

University of Mumbai
Examination First Half Summer 2022

Examinations Commencing from 18 May 2022 to 31 May 2022

Program No. & Name of the Examination :1T00836 T.E.(Electrical Engineering)(SEM-VI)(Choice
Base Credit Grading System) (R- 19) (C Scheme)

Subject/Paper Code:89306 Electric Traction DLOC-II

Time: 2 hour 30 minutes

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Long distance railways use which of the following?
Option A:	200 V D.C. Option
Option B:	25 kV single phase A.C.
Option C:	25 kV two phase A.C.
Option D:	25 kV three phase A.C.
2.	Power for lighting in passengers coach in a long distance electric train is provided
Option A:	directly through overhead electric line
Option B:	through individual generator of bogie and batteries
Option C:	through rails
Option D:	through locomotive
3.	The specific energy consumption for suburban services is usually
Option A:	18 to 25 watt-hours per tonne-km
Option B:	50 to 75 watt-hours per tonne-km
Option C:	125 to 150 watt-hours per tonne-km
Option D:	155 to 200 watt-hours per tonne-km
4.	Which of the following drives is suitable for mines where explosive gas exists?
Option A:	Steam engine
Option B:	Diesel engine
Option C:	Battery locomotive
Option D:	Electric locomotive
5.	The free-running speed of a train does NOT depend on the
Option A:	Duration of stops
Option B:	Distance between the stops
Option C:	Running time
Option D:	Acceleration
6.	For supply on 25 kV, 50 Hz single phase, the suitable motor for electric traction is
Option A:	Ac single-phase split phase motor
Option B:	Ac single phase universal motor
Option C:	Dc shunt motor
Option D:	Dc series motor
7.	----- is called encumbrance
Option A:	The axial distance between catenary and contact wire
Option B:	The axial distance between Mast and contact wire
Option C:	The axial distance between suspension clamp and contact wire
Option D:	The axial distance between steady arm and contact wire
8.	Overhead lines for power supply to tram car are at a minimum height of

Option A:	3m
Option B:	6m
Option C:	10m
Option D:	20m
9.	The current collector that can be employed with different speeds under all wind conditions and stiffness of OHE is known as the
Option A:	messenger collector.
Option B:	pantograph collector.
Option C:	trolley collector.
Option D:	bow collector.
10.	DC track circuit consists of
Option A:	Amplitude modulation equipment.
Option B:	A negative booster, feeding points and signals.
Option C:	An insulated joint and track, track bonding, regulating resistance, track battery to track relay.
Option D:	Amplitude modulation equipment and negative booster

Q2.	Solve any Four out of Six	5 marks each	20 Marks
A	Discuss the advantages of 25 kV ac system over DC system.		
B	What do you understand by train resistance and on what factor does this depend?		
C	Explain the desirable characteristics of traction motors.		
D	Illustrate the merits and demerits of DC system of track electrification.		
E	Explain the working of Pantograph current collector system in traction.		
F	Write short note on Principle of interlocking in railway signaling.		
Q3	Solve any Two Questions out of four	10 marks each	20 Marks
A	Derive the expression for specific energy consumption and illustrate the effect of various factors on specific energy consumption		
B	Discuss the suitability of dc series motor for its application in electric locomotive for traction duty.		
C	Explain the necessity of employing MHO relay in the protection scheme for 25 KV OHE.		
D	Illustrate the design requirements of catenary wire, contact wire, automatic weight tensioning system and section insulator used in traction.		
Q4	Solve any Two Questions out of four	10 marks each	20 Marks
A	What is Speed Time Curve? Draw and Explain actual Speed Time Curve for Suburban and Urban Service.		
B	Explain the theory, working and characteristic of linear IM for traction purpose.		
C	Describe a typical traction substation with the help of a sketch of substation equipment layout.		
D	Discuss different type of catenary construction for traction system		

