CBCS SCHEME

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15EE662

Sixth Semester B.E. Degree Examination, June/July 2018
Sensors and Transducers

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define transducer. What are the advantages and disadvantages of electrical transducers? **(06 Marks)**

b. Explain briefly the LVDT with neat diagram. **(04 Marks)**

c. A parallel plate capacitive transducer uses plates of area 250mm^2 which are separated by a distance 0.2mm.

i) Calculate the value of capacitance when the dielectric is air having a permittivity of 8.85×10^{-12}F/m

ii) Calculate the change in capacitance if a linear displacement reduces the distance between the plates to 0.18mm. Also calculate the ratio of per unit change of capacitance to per unit change of displacement

iii) If a mica sheet 0.01mm thick is inserted in the gap, calculate the value of original capacitance and change in capacitance for the same displacement. Also calculate the ratio of per unit change of capacitance to per unit change in displacement. The dielectric constant of mica is 8. **(06 Marks)**

OR

2 a. Explain the following terms : i) Sensitivity ii) Linearity iii) Resolution iv) Hysteresis v) Accuracy vi) Repeatability. **(06 Marks)**

b. The resistivity of semiconductor material was known to be 0.00912Ωm at room temperature. The flux density in the hall model was 0.48Wb/m^2. Calculate the hall angle for a hall co-efficient of 3.55×10^{-4}m^3/c. **(04 Marks)**

c. Explain the followings with neat diagram :

i) photoemissive cell

ii) photoconductive cell. **(06 Marks)**

Module-2

3 a. What is strain gauge? Explain briefly the followings with neat diagram.

i) Foil type strain gauge ii) Semiconductor strain gauge. **(07 Marks)**

b. A simple electrical strain gauge of resistance 120Ω and having a gauge factor of 2 is bounded to steel having an elastic limit stress of 400MN/m^2 and modulus of elasticity is 200GN/m^2. Calculate the change in resistance,

i) due to a change in stress equal to $\frac{1}{10}$ of the elastic range

ii) due to change of temperature of 20°C if the material is advance alloy. The resistance temperature co-efficient of advance alloy is 20×10^{-6}/°C. **(05 Marks)**

c. Define load cell. Explain briefly hydraulic load cell. **(04 Marks)**

OR

4 a. Explain the followings with neat diagram :
   i) Eddy current proximity sensor
   ii) Pneumatic sensor. **(08 Marks)**

   b. Define digital encoder. Explain various types of digital codes with an example. **(08 Marks)**

Module-3

5 a. Explain the components of a general measurement system with block diagram. **(04 Marks)**

   b. Explain briefly DC and AC signal conditioning system. **(06 Marks)**

   c. State the characteristics of an ideal Op-Amp. Explain the followings :
   i) Buffer amplifier
   ii) Differential amplifier. **(06 Marks)**

OR

6 a. What is a data acquisition system? Explain analog data acquisition system with suitable block diagram. **(04 Marks)**

   b. Explain single channel data acquisition system and multichannel analog multiplexed data equation system with neat diagram **(06 Marks)**

   c. Explain briefly the followings :
   i) Successive approximation analog to digital converter
   ii) R–2R loaded digital to analog converter. **(06 Marks)**

Module-4

7 a. Define "data transmission" and "Telemetry". Explain pneumatic transmission with diagram. **(04 Marks)**

   b. Explain briefly the following :
   i) Voltage telemetering system
   ii) Current telemetering system. **(08 Marks)**

   c. Explain amplitude modulation. **(04 Marks)**

OR

8 a. Define the following terms :
   i) Pressure ii) Atmospheric pressure iii) Gauge pressure iv) Absolute pressure v) Static pressure. **(05 Marks)**

   b. Describe the construction and working of a "Hot–Filament Ionization" gauge. **(05 Marks)**

   c. Describe the construction and working of "Dead Weight Tester". **(06 Marks)**

Module-5

9 a. What is temperature? How are temperature measuring instruments classified? **(07 Marks)**

   b. Give a comparison between "Thermistor" and "Metal Resistor". **(04 Marks)**

   c. Explain briefly the working of radiation pyrometer. **(05 Marks)**

OR

10 a. Explain with a neat sketch the working of electromagnetic flow meter. **(06 Marks)**

   b. Describe the following with neat diagram :
   i) Photoelectric Tachometer
   ii) DC Tachometer. **(06 Marks)**

   c. Explain the liquid level measurement using laser. **(04 Marks)**

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15EE51

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Management and Entrepreneurship

