempt any three from the remaining questions.
(3) Assume suitable data wherever required.

1. Attempt any four (20)
   (a) Compute DFT of the given sequence x(n) = [2,4,6,8].
   (b) What is ROC?
   (c) Give the classification of signals and systems.
   (d) Determine the periodicity of the following continuous time signal:
   $$X(t) = 5\cos 8\pi t + 3\sin 4\pi t$$
   (e) State sampling theorem and explain how aliasing error occurs?

2. (A) An 8-point sequence is given by x(n) = [0,1,1,1,1,1,1,1]. Compute 8-point DFT of x (n) by radix 2 DIT-FFT method. (10)
   (B) Prove any three DFT Properties. (10)

3. (A) Explain any three properties of Z-Transform. (10)
   (B) Obtain magnitude and phase response of the following system: (10)
   $$H(n) = [1, -\tfrac{1}{2}]$$

4. (A) Determine the inverse Z-Transform of the function for all possible ROCs: (10)
   $$X(z) = \frac{1}{1-0.8z^{-1}+0.12z^{-2}}$$
   (B) Find x(n) for the following: (10)
   $$X(z) = \frac{10z}{(z-1)(z-2)}$$

5. (A) Classify the following systems as linear, non-linear, time-variant, time invariant, causal, non-causal, static, dynamic, stable and unstable. (10)
   (a) $y(n) = n\,x(n)$
   (b) $y(n) = x(n^2)$
   (B) Determine the response of the LTI system governed by the difference equation:
   $$Y(n) - 0.5\,y(n-1) = x(n)$$
   for input $x(n) = 5^n u(n)$ and initial condition $y(-1) = 2$. (10)

Q 6 a. Explain any five properties of Z-transform. (10)

b. Using Bilinear transformation, obtain Butterworth filter design which satisfies the following conditions
$0.8 \le |H(e^{jw})| \le 1 \qquad 0 \le w \le 0.2\pi$
$|H(e^{jw})| \le 0.2 \qquad 0.6\pi \le w \le \pi$ (10)

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1. Question no. 1 is compulsory
2. Attempt any three questions out of remaining five questions
3. Assume suitable data whenever necessary
4. Figures to the right indicate full marks

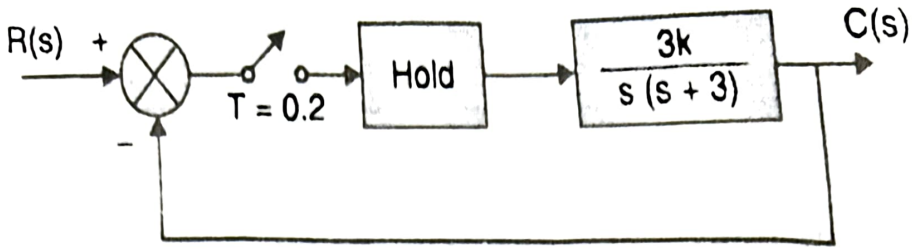
TE - Sem-VI - Elect - R-19 qp code: 10095292

Q. 1 Attempt All

		Marks
a	Compare lag and lead compensators along with electrical equivalent circuit and pole-zero plot in S-plane.	05
b	Define controllability and observability of a system.	05
c	Develop a flowchart for the digital compensator defined by $Gc(z)=\frac{X(z)}{E(z)}=\frac{z-0.8}{z^2-0.4z+0.8}$	05
d	Convert given transfer function into cascade form of state space $\frac{Y(s)}{U(s)}=\frac{(s+3)}{(s+2)(s+4)(s+6)}$	05