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Heat energy collected from the sun by solar plate collectors is transferred by transfer medium (air) to Rock bed which absorbs the heat and cooled air is circulated. Name the type of Energy storage system.
Option A:	Latent TES
Option B:	Sensible TES
Option C:	Super-magnetic Energy storage
Option D:	Flywheel energy storage
2.	The typical value of each cell voltage of Nickel metal Hydride battery is-
Option A:	1.35 V
Option B:	4.1 V
Option C:	5 V
Option D:	12 V
3.	Which layer of a solar pond acts as a thermally insulating layer to trap the sun's heat within the solar pond?
Option A:	Upper convective zone
Option B:	Middle non-convective zone
Option C:	Bottom convective zone
Option D:	Surface non-convective zone
4.	The battery charging method which involves charging it at a higher Constant Current for an initial period, lowering the current amplitude as battery voltage increases is -
Option A:	Pulse charging
Option B:	Constant current Constant Voltage charging
Option C:	multi-step CC charging method
Option D:	Reflex charging
5.	_____ stores energy in the magnetic field created by the flow of direct current in a superconducting coil which has been cryogenically cooled to a temperature below its critical temperature.
Option A:	Flywheel ESS
Option B:	Super capacitors
Option C:	SMES
Option D:	Batteries
6.	The battery estimation done to predict the remaining useful life or the remaining charge-discharge cycles, which infers if batteries need to be replaced with new ones is known as-
Option A:	SOC estimation
Option B:	SOH estimation
Option C:	SOS estimation
Option D:	SOT estimation
7.	Determine the energy stored in a Capacitor of capacitance 1200 μF and charge across its plates is 0.4 C?
Option A:	66 J
Option B:	6.67 J

Option C:	1.67 J
Option D:	166 J
8.	For battery application in Electric vehicles, the driving range of a vehicle is roughly proportional to its -----.
Option A:	Specific power density
Option B:	Specific Energy density
Option C:	Depth of discharge
Option D:	Cycle life
9.	The C rate of a battery of capacity 30 kWh if it discharges at the rate of 15 kW in 2 hours is-
Option A:	0.1C
Option B:	2C
Option C:	10C
Option D:	0.5C
10.	What is typically the value of specific energy density of Lithium Ion batteries?
Option A:	35 to 40 Wh/kg
Option B:	10 to 20 Wh/kg
Option C:	300 to 500 Wh/kg
Option D:	150 to 200 Wh/kg

Q2 (20 Marks Each)	
A	Solve any Two 5 marks each
i.	Explain the working principle of Flywheel Energy storage system. What factors determine the amount of energy stored in it?
ii.	Explain the features and applications of ultra-capacitors.
iii.	Explain working of sensible thermal energy storage system.
B	Solve any One 10 marks each
i.	Explain with neat diagram the working of Vanadium Redox Flow battery. What are its advantages as compared to conventional batteries?
ii.	With neat diagram explain Pumped Hydro Energy Storage system. Give its applications.

Q3 (20 Marks Each)	
A	Solve any Two 5 marks each
i.	Explain the necessity of Energy storage.
ii.	Explain with neat diagram how energy is stored in (CAES) Compressed Air Energy Storage system.
iii.	Explain the types and applications of Fuel Cells?
B	Solve any One 10 marks each
i.	With neat diagram explain the construction, working, cell reactions, advantages and applications of Lithium-ion batteries.
ii.	Explain the following parameters related to Electrochemical batteries- Specific Energy density, C-rate, depth of discharge, Cycle Life and Self- discharge.

Q4 (20 Marks Each)	
A	Solve any Two 5 marks each

i.	Explain the V2X, G2V and V2G modes of operation of Electric Vehicles.
ii.	What are Solar Ponds? Explain with neat diagram how energy can be stored and utilized from a Solar Pond?
iii.	Explain any two methods for battery SOC estimation.
B	Solve any One 10 marks each
i.	Explain the configurations and applications of Hybrid Energy Storage Systems (HESS).
ii.	Compare the different Energy storage technologies with respect to their storage capacity, Mass and volume energy density, power density, Cycle life, response time, discharge time, cost, Self-discharge and applications.

University of Mumbai

Program: **Electrical**

Curriculum Scheme: Rev2019

Examination: TE Semester VI

Course Code: EEC603 and Course Name: Control System Design

Time: 2 and half hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks (20Marks)
1.	Which of the following system provides excellent steady state response
Option A:	Lead compensator
Option B:	Lag compensator
Option C:	Proportional + Differential controller
Option D:	Proportional + Integral controller
2.	The state feedback controller
Option A:	Increases the steady state error
Option B:	Decreases the steady state error
Option C:	Improves the transient behavior
Option D:	Improves both steady state and transient behaviour
3.	Where on the s-plane should a pole be placed to drive the steady-state error of a system to zero?
Option A:	At origin
Option B:	$s=1$
Option C:	$s<1$
Option D:	$s>1$
4.	Pole of a first order compensator is on the right side of the compensator zero on s-plane. Identify the compensator
Option A:	Lead compensator
Option B:	Lag compensator
Option C:	Lag-Lead compensator
Option D:	Lag or Lead compensator
5.	The objective of the continuous compensator design is to reduce the settling time by a factor of 2 with the same damping ratio. One of the dominant closed loop poles of the system with the required damping ratio is at $-5-j4$. Then the new peak time is
Option A:	8sec
Option B:	10sec
Option C:	0.31sec
Option D:	0.39sec
6.	What is the steady state error for the digital system with forward transfer function $G(z) = \frac{0.13(z+2)}{(z-1)(z-0.6)}$ with ramp input, if the sampling time $T=0.5\text{sec}$?
Option A:	0