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Distinguish between:
i) Management and administration
ii) Management as science and management as art. **(06 Marks)**

b. What are managerial skills? How are they linked to levels of management? **(05 Marks)**

c. Explain briefly nature and characteristics of management. **(05 Marks)**

OR

2 a. Explain the importance and purpose of planning in a large organization. **(06 Marks)**

b. Name and explain various categories of standing plans and single-use plans. **(06 Marks)**

c. Write a chart depicting a typical decision making process in an organization and explain the need for decision making. **(04 Marks)**

Module-2

3 a. What is organizing? Explain the important steps in the process of organizing. **(06 Marks)**

b. Explain: (i) Decentralization of authority, (ii)Staffing. **(06 Marks)**

c. Explain briefly the process of recruitment in an organization. **(04 Marks)**

OR

4 a. Discuss leadership styles and role of a leader. **(06 Marks)**

b. Name and explain any two motivation theories. **(06 Marks)**

c. What is 'coordination'? What is the importance? What are the techniques? **(04 Marks)**

Module-3

5 a. Explain: (i) Social audit, (ii) Business ethics, (iii) Corporate governance, briefly. **(06 Marks)**

b. What is meant by 'social responsibilities of business towards different groups'? Explain with examples drawn from Indian business groups. **(06 Marks)**

c. Explain briefly the concept of entrepreneurship. **(04 Marks)**

OR

6 a. What is importance of 'entrepreneurship' to a nation? How to classify 'Entrepreneurs'? Explain. **(06 Marks)**

b. Explain few problems faced by entrepreneurs. How to overcome them? What are the myths about entrepreneurship? **(06 Marks)**

c. Explain: (i) Entrepreneurial development model
(ii) Capacity building for entrepreneurship. **(04 Marks)**

Module-4

7 a. Define ancillary and tiny industries and discuss the role of small scale industries in the development of nation like India. **(06 Marks)**

b. How government policies have developed growth of small scale industries sector on India? What is the impact of WTO/GATT on the sector? Explain. **(06 Marks)**

c. Discuss performance SSIs under the impact of Globalization. **(04 Marks)**

OR

8 a. Discuss the problems faced by small scale industries and the strategies to overcome them. **(06 Marks)**

b. Discuss the policies of schemes of central-level institutions than support small sized or medium sized business enterprises. **(06 Marks)**

c. Discuss state-level institutional supports to small scale industries sector. **(04 Marks)**

Module-5

9 a. Explain:
(i) Significance of project report
(ii) Formulation of project report. **(06 Marks)**

b. Describe:
(i) Project identification and selection
(ii) Project life cycle. **(06 Marks)**

c. Explain:
(i) Capital budgeting,
(ii) Generating investment with reference to a project undertaken. **(04 Marks)**

OR

10 a. Explain the importance of network analysis. **(05 Marks)**

b. Discuss the different steps involved in PERT analysis. **(05 Marks)**

c. Write about the differences between PERT and CPM and limitation of PERT and CPM. **(06 Marks)**

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15EE52

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Microcontroller

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Discuss the need for stack memory in microcontroller. How stack is operated in 805 μc? What is the default location of stack? **(06 Marks)**

b. With an example explain the various addressing modes used in 8051 μc (any four). **(06 Marks)**

c. Compare RISC and CISC micro controllers. **(04 Marks)**

OR

2 a. Explain the bit pattern of program states word. **(06 Marks)**

b. With a neat diagram, explain the steps to interface 8K bytes of program RDM and 6 K bytes of data ROM to 8031 based system. **(06 Marks)**

c. Identify the addressing modes of the following instructions:
i) MOV C, A , @ A+DPTR
ii) MOV DPTR, #1234
iii) MOV A, 4
iv) CLR C **(04 Marks)**