Q.2	a)	Design a lead compensator by root locus technique for the unity feedback system which has the forward system given by G(S)=K/s(s+4)(s+6) which will reduce the settling time by a factor of 2 while maintaing 30% overshoot.	15
	b)	Explain how to improve the steady state error by cascade compensation	05
Q 3	a)	The open loop transfer function of a uncompensated system is G(s)=5/s(s+2). Design a suitable lag compensator for the system so that static error constant Kv=20, phase margin is at least 55^0 and the gain margin is at least 12 dB. Use Bode plot.	15
	b)	Explain the steps in lag-lead compensator design using frequency domain analysis.	05
Q 4	a)	Design a state variable feedback controller to yeild 5% overshoot and peak time of 0.3 sec for a plant G(s)= 100(S+10)/s(s+3)(s+12) which is represented phase variable form.	15
	b)	Given T(z) = N(Z)/D(Z) where $D(Z)= z^4 + z^3 -2z+0.5$. Use Routh-Hurwitz criterion to find the number of z plane poles of T(z) inside, outside and on the unit circle. Is the system stable.	05
Q 5	a)	Consider a unity feedback system with open loop transfer function G(S)=K/s(s+1)(s+2). Design a suitable lag-lead compensator to acquire Kv=10, phase margin=50^0 and gain margin >=10 dB. Use frequency response analysis.	10
	b)	Design a lag compensator using root locus technique with open loop transfer function G(S)=k/s(s+2)(s+8) to meet damping ratio =0.174. Steady state error to be improved by the factor of 10.	10

Q 6 a) Find the range of gain K to make the system shown in the given figure is stable 10



b) Design the observer of the plant G(S)=(S+4)/(S+1)(S+2)(S+5) which is represented in observer canonical form that will respond 10 times faster. Design specifications are 20.8 % overshoot, 4 sec settling time. 10

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QP code: 10083469

TE sem VI Electrical R-19 Cscheme

(3 Hours) **Total Marks: 80**

14 MAY 2025

NB: 1) Question **No. 1** is **compulsory**.
2) **Answer** any **THREE** questions out of the remaining **FIVE** questions.
3) Assume suitable data if **necessary** and **justify** them.
4) **Figure** to the **right** indicates **marks**.

1.	a)	Explain time grading & current grading protection of the radial feeder.	5
	b)	What are the difficulties experienced in plain differential protection of transformers?	5
	c)	State advantages & disadvantages of static relay.	5
	d)	Write a short note on ELCB.	5
2.	a)	Explain different ways of connections of earth fault relay and their applications.	10
	b)	What is primary and back-up protection? Explain types of back-up protections.	10
3.	a)	With a neat diagram, explain construction and working of vacuum circuit breaker.	10
	b)	Explain three stepped distance protection provided to long transmission lines.	10
4.	a)	Write a short note on the following:- i) Instrument transformers used in protection. ii) Contactors.	10
	b)	Explain the different abnormal conditions observed in motors and protection provided against them.	10
5.	a)	Explain the construction, working and applications of HRC fuse.	10
	b)	What are incipient faults? Explain the protection provided to power transformers against them.	10
6.	a)	Explain the working of a numerical relay with a block diagram.	10
	b)	Explain negative phase sequence protection & field failure protection provided to generator.	10

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QP code : 10096972

TE sem VI Electrical R-19 cscheme

Duration – 3 Hours **Total Marks assigned to the paper- 80**

Note: - (1) Question No.1 is compulsory.
(2) Attempt any **THREE** from remaining questions.
(3) Figures to the right indicates full marks
(4) Assume suitable data if required.

Q. 1. Attempt **any four** questions. **(20 marks)**

i. Differentiate between microcontroller and microprocessor.

ii. Differentiate between interrupting and polling.

iii. Explain the status register used in Pic18 microcontroller.

iv. Explain the following special function registers

(a) Table Pointer (TBLPTR) (b) Stack Pointer (STKPTR)

v. Explain the following assembly level instructions

a) CALL Lebel (b) TBLRD*+

vi. Brief the CCP module of pic microcontroller.