Option B:	2.12
Option C:	1.95
Option D:	2.05
7.	During the lag compensator design with Bode-plot it is observed that the frequency corresponds to $PM_{\text{required}} -180 +10$ is 29rad/sec. At this frequency, magnitude of the uncompensated system is 22dB. Then the lag compensator is,
Option A:	$\frac{0.079(s+2.9)}{(s+0.23)}$
Option B:	$\frac{0.018(s+2.9)}{(s+0.052)}$
Option C:	$\frac{0.079(s+0.018)}{(s+2.9)}$
Option D:	$\frac{0.018(s+0.079)}{(s+2.9)}$
8.	Which of the following system is controllable but not observable?
Option A:	$A = \begin{bmatrix} -5 & 0 \\ 0 & -2 \end{bmatrix}$ $B = \begin{bmatrix} 2 \\ 0 \end{bmatrix}$ and $C = [1 \ 5]$
Option B:	$A = \begin{bmatrix} -5 & 0 \\ 0 & -2 \end{bmatrix}$ $B = \begin{bmatrix} 2 \\ -3 \end{bmatrix}$ and $C = [0 \ 5]$
Option C:	$A = \begin{bmatrix} -5 & 0 \\ 0 & -2 \end{bmatrix}$ $B = \begin{bmatrix} 0 \\ -3 \end{bmatrix}$ and $C = [0 \ 5]$
Option D:	$A = \begin{bmatrix} -5 & 0 \\ 0 & -2 \end{bmatrix}$ $B = \begin{bmatrix} 2 \\ -3 \end{bmatrix}$ and $C = [2 \ 5]$
9.	A pulsed transfer function in the forward path of the unity feedback system is $G(z) = \frac{K(z+3)}{(z-0.2)(z-0.5)}$. What is the range of K for which the system is stable?
Option A:	$0 < K < 0.25$
Option B:	$0 < K < 0.5$
Option C:	$0 < K < 0.3$
Option D:	$0 < K < 0.125$
10.	One of the dominant closed loop poles of a digital system in z-domain is at $0.4 + j0.5$. What is the settling time with the sampling time $T=0.25$?
Option A:	4.42 sec
Option B:	2.24 sec
Option C:	1.26sec
Option D:	2.83sec

PART-B

Q2	Solve any Two Questions out of Three	10 marks each
A	Given the negative unity feedback system $G(s) = \frac{K}{s(s+8)(s+15)}$ use frequency response methods to determine the value of gain, K, to yield a step response with a 20% overshoot.	
B	Consider the following transfer function: $G(s) = \frac{(s+6)}{(s+3)(s+8)(s+10)}$. If the system is represented in cascade form, design a controller to yield a closed loop response of 10% overshoot with a settling time of 1 sec. Design the controller	

	by first transforming the plant to phase variables. Draw the plant representation in cascade form with the controller gains.
C	<p>For step, ramp, and parabolic inputs, find the steady-state error for the feedback control system shown in Figure with $G_1(s) = \frac{10}{s(s+1)}$. Consider $T=0.1$ sec.</p>

Q3	Solve any Two Questions out of Three	10 marks each
A	<p>Consider a unity feedback system with feed forward transfer function $G(s) = \frac{K(s+6)}{(s+2)(s+3)(s+5)}$. It is operating with a dominant-pole damping ratio of 0.707. Using Root-locus, design a PD controller so that the settling time is reduced by a factor of 2. Draw the compensated Root-locus and verify the performance.</p>	
B	<p>Find the range of sampling interval, T, that will keep the following system with $G_1(s) = \frac{10}{(s+1)}$ stable.</p>	
C	<p>Given the plant $x' = \begin{bmatrix} -1 & 1 \\ 0 & 2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ $y = [1 \quad 1]x$</p> <p>Design an integral controller to yield a 15% overshoot, 0.6 second settling time, and zero steady-state error for a step input.</p>	