Module-2

3 a. Write a program to find the square root of a given number. **(06 Marks)**

b. With a neat diagram explain the range of JUMP and CALL instructions. **(08 Marks)**

c. Explain the following instructions: i) DA A, ii) ANL C, P2.5 **(02 Marks)**

OR

4 a. What are assembler directives? Explain any four of them with an example. **(06 Marks)**

b. Assume that register 'A' is loaded with number 'N' (any integer value from 0 to 255). Write a program to count the number of ones in even numbered bits of accumulator. **(05 Marks)**

c. Write a program to complement the content of accumulator 62500 times. **(05 Marks)**

Module-3

5 a. Explain the different data types supported by 8051C microcontroller. **(08 Marks)**

b. Write a program to create a square wave of 100 Hz with a duty cycle of 80% on port 1.1. Use timer '0' and operate that timer '0' in mode '1'. Assume XTAL f_{mov} = 12 MHz. **(08 Marks)**

OR

6 a. A switch is connected to pin P1.2. Write on 8051 C program to monitor 'SW' and create the following frequencies on pin P1.7.
SW = 0 : 500 Hz
SW = 1 : 750 Hz
Use timer '0', mode '1' for both of them. Assume crystal frequency = 11.0592 MHz. **(08 Marks)**

b. Write an 8051C program to them bit P1.5 ON and OFF 50000 times. **(03 Marks)**

c. Write a program for counter '1' in mode '2' to count the clock pulse and display the state of the TL, count on P2. **(05 Marks)**

Module-4

7 a. Write a program to retrieve the data serially and put them in P1. Set the band rate at 4800, 8-bit data and one stop bit. **(06 Marks)**

b. Write an 8051C program to transfer the message "INDIA" serially at 9600 band rate. 8 bit data and one stop bit, continuously. **(06 Marks)**

c. Explain the importance of TI and RI flags. **(04 Marks)**

OR

8 a. What is an interrupt? List the various interrupts of the 8051 with their corresponding vector address. **(06 Marks)**

b. Write a program that continuously gets 8-bit data from 'P0' and sends it to 'P1' where simultaneously creating a square wave of 200 μs period on pin P2.1. Use timer '0' to create square wave. Assume KTAL = 11.0952 MHz. **(07 Marks)**

c. Explain simplex, half duplex and full duplex serial data transfer. **(03 Marks)**

Module-5

9 a. A switch is connected to pin P2.7. Write a 'C' program to monitor the status of 'SW' and perform the following:

i) If SW = 0 : the stepper motor moves clock wise.

ii) If SW = 1 : the stepper motor moves counter clock wise. **(10 Marks)**

b. Explain the control word format of 8255. **(06 Marks)**

OR

10 a. Explain the various modes of 8255 and find the control word for following configurations:

i) All ports of A, B and C are O/P ports (mode '0')

ii) PA = IN, PB = OUT, PCL = OUT and PCH = OUT. **(08 Marks)**

b. Explain the steps to interface ADC 0808 to the 8051 microcontroller. **(08 Marks)**

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Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Power Electronics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With the help of circuit diagram, input and output waveforms explain working of different types of power electronic converters. **(08 Marks)**

b The reverse recovery time of a diode is 5μs and rate of fall of diode current is 80A/μs. Calculate : i) the storage charge Q_{RR} ii) Peak reverse current I_{RR}. **(04 Marks)**

c. List the parameters on which the performance of rectifier is evaluated. **(04 Marks)**

OR

2 a. Briefly explain different types of power diodes. **(06 Marks)**

b. Explain the peripheral effects of power electronic equipments. **(06 Marks)**

c. The bridge rectifier has an AC source with $V_m = 100V$ at 60Hz and a series load (RL) with $R = 10\Omega$ and $L = 10mH$. Calculate :
i) Average current in the load
ii) Average currents in the diodes. **(04 Marks)**