Q. 2. A] What is mean by addressing modes? Explain the different addressing modes used in pic18 microcontroller. **(10 marks)**

Q. 2. B] What is mean by assembler directives? Explain any seven assembler directives used in pic18 microcontroller. **(10 marks)**

Q. 3. A] Describe the different instruction formats used in pic18 microcontroller. **(10 marks)**

Q. 3. B] Explain the Table Read operation of pic 18 microcontroller. Also explain the instructions associated with table read operation. **(10 marks)**

Q. 4. A] Write a embedded C program for Timer0 to generate a square wave of 500 Hz for the given specifications as 16-bit operation mode, Oscillator frequency of 10 MHz and Prescalor of 128. Display the output waveform on Port B pin number 7. **(10 marks)**

Q. 4. B] Explain given registers used in serial communication: SPBRG, TXSTA and RCSTA. **(10 marks)**

Q. 5. A] Draw and explain the Analog to digital (ADC) converter module of Pic18f4520 microcontroller and hence describe ADCON register of the same. **(10 marks)**

Q. 5. B] Explain the vectored interrupt used in pic18 microcontroller and hence describe the roll of GIE and PEIE. **(10 marks)**

Q. 6. Write short notes on **any 02.** **(20 marks)**

A] Stepper motor interfacing with pic microcontroller
B] DC motor interfacing with pic microcontroller
C] LCD interfacing with pic microcontroller

QP code : 10001192

TE Sem VI Electrical R-19 c scheme

Duration: 3 hours **Total Marks : 80**

Instructions:
1. Question No. 1 is compulsory
2. Attempt **any three** questions out of remaining **five** questions.
3. Assume suitable data, if necessary and justify the same.

Q1. Answer the following questions. **20**

A) Explain Slepain theory of arc interruption. 5
B) Explain with neat sketch, the operation of ELCB. 5
C) Explain the significance of TSM and PSM 5
D) Compare static relay with electromagnetic relay 5

Q2. a) Explain with neat diagram, the construction and working of SF6 Circuit Breaker. 10
Q2. b) (i) Explain applications of C.T. and P.T. in protection system 5
(ii) Write a short note on Contactors 5

Q3. a) Explain the construction, working and operating characteristics of HRC Fuse. 10

Q3. b) Differentiate between impedance, reactance and MHO relay with the help of their characteristics. 10

Q4. a) Draw and explain the protection scheme for protection of induction motor against Single phasing. 10
Q4. b) Explain the construction and working principle of Induction Disc relay. 10

Q5.a) Explain the phenomenon of overreach and underreach in impedance relay and state the measure to overcome it. 10
Q5.b) Describe the differential protection scheme for star-delta connected transformer. 10

Q6. a) Draw the block diagram of Numerical relay and explain the function of each component used inside the relay 10
Q6. b) Write a short note on Phase comparison carrier current protection. 10

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TE - VI - Elect - R-19 Qp:- 1009368l

Time: 3 Hours Marks :80

Note: - 1. Question No. 1 is compulsory

2. Attempt any three questions out of remaining five questions

3. Assume suitable data if necessary & justify the same

4. Figures to the right indicates marks.

		Marks
Q. 1	Solve **ANY FOUR** questions from following	
(a)	What are the requirements of ideal traction system?	[5]
(b)	Explain the working of Booster transformers	[5]
(c)	Differentiate the speed time curve for urban, suburban and main line services.	[5]
(d)	Discuss the suitability of DC series motor for traction drive.	[5]
(e)	Write a brief note on Kando system	[5]
Q. 2 (a)	Explain the speed time curve of main line services along with its characteristics	[10]
(b)	What is tractive effort? Derive the expression of total tractive efforts.	[10]
Q.3 (a)	State the important features of traction drive. Discuss the semiconductor based convertor controlled traction drive.	[10]
(b)	Discuss the protection scheme provided for traction transformer and catenary wire system.	[10]
Q.4 (a)	Draw the layout of 132/25 KV traction substation. Explain it in detail	[10]
(b)	Discuss the power circuit equipment's used in locomotive with neat diagram.	[10]
Q.5 (a)	Explain the design requirement of catenary wire system	[10]
(b)	Derive the expression of specific energy consumption. What are the factors affecting it?	[10]
Q.6 (a)	Discuss any one current collection technique used in overhead system. State its advantages.	[10]
(b)	Discuss the operation of AC track circuit used in traction railway signaling	[10]

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TE - VI - Elect - R - 19 QP :- 10096715

(3 Hours) [Total Marks: 80]

N.B. : (1) Question No.1 is compulsory
(2) Attempt any three from the remaining
(3) Figures to the right indicate full marks
(4) Assume suitable data if necessary