Q4	Solve any Two Questions out of Three	10 marks each
A	<p>Given $T(z) = \frac{N(z)}{D(z)}$ where $D(z) = z^4 + z^3 - 2z + 0.5$, use the 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?</p>	
B	<p>For a unity feedback system with $G(s) = \frac{K}{s(s+10)(s+200)}$ design a lag compensator using Bode-plot so that the system operates with a 20% overshoot and a static error constant of 100. Draw the compensated Bode-plot to verify the performance after the design.</p>	
C	<p>Consider the plant $G(s) = \frac{(s+2)}{(s+5)(s+6)(s+9)}$ which is represented in parallel form. Design an observer with a transient response described by $\zeta=0.6$ and $w_n=120$. Place the observer third pole 10 times as far from the imaginary axis as the observer dominant poles. Transform the plant to observer canonical form for the design.</p>	

University of Mumbai
Examinations Summer 2022

Time: 2 hour 30 minutes

Max. Marks: 80

Q1. (20 Marks)	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks (02 marks each)
1.	The Access Bank of PIC18 consists of _____ and _____ Registers.
Option A:	General Purpose & Bank select
Option B:	General Purpose & File Select
Option C:	General Purpose & Working
Option D:	General Purpose & Special Function
2.	RLCF F, d, a For the given instruction syntax, which STATUS flag/s will get affected
Option A:	Z
Option B:	Z, N
Option C:	Z, N, C
Option D:	N
3.	PIC18 microcontroller has _____ size of address bus and _____ size of data bus to access Data RAM.
Option A:	8 bit, 8 bit
Option B:	12 bit, 8 bit
Option C:	16 bit, 8 bit
Option D:	21 bit, 16 bit
4.	MOVLW 00xH, MOVWF TRISC What will happen after execution of above instructions?
Option A:	Port C will act as Input Port
Option B:	Port C will act as Output Port.
Option C:	Port C will Load WREG register with 00H value
Option D:	WREG register will get loaded with the content in PORTC register.
5.	To access the program code from program memory, _____ pointer is used and to access the data from program memory, _____ pointer is used.
Option A:	Program Counter, Table Pointer
Option B:	Program Counter, File Select Register
Option C:	Table Pointer, File Select Register
Option D:	Table Pointer, Program counter
6.	The Analog to Digital converter of Pic18F is a _____ bit converter.
Option A:	4
Option B:	8
Option C:	10
Option D:	12
7.	To write the Command Word to Command Register of LCD, select the appropriate status to be maintained at RS and RW pin respectively.
Option A:	RS =0, RW = 0
Option B:	RS =0, RW = 1
Option C:	RS =1, RW = 0

Option D:	RS =1, RW = 1
8.	Write an instruction to Start the analog to digital conversion in ADC module of Pic18 microcontroller.
Option A:	ADCON0bits.ADON=0;
Option B:	ADCON0bits.ADON=1;
Option C:	ADCON0bits.GO=0;
Option D:	ADCON0bits.GO=1;
9.	If the SPBRG register of serial communication is loaded with 03H and the clock frequency (Fosc) is 10MHz. Select the most appropriate Baud are set by serial communication module.
Option A:	2400
Option B:	9600
Option C:	19200
Option D:	38400
10.	In PWM mode of CCP module, the associated CCP pin is set as _____.
Option A:	Input pin
Option B:	Output pin
Option C:	Clock input pin for timer
Option D:	Interrupt pin

Q2 (20 Marks)	Solve any Four out of Six questions (05 marks each)
A.	Explain the Status register used in Pic18 microcontroller and also explain its significance.
B	Write the differences between microprocessor and microcontroller.
C	Describe the Access Bank concept used in Pic18 microcontroller.
D	Explain the structure of Timer0 control register (T0CON) used in Timer0.
E	Explain the GIE and PEIE bits with reference to interrupt.
F	Explain stack and subroutine. Explain any one instruction associated with that.

Q3 (20 Marks)	Solve any Two Questions out of Three (10 marks each)
A	What is mean by addressing mode? Explain the different addressing modes used in pic18 microcontroller.
B	Describe the various special function registers used in USART module used in Pic18 microcontroller for serial communication.
C	Draw the block diagram of ADC module used in Pic18 microcontroller and hence explain the control registers associated with the same.

Q4 (20 Marks)	Solve any Two Questions out of Three (10 marks each)
A	Write a C program for Timer0 to generate a square wave of 100 Hz frequency at RB7 pin. Assume the oscillatory frequency (Fosc) as 10 MHz. Operate Timer0 in 16 bit mode with a prescaler of 128.
B	Describe the Compare, Capture and PWM (CCP) module of Pic18 microcontroller.
C	Write a short note on Stepper motor interfacing with Pic18 microcontroller.