Module-2

3 a. Explain the switching characteristics of MOSFET. **(05 Marks)**

b. Explain the anti-saturation control of BJT. **(05 Marks)**

c. The β of bipolar transistor varies from 12 to 75. The load resistance is 1.5Ω. The supply voltage $V_{CC} = 40V$ and base input voltage is 6V. If $V_{CE(sat)} = 1.2V$, $V_{BE(sat)} = 1.6V$ and $R_B = 0.7\Omega$, calculate : i) ODF ii) Forced β iii) total power loss in transistor. **(06 Marks)**

OR

4 a. List and explain the switching limits of power BJT. **(08 Marks)**

b. The base drive circuit of anti-saturation control has supply voltage 400V, collector resistance 4Ω, V_{d1}=3.6V, $V_{d2} = 0.9V$, $V_{BE(sat)} = 0.7V$. The voltage to the base circuit is 15V. $R_B = 1.1\Omega$ and $\beta = 12$. Find : i) Collector current without clamping ii) collector clamping voltage V_{CE} and ii) Collector current with clamping. **(08 Marks)**

Module-3

5 a. Explain the V-I characteristics of SCR. Also define : i) holding current and ii) Latching current. (06 Marks)

b. Explain different methods of turning on of thyristor. (06 Marks)

c. For the SCR shown in Fig.Q5(c), has a latching current of 20mA and is fired by a pulse width of 50μs. Determine whether the SCR turns on as not and comment on the result obtained. (04 Marks)

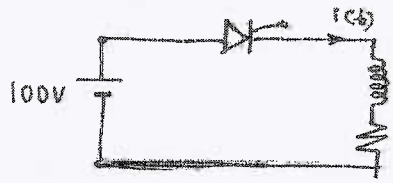

Fig.Q5(c)

OR

6 a. With the help of two transistor model, derive an expression for anode current of a thyristor and explain why gate looses its control over the device once thyristor is turned on (08 Marks)

b. A string of SCRs are connected in series to withstand a DC voltage of 15KV. The maximum leakage current and recovery charge difference of thyristor are 10mA and 150 μC respectively. A derating factor of 20% is applied for steady state and transient state voltage sharing's of thyristors. If the maximum steady state voltage sharing is 1000V. Calculate : i) steady state voltage sharing resistance R for each thyristor ii) transient voltage capacitance C_1 and iii) string efficiency. (08 Marks)

Module-4

7 a. With the help of circuit diagram and waveforms, explain the working of single – phase full converter with R-L load. (08 Marks)

b. A single –phase full wave AC voltage controller has an input voltage of 150V (rms) and a load of 8Ω. The firing angle of thrystor is 60°. Find : i) average output voltage ii) rms output voltage iii) output power and iv) input P.F. (08 Marks)

OR

8 a. Explain the working of single – phase full wave AC voltage controller with resistive load. Draw relevant circuit, waveforms. Derive an expression for rms output voltage. (08 Marks)

b. A single – phase circulating current dual converter is fed by 230V, 50Hz supply. The load is resistive. The peak current of converter 1 is 39.7A. The firing angles are 45° and 135° respectively. If peak – circulating current is 11.5A, Find : i) inductance of current limiting reactor ii) load resistance. (08 Marks)

Module-5

9 a. Explain the working of step-up chopper. Draw the relevant waveforms. Derive an expression for average output voltage. (06 Marks)

b. A step-down chopper has an input voltage of 200V and a load of 8Ω resistance. The voltage drop across thryristor is 2V and the chopping frequency is 800Hz.The duty cycle is 0.4. Find : i) average output voltage ii) rms output voltage iii) chopper efficiency. (06 Marks)

c. Briefly explain the factors that influence the performance of inverter. (04 Marks)

OR

10 a. Explain the voltage control of single –phase inverter using : i) multiple pulse width modulation ii) sinusoidal pulse width modulation. (08 Marks)

b. With the help of circuit diagram, explain the operation of different types of choppers. (08 Marks)

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15EE54

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Signals and Systems

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the classification of signals. **(06 Marks)**

b. Find the even and odd components of the signal $x(t) = (1 + t^2)\cos^3(10t)$. **(04 Marks)**

c. Sketch the signal $y(t) = [x(t) + x(2 - t)]\, u(1 - t)$, where x(t) is shown in Fig.Q1(c). **(06 Marks)**