1.	(a)	Write a short note on: Lead-acid battery.	05
	(b)	Explain the necessity of energy storage in a conventional power system.	05
	(c)	Describe the principle of operation of a fuel cell.	05
	(d)	Write a short note on : Energy Storage in Pressurized Gas.	05
2.	(a)	What are solar ponds? Explain with a neat diagram how energy can be stored and utilised from a solar pond?	10
	(b)	Explain in detail about sensible heat storage.	10
3.	(a)	Explain briefly about Compressed air energy storage (CAES).	10
	(b)	Explain the configurations and applications of hybrid energy storage systems (HESS).	10
4.	(a)	Write a short note on Superconducting magnetic energy storage (SMES).	10
	(b)	Illustrate environmental and sustainability issues in energy storage.	10
5.	(a)	Explain in detail about the Molten salt thermal energy storage. Give its applications.	10
	(b)	Illustrate the working principle of Rechargeable battery.	10
6.	(a)	Write a short note on: Nickel-Metal hydride battery.	10
	(b)	Discuss the operation of seasonal thermal energy storage.	10

TE - VI - Elect - R-19 Gp:- 20000375

(3 Hours) **Total Marks: 80**

N.B: (1) Question No. 1 is compulsory.
(2) Attempt any three from the remaining questions.
(3) Assume suitable data wherever required.

1. Attempt any four (20)
   (a) Compute DFT of the given sequence x(n) = [2,4,6,8].
   (b) What is ROC?
   (c) Give the classification of signals and systems.
   (d) Determine the periodicity of the following continuous time signal:
   $$X(t) = 5\cos 8\pi t + 3\sin 4\pi t$$
   (e) State sampling theorem and explain how aliasing error occurs?

2. (A) An 8-point sequence is given by x(n) = [0,1,1,1,1,1,1,1]. Compute 8-point DFT of x (n) by radix 2 DIT-FFT method. (10)
   (B) Prove any three DFT Properties. (10)

3. (A) Explain any three properties of Z-Transform. (10)
   (B) Obtain magnitude and phase response of the following system: (10)
   $$H(n) = [1, -\tfrac{1}{2}]$$

4. (A) Determine the inverse Z-Transform of the function for all possible ROCs: (10)
   $$X(z) = \frac{1}{1-0.8z^{-1}+0.12z^{-2}}$$
   (B) Find x(n) for the following: (10)
   $$X(z) = \frac{10z}{(z-1)(z-2)}$$

5. (A) Classify the following systems as linear, non-linear, time-variant, time invariant, causal, non-causal, static, dynamic, stable and unstable. (10)
   (a) $y(n) = n\,x(n)$
   (b) $y(n) = x(n^2)$
   (B) Determine the response of the LTI system governed by the difference equation:
   $$Y(n) - 0.5\,y(n-1) = x(n)$$
   for input $x(n) = 5^n u(n)$ and initial condition $y(-1) = 2$. (10)

Q 6 a. Explain any five properties of Z-transform. (10)

b. Using Bilinear transformation, obtain Butterworth filter design which satisfies the following conditions
$0.8 \le |H(e^{jw})| \le 1 \qquad 0 \le w \le 0.2\pi$
$|H(e^{jw})| \le 0.2 \qquad 0.6\pi \le w \le \pi$ (10)

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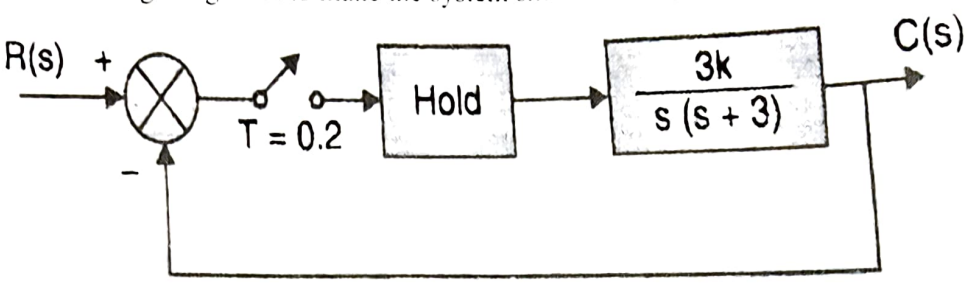
1. Question no. 1 is compulsory
2. Attempt any three questions out of remaining five questions
3. Assume suitable data whenever necessary
4. Figures to the right indicate full marks