University of Mumbai

Examinations Summer 2022

Time: 2hour 30 minutes Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	An isolator is installed _____.
Option A:	to operate the relay of C.B.
Option B:	as substitute for C.B.
Option C:	generally, on one side of a C.B.
Option D:	generally, on both sides of a C.B.
2.	Circuit breakers usually operate under _____.
Option A:	steady short circuit current
Option B:	sub transient state of short circuit current
Option C:	transient state of short circuit current
Option D:	Zero sequence current
3.	The relay operating speed does not depend upon _____.
Option A:	The spring tension
Option B:	The rate of flux built up
Option C:	Armature core airgap
Option D:	Area of the moving sector
4.	Plug setting of electromagnetic relay can be altered by varying _____.
Option A:	Number of amperes turns
Option B:	Air gap of magnetic path
Option C:	Adjustable back stop
Option D:	Time setting
5.	A single phasing relays are used for protection of _____.
Option A:	Single phase motor only
Option B:	Two phase motor only
Option C:	Two phase motors running in parallel
Option D:	Three phase motor only
6.	Carrier current protection scheme is normally used for _____.
Option A:	HV transmission only
Option B:	HV cables only
Option C:	HV transmission and cables
Option D:	LV transmission only
7.	The Overhead ground wires are used to protect a transmission line against _____.
Option A:	Line to ground faults
Option B:	Arcing earths
Option C:	Voltage surges due to direct lightning stroke
Option D:	High-voltage oscillations due to switching

8.	The Phase comparison relay has merit that _____.
Option A:	Its operation does not depend upon the direction of power flow
Option B:	It can operate even for low value of fault current
Option C:	Correct relay action can be obtained by using series capacitor on the line
Option D:	It can be used to compare scalar quantities as well.
9.	The number of pilot wires required for protecting 3 phase transmission lines using Translay system of protection is _____.
Option A:	6
Option B:	4
Option C:	3
Option D:	2
10.	The _____ relay is used for phase fault on short transmission line.
Option A:	Induction type
Option B:	Reactance
Option C:	Impedance.
Option D:	Admittance

Q2. (20 Marks)	Solve any Two Questions out of Three	10 marks each
A	Draw and explain construction and working of Pantograph Isolators.	
B	Draw and explain construction, working and operating characteristic of HRC Fuse.	
C	Explain working principle of induction type of relays and its characteristics.	
Q3. (20 Marks)	Solve any Two Questions out of Three	10 marks each
A	Explain the phenomenon of current chopping and its effect in the circuit breakers.	
B	Explain Numerical Relay in detail.	
C	Explain phase comparison carrier current protection	
Q4. (20 Marks)	Solve any Two Questions out of Three	10 marks each
A	Explain REF protection for alternator. How 100% winding is protected in an alternator?	
B	Explain the operation of Harmonic restraint relay.	
C	Explain the effect of power swing in distance relay.	

University Of Mumbai
 May June 2022 Examination
 Program: Electrical Engineering
 Curriculum Scheme: Rev2016
 Examination: TE Semester VI

Course Code: EEC605 and Course Name: Control System-II (CS-II)

Time: 3 hour

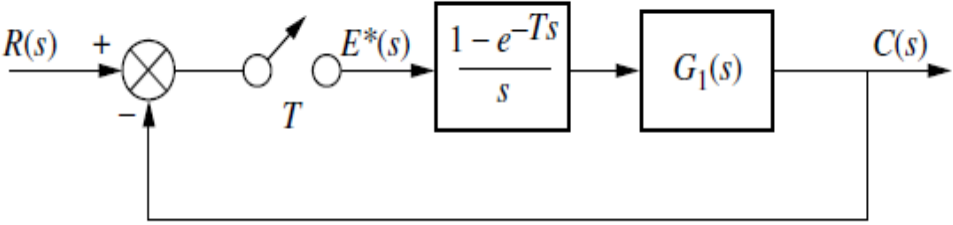
Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks [2 Marks Each]
1.	Lag-lead compensator is an example of _____ compensator.
Option A:	Active
Option B:	Passive
Option C:	Selective
Option D:	Predictive
2.	The transfer function of lag compensator is define by _____.
Option A:	$G_{c(s)} = \frac{K * (S + Z_c)}{S}$
Option B:	$G_{c(s)} = \frac{K * (S + Z_c)}{(S + P_c)}$
Option C:	$G_{c(s)} = \frac{K * S}{(S + P_c)}$
Option D:	$G_{c(s)} = K(S + Z_c)$
3.	The dominant pole of a system is defined by $S_d = -2 \pm j12$. The system peak time is _____ sec.
Option A:	1.5Sec
Option B:	1.0 Sec
Option C:	0.26 sec
Option D:	0.36 Sec
4.	Phase angle contributed by lag compensator is always _____.
Option A:	Negative
Option B:	Positive
Option C:	Zero
Option D:	All of them
5.	Lead compensator _____ the bandwidth by increasing the gain crossover frequency.
Option A:	Constant
Option B:	Decreases
Option C:	Increases
Option D:	All of them
6.	The characteristic equation of controller is defined by _____.
Option A:	$ SI - (A - CK) = 0$
Option B:	$ SI - (A - BK) = 0$
Option C:	$ SI - (B - CK) = 0$
Option D:	$ SI - (C - BK) = 0$