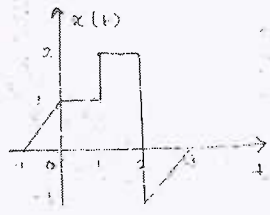

Fig.Q1(c)

OR

2 a. Find the overall operator the system $y(n) = \frac{1}{3}[x(n + 1) + x(n) + x(n - 1)]$. **(04 Marks)**

b. Find the average power of square wave show in Fig.Q2(b). **(07 Marks)**

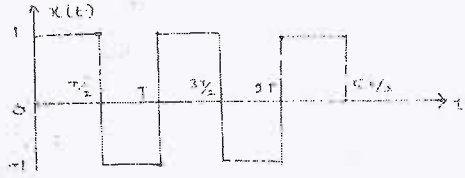

Fig.Q2(b)

c. Determine whether the system $y(t) = x\left(\frac{t}{2}\right)$ is, i) Linear ii) Time-invariant iii) Memory iv) Causal v) Stable. **(05 Marks)**

Module-2

3 a. A continuous time LTI system with unit impulse response, h(t)=u(t) and input $x(t) = e^{-at}u(t)$: $a > 0$. Find the output y(t) of the system. **(08 Marks)**

b. Find the step response for the LTI system represented by the impulse response $h(n) = (\frac{1}{2})^n u(n)$. **(04 Marks)**

c. Consider a continuous time LTI system is represented by the impulse response $h(t) = e^{-3t}u(t - 1)$. Determine whether it is (i) Stable ii) Causal. **(04 Marks)**

OR

4 a. Solve the differential equation :

$$\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = 2x(t) \text{ with } y(0) = -1 : \left.\frac{dy(t)}{dt}\right|_{t=0} = 1 \text{ and } x(t) = \cos t\, u(t).$$ **(08 Marks)**

b. Draw the direct form I and II implementation for the difference equation :

$y(n) + \frac{1}{5}y(n - 1) - y(n - 3) = 2x(n - 1) + 7x(n - 2)$. **(08 Marks)**

Module-3

5 a. Find the Fourier transform of $x(t) = \sum_{k=0}^{\infty} \alpha^k f(t - kT); |\alpha| < 1$. **(06 Marks)**

b. Find the inverse Fourier transform of $k(j\omega) = \frac{j\omega}{(2 + j\omega)^2}$. **(04 Marks)**

c. The impulse response of a continuous time LTI system is given by $h(t) = \frac{1}{RC} e^{-t/RC} u(t)$. Find the frequency response and draw its spectrum. **(06 Marks)**

OR

6 a. Find the frequency response and impulse response of the system having $y(t) = e^{-2t}u(t) + e^{-3}u(t)$, for the input $x(t) = e^{-t}u(t)$. **(08 Marks)**

b. Find the frequency response and the impulse response of the system described by differential equation : $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = 4\frac{dx(t)}{dt} + x(t)$. **(08 Marks)**

Module-4

7 a. State and prove Parseval's theorem in discrete time domain. **(06 Marks)**

b. Find the DTFT of the signal $x(n) = a^{|n|}; |a| < 1$. **(05 Marks)**

c. Find the inverse DTFT of the signal. $x(e^{j\Omega}) = \frac{3 - \frac{1}{4}e^{-j\Omega}}{-\frac{1}{16}e^{-j2\Omega} + 1}$. **(05 Marks)**

OR

8 a. Find the impulse response of the system having output $y(n) = \frac{1}{4}\left(\frac{1}{2}\right)^n u(n) + \left(\frac{1}{4}\right)^n u(n)$ for the input $x(n) = \left(\frac{1}{2}\right)^n u(n)$. **(08 Marks)**

b. Obtain the difference equatin for the system with frequency response :

$$H(e^{j\Omega}) = 1 + \frac{e^{-j\Omega}}{\left(1 - \frac{1}{2}e^{-j\Omega}\right)\left(1 + \frac{1}{4}e^{-j\Omega}\right)}$$ **(08 Marks)**