TE - Sem-VI - Elect - R-19 QP Code: 10095292

			Marks
Q. 1		Attempt All	
	a	Compare lag and lead compensators along with electrical equivalent circuit and pole-zero plot in S-plane.	05
	b	Define controllability and observability of a system.	05
	c	Develop a flowchart for the digital compensator defined by $Gc(Z)=\frac{X(z)}{E(z)}=\frac{z-0.8}{z^2-0.4z+0.8}$	05
	d	Convert given transfer function into cascade form of state space $\frac{Y(s)}{U(s)}=\frac{(s+3)}{(s+2)(s+4)(s+6)}$	05
Q.2	a)	Design a lead compensator by root locus technique for the unity feedback system which has the forward system given by G(S)=K/s(s+4)(s+6) which will reduce the settling time by a factor of 2 while maintaing 30% overshoot.	15
	b)	Explain how to improve the steady state error by cascade compensation	05
Q 3	a)	The open loop transfer function of a uncompensated system is G(s)=5/s(s+2). Design a suitable lag compensator for the system so that static error constant Kv=20, phase margin is at least 55^0 and the gain margin is at least 12 dB. Use Bode plot.	15
	b)	Explain the steps in lag-lead compensator design using frequency domain analysis.	05
Q 4	a)	Design a state variable feedback controller to yeild 5% overshoot and peak time of 0.3 sec for a plant G(s)= 100(S+10)/s(s+3)(s+12) which is represented phase variable form.	15
	b)	Given T(z) = N(Z)/D(Z) where $D(Z)= z^4 + z^3 -2z+0.5$. Use Routh-Hurwitz criterion to find the number of z plane poles of T(z) inside, outside and on the unit circle. Is the system stable.	05
Q 5	a)	Consider a unity feedback system with open loop transfer function G(S)=K/s(s+1)(s+2). Design a suitable lag-lead compensator to acquire Kv=10, phase margin=50^0 and gain margin >=10 dB. Use frequency response analysis.	10
	b)	Design a lag compensator using root locus technique with open loop transfer function G(S)=k/s(s+2)(s+8) to meet damping ratio =0.174. Steady state error to be improved by the factor of 10.	10

Q 6 a) Find the range of gain K to make the system shown in the given figure is stable 10



b) Design the observer of the plant G(S)=(S+4)/(S+1)(S+2)(S+5) which is represented in observer canonical form that will respond 10 times faster. Design specifications are 20.8 % overshoot, 4 sec settling time. 10

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QP code : 10081136

TE sem VI Electrical R-19 C scheme

Duration – 3 Hours **Total Marks: 80**

Note: - (1) Question No.1 is compulsory.
(2) Attempt any three questions out of the remaining five questions.
(3) Assume suitable data if necessary and justify the same.

Q 1	Answer the following.	20M
(a)	Discuss the steps taken by the microcontroller when an interrupt occurs.	5M
(b)	What is timer roll over? Specify the significance of TMR0IF.	5M
(c)	Explain the Compare instructions used in PIC18F microcontroller.	5M
(d)	Explain STACK and STACK pointer in PIC18F.	5M
Q 2 (a)	Explain the memory organization (RAM and ROM) of PIC 18F microcontroller.	10M
Q 2 (b)	Build a C code to transmit a character 'Y' serially at 9600bps continuously. Assume XTAL = 10MHz.	10M
Q 3 (a)	Explain the different types of instruction sets and mention two examples of each set.	10M
Q 3 (b)	Write an Assembly language program to separate odd and even numbers from a given set of 10 numbers. Store the even numbers in the memory location starting from 20H and the odd numbers in the memory location starting from 30H onwards. Use register indirect addressing mode.	10M
Q 4 (a)	Explain the registers SPBRG, TXREG and RCSTA registers associated with serial communication in PIC 18F.	10M
Q 4 (b)	With a neat diagram, demonstrate a PIC microcontroller-based system to operate a stepper motor in forward and reverse directions using push buttons.	10M
Q 5 (a)	Illustrate the different addressing modes used in PIC18F458.	10M
Q 5 (b)	Describe the steps to program the Timer0 in 16-bit mode to generate a 1 ms delay. XTAL = 10MHz.	10M
Q 6	Write a short note on (Attempt any two)	
(a)	PWM signal generation using CCP module	10M
(b)	Seven Segments LED Interfacing with PIC 18 Microcontrollers.	10M
(c)	DC Motor interfacing with PIC18 Microcontroller	10M