7.	The “Integral controller” is used to reduce steady state error to zero by _____ the order of system.
Option A:	Decreasing
Option B:	Constant
Option C:	Increasing
Option D:	All of them
8.	The transfer function of zero order hold is described by _____.
Option A:	$G_h(s) = \frac{1 - e^{-2TS}}{S}$
Option B:	$G_h(s) = \frac{1 + e^{-TS}}{S}$
Option C:	$G_h(s) = \frac{1 - e^{TS}}{S}$
Option D:	$G_h(s) = \frac{1 - e^{-TS}}{S}$
9.	If closed loop poles lies outside the unit circle the system is said to be _____.
Option A:	Unstable
Option B:	Stable
Option C:	Marginally stable
Option D:	All of them
10.	Tustin transformation function is defined by _____.
Option A:	$s = \frac{6(Z - 1)}{T(Z + 1)}$
Option B:	$s = \frac{4(Z - 1)}{T(Z + 1)}$
Option C:	$s = \frac{8(Z - 1)}{T(Z + 1)}$
Option D:	$s = \frac{2(Z - 1)}{T(Z + 1)}$

Q2	Solve any Four out of Six	(05 Marks Each)
A	Derive the pulse transfer function of digital system.	
B	Define the stability criteria for Digital Control System.	
C	Explain the design procedure of lag compensator. (For Frequency response Technique)	
D	Explain the design procedure of lead compensator. (For Root locus Technique)	
E	Derive the transfer function of lag compensator.	
F	Explain the advantages of Digital control system.	

Q3.	Solve any Two Questions out of Three (10 Marks Each)
A	Implement the PID controller defined by , $G_c(s) = \frac{(S+55.92)(S+0.5)}{s}$
B	Given a plant, $G(s) = \frac{20(S+5)}{s(S+1)(S+4)}$ Design a phase variable feedback gain to yield 9.5 % Overshoot & settling time of 0.74 seconds.
C	For a unity feedback system with forward transfer function $G(s) = \frac{100K}{s(S+36)(S+100)}$, design a lead compensator to yield a 20% overshoot & $K_v = 40$ with peak time of 0.1 second. (Use frequency response technique)

Q4.	Solve any Two Questions out of Three (10 Marks Each)
A	For a unity feedback system with forward transfer function $G(s) = \frac{K}{s(S+50)(S+120)}$ find gain K to yield 20 % overshoot. (Use Root Locus Technique)
B	<p>Given a Z.O.H in cascade with , $G_1(s) = \frac{(S+2)}{(S+1)}$. Find the sampled data transfer function $G(z)$, if T is 0.5 seconds.</p> 
C	Explain the design procedure of Observer design by transformation method.

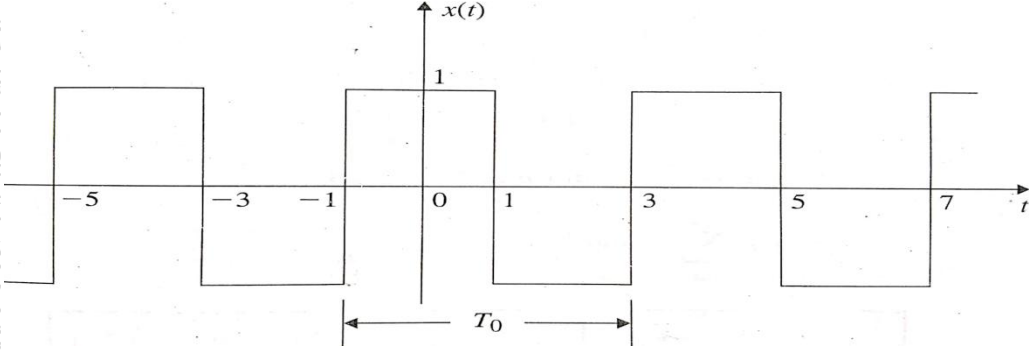
University of Mumbai
Examinations Summer 2022