Module-5

9 a. Determine the z – transform of $x(n) = -u(-n-1) + (\frac{1}{2})^n u(n)$. Find the RoC and poles –zeros locations of x(z). **(06 Marks)**

b. Find the z – transform of $x(n) = n^2(\frac{1}{2})^n u(n-3)$ using appropriate properties. **(04 Marks)**

c. Find the inverse z-transform of x(z) using partial fraction method,

$$x(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - \frac{3}{2}z^{-1} + \frac{1}{2}z^{-2}}; |z| > 1 \text{ as RoC.}$$ **(06 Marks)**

OR

10 a. A system has impulse response $h(n) = \left(\frac{1}{2}\right)^n u(n)$. Determine the input to the system if the output is given by, $y(n) = \left(\frac{1}{3}\right)^n u(n) + \frac{2}{3}\left(-\frac{1}{2}\right)^n u(n)$. **(08 Marks)**

b. Solve the following difference equation using z-transform,

$y(n) - \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = x(n)$ for $n \geq 0$, with $y(-1) = 4$, $y(-2) = 10$ and $x(n) = \left(\frac{1}{4}\right)^n u(n)$ **(08 Marks)**

CBCS Scheme

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15EE552

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Electrical Engineering Materials

Time: 3 hrs. Max. Marks: 80

Note: *Answer FIVE full questions, choosing one full question from each module.*

Module-1

1 a. Classify the electrical engineering materials on the basis of their energy gaps and briefly explain each of them. How do the conductors, semiconductors and insulators differ from each other? **(10 Marks)**

b. What are left-handed materials? Mention their application. **(06 Marks)**

OR

2 a. Mention the characteristics of a good conductor. Discuss the effects of temperature and effect of impurity on resistivity of a conductor. **(10 Marks)**

b. What is thermo electric effect? Mention the applications of thermoelectric effect. **(06 Marks)**

Module-2

3 a. Discuss the requirements of a good contact material, how do the lightly loaded contacts differ from heavily loaded contacts. **(08 Marks)**

b. Mention the characteristics of electrical carbon material which is most useful for the purpose of alternator brush, why carbon graphite is most suitable brush material among all types. **(08 Marks)**

OR

4 a. Classify dielectric materials on the basis of state of material and quote examples of each type. **(06 Marks)**

b. What is polarization? Explain electronic polarization and space charge polarization. **(06 Marks)**

c. Capacitance of a capacitor is 0.025 μF and the power factor is 0.0005. Estimate the dielectric loss of the capacitor when it carries a current of 200 ampere at a frequency of 25 kHz. **(04 Marks)**

Module-3

5 a. Write the applications of Porcelien insulating material. **(04 Marks)**

b. What are the requirements of good liquid insulating materials? **(06 Marks)**

c. Write a note on air and nitrogen as insulating material. **(06 Marks)**

OR

6 a. Differentiate between Diamagnetism and Paramagnetism. **(04 Marks)**

b. A magnetic field of 2400 A/m is applied to a material having a susceptibility of 1500. Determine (i) its relative permeability (ii) intensity of magnetization and (iii) the resonance. Take $\mu_0 = 4\pi \times 10^{-7}$ henry/metre. **(06 Marks)**

c. Relative permeability of 'supermalloy' is 200000. It has a magnetization of 6000 A/m. Determine the strength of the magnet thus produced. Take $\mu_0 = 4\pi \times 10^{-7}$ henry/metre. **(06 Marks)**

Module-4

7 a. Compare hard and soft magnetic materials. Why is a soft magnetic material preferred over hard magnetic material for use in the transformer core? **(05 Marks)**

b. What are the high energy hard magnetic materials? Describe their different types. **(05 Marks)**

c. Critical magnetic field at zero Kelvin and critical temperature for Pb are 65 KA/m and 7.18 K respectively. Determine the critical current density at 4.2 K in a lead wire of 1 mm diameter. Consider a parabolic dependence of H_C on temperature. **(06 Marks)**

OR

8 a. Mention the properties of super conductors below their critical temperatures. **(04 Marks)**

b. Write the applications of super conductors stating their limitations. **(08 Marks)**

c. Distinguish between low temperature super conductor and high temperature super conductor. **(04 Marks)**