ap code : 10085104

TE sem VI Electrical R-19 e scheme

Marks:80

Duration :3 Hr.

Note :

- **Question No.1 is compulsory.**
- Solve **ANY THREE** questions from the **remaining** five questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.

Q. 1 Solve **any four** questions from following. (Each question carries 5 marks) **20**

a) Define controllability and observability in state space. Which form of State space representation is best to directly observe the controllability and observability of system and why? **05**

b) Digital compensator is given by G(s)=10/(S+5). Obtaine the discrete transfer function for T=0.02 msec. **05**

c) Realize a PD controller with passive network. Given the controller transfer function $Gc(s) = \frac{s+3}{s+10}$ **05**

d) For a system with $G(s)=\frac{35(s+5)}{s(s+3)(s+10)}$, determine the corner frequencies, intial slope and magnitude of the bode plot at ω=0.1 rad/sec. **05**

e) The open loop transfer function G(s) of a plant has 3 poles: one at origin and the other two at -1 anc -3 respectively. The constant %OS line corresponds to 10% overshoot intersect the Root locus at the point A. Evaluate the settling time corresponding to the point A. **05**

Q. 2 a) Design an integral controller to yield a 16% overshoot, 0.6sec. peak time and zero steady state error for a step input for the following plant. Analyse the designed system and verify the zero steady state error. **10**

$$\dot{x} = \begin{bmatrix} -2 & 1 \\ 0 & -4 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u; \qquad y = [1 \quad 1]\, x$$

b) Identify the active and passive compensators which can be used to improve only the steady state response for the given system. Model the compensators with the corresponding typical Transfer functions and pole-zero plots. Also, draw the corresponding compensator circuits. **10**

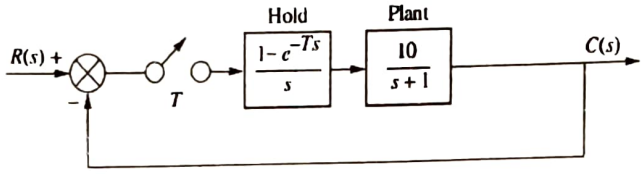
Q. 3 a) Design a lag compensator for the unity feedback system with forward path $G(S) = \frac{K}{S(S+8)(S+30)}$ to meet percentage overshoot of 10% and K_v=10. Use frequency response analysis. **10**

b) Explain the selection criteria of cpmpensators. Explain the steps in lag-lead compensator design using frequency domain analysis. **10**

Q. 4 a) A unity feedback system with forward path transfer function $G(s)=\frac{K}{(s+2)(s+4)(s+6)}$ has 15% overshoot. Analyse the system with the help of root locus and determine the dominant pole and gain K for the given % overshoot. 10

b) Analyse the system given in Q. 4a) to determine the current peak time for 15% overshoot, design a PD controller to reduce the peak time by a factor of 1.5. Draw the compensated root locus and verify the design. 10

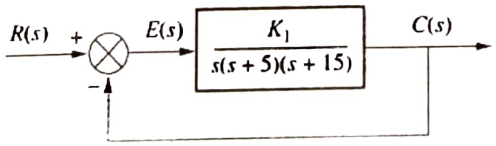
Q. 5 a) Determine the range of T that will make the system stable and the range that will make the system unstable. 10