Time: 2 hour 30 minutes

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks. (2 marks each) (20 Marks)
1.	If $x(-t) = x(t)$ then the signal is said to be _____
Option A:	Even signal
Option B:	Odd signal
Option C:	Periodic signal
Option D:	Non periodic signal
2.	Given a unit step signal $u(n)$, the time difference $[u(n)-u(n-1)]$ is equal to
Option A:	a unit impulse signal
Option B:	another step signal
Option C:	a unit ramp signal
Option D:	None of there
3.	The unit impulse is defined as
Option A:	$\delta(t) = \infty; t = 0$
Option B:	$\delta(t) = \infty; t = 0$ $=0; t \neq 0$
Option C:	$\delta(t) = \infty; t = 0$ and $\int_{-\infty}^{\infty} \delta(t) dt = A$
Option D:	$\delta(t) = \infty; t = 0$ $=0; t \neq 0$ And $\int_{-\infty}^{\infty} \delta(t) dt = 1$
4.	A periodic signal $x(n)$ of period $N1$ is added to another periodic signal of period $N2$. Then the period of the resulting signal is always
Option A:	$N1+N2$
Option B:	$N1N2$
Option C:	LCM of $N1$ and $N2$
Option D:	GCD of $N1$ and $N2$
5.	What does the zero-state response of the system means?
Option A:	Response of the system when initial state of the system is zero
Option B:	Response of the system due to input alone
Option C:	Response of the system due to input alone when initial state of the system is zero
Option D:	Response of the system due to input alone when initial state is neglected
6.	For $H(z)$ the ROC of the stable LTI system is given as
Option A:	Entire z -plane, except at $z=0$
Option B:	Entire z -plane, except at $z=\infty$
Option C:	Contain unit circle
Option D:	ROC does not exist
7.	An LTI system is said to be causal when
Option A:	the value of an impulse response is zero for all negative values of time

Option B:	the value of an impulse response is unity for all negative values of time
Option C:	the value of an impulse response is infinity for all negative values of time
Option D:	the value of an impulse response is negative for all negative values of time
8.	A LTI system is _____ if $\sum h(n) < \infty$. Here the summation is absolutely summable
Option A:	stable
Option B:	causal
Option C:	unstable
Option D:	time invariant
9.	The IIR filter designing involves
Option A:	Designing of digital filter into digital domain and transforming into analog domain
Option B:	Designing of analog filter into digital domain and transforming into analog domain
Option C:	Designing of digital filter into analog domain and transforming into digital domain
Option D:	Designing of analog filter into analog domain and transforming into digital domain
10.	A filter is said to be linear phase filter if the phase delay and group delay are
Option A:	High
Option B:	Moderate
Option C:	Low
Option D:	Constant

Q2.	Solve any Four out of Six. (5 marks each)	(20 Marks)
A	Determine Even and Odd parts of the signal $x(n) = \{2, -2, 6, -2\}$	
B	Explain any five properties of Z transform	
C	Find the Trigonometric Fourier series for the periodic signal shown in figure 	
D	Find IDFT of $X(K) = \{4, -j2, 0, j2\}$ using DFT by matrix method.	
E	State the advantages and limitations of digital filters.	
F	Find the order of the IIR filter for a given specification using Bilinear Transformation method. $0.8 \leq H(e^{j\omega}) \leq 1$ ----- $0 \leq \omega \leq 0.2\pi$ $ H(e^{j\omega}) \leq 0.2$ ----- $0.6\pi \leq \omega \leq \pi$	

Q3.	Solve any Two Questions out of Three. (10 marks each) (20 Marks)
A	Determine the impulse response and step response of the causal system given below and discuss on stability $y(n) - y(n-1) - 2y(n-2) = x(n-1) + 2x(n-2)$
B	Find DFT of the sequence $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using radix-2 DIT FFT algorithm
C	Discuss the design procedure for low pass digital Butterworth IIR filter.