Module-5

9 a. What are plastic? Differentiate between thermosetting and thermoplast plastics and quote their examples. **(08 Marks)**

b. Differentiate between transperant, translucent and opaque materials, quote examples of each of them. **(08 Marks)**

OR

10 a. Explain reflectivity, refraction, transmissivity and scattering optical phenomena that are observed when light falls on a material. **(06 Marks)**

b. What is photo conductivity? What are its various applications? Write the names of photo conductive materials and enlist their main applications. **(10 Marks)**

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CBCS Scheme

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Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Programmable Logic Controllers

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain the advantages that PLC's offer over conventional relay based control system. **(08 Marks)**

b. Explain typical parts of a modular type PLC. **(08 Marks)**

OR

2 a. Explain any 5 special I/O modules. **(06 Marks)**

b. Explain different PLC programming language defined by IEC – 61131. **(10 Marks)**

Module-2

3 a. Explain the basic operating principle of electromagnetic control Relay. **(08 Marks)**

b. Explain the principle of operation of retentive a on delay timer. **(08 Marks)**

OR

4 a. Write a short notes on :
i) Temperature sensors
ii) Flow measurement **(08 Marks)**

b. Explain each of the following quantities associated with PLC timer instruction.
i) Present time ii) Accumulated time iii) Timer base. **(06 Marks)**

c. Write the IEC and NEMA symbols used to represent each of the following :
i) NO and NC push button
ii) NO limit switch
iii) NO temperature switch
iv) NO pressure switch. **(02 Marks)**

Module-3

5 a. Explain Allen – Bradley SLC 500 counter file C5 **(08 Marks)**

b. Explain Master Control Reset (MCR) instruction with ladder logic program. **(08 Marks)**

OR

6 a. Describe the basic programming process involved in the cascading of two counters. **(08 Marks)**

b. Explain Allen Bradley subroutine related instructions. **(08 Marks)**

Module-4

7 a. Explain Move with Mask (MVM) instruction with an example. **(08 Marks)**

b. Explain Addition (ADD) instruction used in SLC 500 controller and write the ladder logic program used to add the accumulated counts of 2 up counters. **(08 Marks)**

OR

8 a. Explain multiplication instruction (MUL) used with the SLC 500 controllers with an example. **(08 Marks)**

b. Explain each of the following instruction used in data manipulation.
   i) Equal (EQU)
   ii) Greater than (GRT)
   iii) Greater than or equal (GEQ) **(08 Marks)**

Module-5

9 a. Explain sequencer output (SQO) instruction and its parameters. **(08 Marks)**

b. Explain the structure of control systems. **(08 Marks)**

OR

10 a. Explain the operation of the following devices used in motion control.
   i) Servo drive
   ii) Servo motor
   iii) Programmable logic controller **(08 Marks)**

b. Explain FFL and FFU (FIFO load 4 unload) instructions used in word shift operations. **(08 Marks)**

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10EE52

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1 a. What is continuous time and discrete time signals? Explain, with examples. **(04 Marks)**

b. Sketch and label for each of the following for the given signal x(t) shown in Fig.Q1(b). **(08 Marks)**

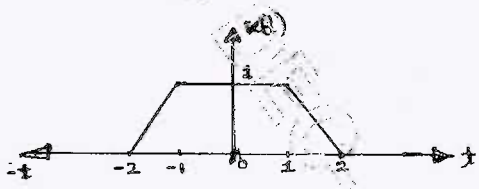

Fig.Q1(b)

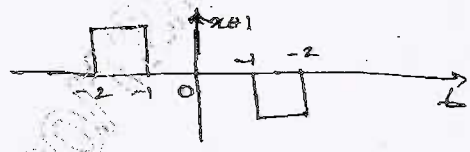

Fig.Q1(c)

i) x(2t + 3) ii) x(–3t + 2) iii) x(2(t/3 – 1)).

c. For the signal x(t) shown in Fig.Q1(C) find the energy in that signal. **(04 Marks)**

d. A system has an input x(t) and corresponding output is $y(t) = \frac{d}{dt}\left\{e^{-t}x(t)\right\}$ determine whether the system is : i) memoryless ii) stable iii) causal iv) linear v) time invariant. **(04 Marks)**