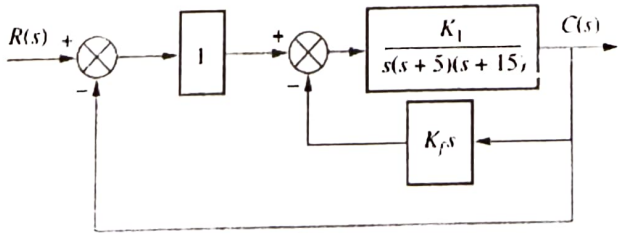
b) Design a lag compensator using root locus technique with open loop transfer function $G(S)=\frac{K}{S((S+2)(S+8)}$ to meet damping ratio =0.5, settling time=5 and velocity error >5 10

Q. 6 a) $G(s)=\frac{20(s+2)}{s(s+5)(s+7)}$. Analyse the system for controllability and if controllable, determine the transformation matrix to do the state feedback controller design in phase variable form, if the plant is represented in the parallel form. 10

b) What is rate feedback controller. Given the system of Figure (a), design rate feedback compensation, as shown in Figure (b), to reduce the settling time by a factor of 4 while continuing to operate the system with 20% overshoot. 10



(a)



(b)

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QP code : 10086606

TE sem VI Electrical R-19 Cscheme

Time (3 Hours) **80 Marks**

Note: (1) Question no. 1 compulsory
(2) Attempt any 3 question out of remaining five questions.
(3) Draw neat diagram wherever necessary.

Q 1. Attempt **any Four** out of Six questions **(5 marks each)** **(20)**

a. Determine the Fourier series representation of $x(t) = 2Sin(2\pi t - 3) + Sin(6\pi t)$
b. State the conditions for an LTI system to stable and casual.
c. Determine whether the continuous time signal $x(t) = 3\cos(4t + \frac{\pi}{3})$ is periodic, determine its fundamental period.
d. State four important properties of DTFT.
e. Determine the z-transform and ROC of the signal $x(n) = 3^n u(-n-1)$
f. Describe the following signals with their graphical and mathematical representations.
(i)Step (ii) Ramp (iii) Impulse.

Q 2. a. Determine the transfer function and the impulse response for the casual LTI system described by the difference equation **(10)**

$$y(n) = \frac{1}{4}y(n-1) - \frac{3}{8}y(n-2) = -x(n) + 2x(n-1)$$

b. Determine whether the system $y(n) = nx(n)$ is **(10)**
(i) Time invariant
(ii)) Linear
(iii) Causal
(iv) Stable

Q3. a. Categorize the following signal as a energy signal or a power signal, find the energy or time averaged power of the signal. **(10)**

$$x(t) = \begin{pmatrix} t, & 0 \le t \le 1 \\ 2-t, & 1 \le t \le 2 \\ 0, & otherwise \end{pmatrix}$$

b. Design a Bandpass FIR filter using rectangular window for N=11 samples **(10)**

$$H_d(e^{j\omega}) = \{1\ , \quad \frac{\Pi}{4} \le |\omega| \le \frac{3\Pi}{4}\}$$
$$\{0\ , \quad \text{otherwise}\}$$

Q4. a. Determine inverse Z-transform of $X(z) = \frac{z^2-3z}{z^2+\frac{3z}{2}-1}$ **(10)**

When ROC is $\frac{1}{2} < |z| < 2$

b. Discuss the method of Bilinear transformation for design of IIR filter **(10)**

Q5. a. Explain any five properties of DFT **(10)**

b. Given x(n) = {1,2,4,8,16,32,64,128) Find X(k) using DIT-FFT algorithm. **(10)**

Q6. a) An LTI system is described by the equation: **(10)**

Y(n) = x(n) + 0.8 x(n-1) +0.8 x(n-2) -0.49 y(n-2)
Determine the transfer function of the system, sketch poles and zeroes on the z-plane.

b) Find y(n) by using convolution if x(n) = [1,3,5,3] and h(n) = [2,3,1,1]. **(10)**

Paper / Subject Code: 89306 / Electric Traction (DLOC)

QP code : 10081970

TE sem VI Electrical R-19 C scheme

Marks: 80

Time: 3 hrs

Note: - 1. Question No. 1 is compulsory

2. Attempt any **three** questions out of remaining **five** questions

3. Assume suitable data if necessary & justify the same

4. Figures to the right indicates marks

Qu.1 Attempt **any Five**.