Q4.	(20 Marks)
A	Solve any Two. (5 marks each)
i.	Check whether the system $y(n) = x(n) x(n-2)$ is 1.Static or dynamic 2.Linear or nonlinear 3.Causal or non-causal, and 4.Shift-invariant or shift-variant
ii.	Design an FIR digital filter to approximate an ideal low pass filter with passband gain of unity, cut off frequency of 850 Hzs and working at a sampling frequency of $f_s = 5000$ Hz. The length of the impulse response should be 5. Use a rectangular window.
iii.	Discuss Rectangular and Hamming windows used to design FIR filters.
B	Solve any One. (10 marks each)
i.	Determine the inverse Z-transform of $X(Z) = \frac{z}{3z^2 - 4z + 1}$ if the ROC are: <ol style="list-style-type: none"> 1. $z > 1$, 2. $z < \frac{1}{3}$ 3. $\frac{1}{3} < z < 1$
ii.	A linear shift invariant system is described by the difference equation, $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + x(n-1)$ with $y(-1) = 0$ and $y(-2) = -1$. Find the natural response of the system

University of Mumbai
Examination First Half 2022
Examinations Commencing from May 2022
Program: ELECTRICAL ENGINEERING
Curriculum Scheme: Rev2016
Examination: TE Semester VI

Course Code: EEC601 and Course Name: Protection and Switchgear Engineering
Time: 2hour 30 minutes Max. Marks: 80

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Note to the students:- All the Questions are compulsory and carry equal marks .

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks [20Marks]
1.	Sequence of operation while closing a circuit
Option A:	1. Close the isolator 2. Open earthing switch 3. Close the circuit breaker.
Option B:	1. Close the circuit breaker. 2. Open earthing switch 3. Close the isolator
Option C:	1. Open earthing switch 2. Close the isolator 3. Close the circuit breaker.
Option D:	1. Open the circuit breaker. 2. Open isolator 3. Close the earthing switch
2.	Current chopping across the contacts of circuit breaker takes place due to
Option A:	High capacitive current interruption
Option B:	Low resistive current interruption
Option C:	Low inductive current interruption
Option D:	Low capacitive current interruption
3.	Arc voltage and arc current are
Option A:	90 degrees out of phase with respect to each other.
Option B:	180 degrees out of phase with respect to each other.
Option C:	45 degrees out of phase with respect to each other.
Option D:	in phase with each other.
4.	The reach of directional element is _____
Option A:	Ideally up to end of the line section

Option B:	Ideally up to 80% of the line section
Option C:	Extends up to 50% in adjacent line section and 20% to next section of line.
Option D:	Ideally infinite in tripping direction and zero in non-tripping direction
5.	The correct type of connection of CT secondary for differential protection of delta-star power transformer, with star grounded is
Option A:	Delta connection on delta side and star connection on star side to nullify 60-degree phase shift
Option B:	Delta connection on delta side and star connection on star side to nullify 30-degree phase shift
Option C:	Delta connection on star side and star connection on delta side to nullify 30-degree phase shift
Option D:	Delta connection on star side and star connection on delta side to nullify 60-degree phase shift
6.	Prioritize/Choose the correct sequence for decreasing effect of power swing on distance relay
Option A:	Mho---simple impedance---reactance
Option B:	Reactance---simple impedance---mho
Option C:	Reactance---mho---simple impedance
Option D:	Simple impedance---mho---reactance
7.	DC offset causes the distance relay to
Option A:	Always overreach
Option B:	Always under-reach
Option C:	Reach remains unaffected
Option D:	Sometimes over-reach while sometimes under-reach
8.	Line trap is a
Option A:	Parallel tuned circuit
Option B:	Series tuned circuit
Option C:	Π type circuit
Option D:	T-type circuit
9.	The operating time of an IDMT relay corresponding to PSM=1 and TMS=0.5 will be

Option A:	3s
Option B:	60s
Option C:	30s
Option D:	infinite
10	Single phasing can be detected by a relay sensitive to
Option A:	+ve sequence component of voltage supplied to motor
Option B:	-ve sequence component of voltage supplied to motor
Option C:	-ve sequence component of voltage across motor
Option D:	Zero sequence component of voltage supplied to motor

Q2. [20Marks]	Solve any Two Questions out of Three	10 marks each
A	Illustrate the differential protection for star delta power transformer.	
B	Outline the different types of faults occurring in transformer and protection needed from incipient faults in a transformer.	
C	Explain the phase comparison carrier current protection for transmission line.	
Q3. [20Marks]	Solve any Two Questions out of Three	10 marks each
A	Derive an expression for the resistance to be provided across circuit breaker contacts for critical damping.	
B	Explain construction & working principle of Vacuum circuit breaker	
C	Where and why isolators, contactors, circuit breaker and relays are used in power system.	
Q4. [20Marks]	Solve any Two Questions out of Three	10 marks each
1	Explain the effect of power swing on distance relays.	
2	List out all the desirable qualities of protection schemes and explain any two in detail.	
3	Explain phase measurement unit and its application in power system.	