(a) Discuss the factors on which final choice of traction system depends [4]

(b) Distinguish the characteristics of urban, suburban and main line services [4]

(c) Discuss the suitable characteristics of traction motor in brief. [4]

(d) Describe the advantages and drawbacks of semiconductor converter controlled traction drives. [4]

(e) Write a note on Kando system [4]

(f) Draw the layout of 2*25 KV AC traction system of power distribution. Describe it in brief. [4]

Qu.2 (a) Derive the expression of specific energy consumption. State the factors affecting specific energy consumption [10]

(b) Sketch the layout of 132/25 kV traction substation & illustrate it in brief. [10]

Qu.3 (a) Discuss 25 KV AC traction using Thyristors converter controlled DC motor. Why a converter with multistage control is employed. Describe the operation of multistage converter in brief. [10]

(b) Discuss the operation of DC track circuit used in traction railway signaling [10]

Qu.4 (a) Discuss the protection scheme required for overhead lines in traction [10]

(b) Define the Tractive efforts. Derive the expression for total tractive efforts [10]

Qu.5 (a) An electric train has quadrilateral speed time curve as follows

1. Uniform acceleration from rest at of 2 Kmphps for 30 sec
2. Coasting for 50 sec.
3. Duration of braking 20 sec. [10]

If the train is moving Up Gradient of 10%, tractive resistance is 40 N/tonne, rotational inertia effect 10 % of dead weight, duration of station stop 15 seconds and overall efficiency of transmission gear and motor as 75%. Calculate 1) Total distance travelled by train (2) Schedule Speed

(b) Describe the operation of AC traction drive using PWM voltage source inverter induction motor drive. State the advantages of using PWM technique in traction drive. [10]

Qu.6 (a) Discuss the pantograph current collection technique used in overhead system. List the advantage of pantograph current collection technique [10]

(b) Write a short note on **Any TWO** [10]

(1) Spacing and location of Traction substation

2) Sectioning and paralleling post.

3) Types of Interlocking in railway signaling

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qp code : 10081092

TE sem VI Electrical R-19 C scheme

(3Hrs) Marks: 80

N.B.

1. **Question No.1 is Compulsory.**
2. Answer any three out of remaining five questions
3. Assume any suitable data wherever required but justified the same
4. Illustrate answer with sketches wherever required

Q 1		**Attempt any FOUR**	
	a)	Illustrate the application of flywheel as an energy storage device.	(05)
	b)	Illustrate the operation of seasonal thermal energy storage.	(05)
	c)	Illustrate the energy storage process in pressurized gas.	(05)
	d)	Explain the V2X mode of operation of an electric vehicle.	(05)
	e)	Justify the necessity of an energy storage in electrical power system.	(05)
Q 2	a)	Draw the schematic of superconducting magnetic energy storage (SMES) and also, elaborate it's working.	(10)
	b)	Compare the performance of super capacitor as an energy storage device over a capacitor	(10)
Q 3	a)	Explain the working of pumped hydro energy storage technology also mention its advantages, disadvantages, and applications.	(10)
	b)	Illustrate in detail, any five energy storage technologies.	(10)
Q 4	a)	Draw load curves with and without energy storage system and state the advantages of energy storage devices from load curve point of view.	(10)
	b)	Explain any two battery technologies which can be used as an electrochemical energy storage.	(05)
	c)	Explain with a neat diagram how energy can be stored and utilized from a solar pond?	(05)
Q 5	a)	Illustrate the process of battery sizing for standalone application.	(10)
	b)	Illustrate the term "Hybrid Energy Storage System" and its applications.	(05)
	c)	Illustrate the principle of operation of fuel cell.	(05)
Q 6	a)	Define SoC of energy storage. Illustrate the types SoC estimation techniques.	(10)
	b)	What is the necessity of series connection of super capacitor?	(05)
	c)	Describe battery system model in brief.	(05)

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