2 a. A system is characterized by impulse response h(t) = δ(t) – δ(t – 1). Determine the step response and sketch that. **(06 Marks)**

b. Using convolution integral, determine output of LTI system for input $x(t) = e^{-at}$; $0 \le t \le T$ impulse response h(t) = 1; $0 \le t \le 2T$. **(08 Marks)**

c. Check whether the system whose impulse response is $h(t) = e^{-t}\,u(t-1)$ is stable, memory less and causal. **(06 Marks)**

3 a. Determine the output of the system described by the following differential equation with input and initial conditions specified.

$$\frac{d^2}{dt^2}y(t) + 6\frac{d}{dt}y(t) + 8y(t) = 2x(t),\ y(0^-) = -1,\ \left.\frac{d}{dt}y(t)\right|_{t=0} = 1,\ x(t) = e^{-t}u(t).$$ **(10 Marks)**

b. Draw direct Form – I and Form – II implementation for the following difference equations :

i) $y[n] - \frac{1}{3}y[n-2] = x[n-1]$

ii) $y[n] + \frac{1}{2}y[n-1] - y[n-3] = 3x[n-1] + 2x[n-2]$. **(10 Marks)**

4 a. What are the conditions that x(t) should satisfy to have Fourier series? **(04 Marks)**

b. Find the complex Fourier co-efficient x(k) for the given x(t) in Fig.Q4(b). Draw the amplitude and phase spectra of x(k). **(11 Marks)**

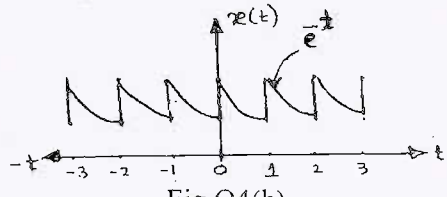

Fig.Q4(b)

c. Determine the complex exponential Fourier series representation of the following signals.

i) x(t) = cos ω0t ii) x(t) = sin ω0t. **(05 Marks)**

PART – B

5 a. Find the Fourier transform of the following signals.

i) $x(t) = e^{-2t}u(t-1)$

ii)

iii) $x(t) = u(t+1) - u(t-1)$. **(15 Marks)**

b. Prove that differentiation in time domain is equal to multiplication of $X(\omega)$ by $j\omega$ in the frequency domain. **(05 Marks)**

6 a. Use the properties and table of transforms to find discrete time Fourier transformer [DTFT] of :

i) $x[n] = (\frac{1}{3})^n u(n+2)$

ii) $x[n] = (n-2)[u(n+4) - u(n-5)]$. **(10 Marks)**

b. A causal discrete time LTI system is described by $y[n] - \frac{3}{4}y[n-1] + \frac{1}{8}y[n-2] = x[n]$. Determine the frequency response and impulse response of the system. **(10 Marks)**

7 a. Determine the z–transform, the ROC and locations of pole zero of x(z) for the following signals :

i) $x[n] = -(\frac{1}{2})^n u(-n-1) - (\frac{1}{3})^n u(-n-1)$

ii) $x[n] = -(\frac{3}{4})^n u(-n-1) + (\frac{1}{3})^n u(n)$. **(10 Marks)**

b. Use the properties of z – transforms to determine x(z) for the given signal :

i) $a^{n+1}u(n+1)$

ii) $n\,a^{n-1}u(n)$

iii) $a^{-n}u(-n)$

Name the property used in each. **(10 Marks)**

8 a. Use the method of partial fraction expansion to find inverse – z transform of given X(z)

$$X(z) = \frac{1 + \frac{7}{6}z^{-1}}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 + \frac{1}{3}z^{-1}\right)}$$ with following conditions : i) $|z| > \frac{1}{2}$ ii) $|z| < \frac{1}{3}$ iii) $\frac{1}{3} < z < \frac{1}{2}$. **(10 Marks)**

b. For the given difference equations and associated input and initial conditions determine the output y[n].

$3y[n] - 4y[n-1] + y[n-2] = x[n]$

With $x[n] = (\frac{1}{2})^n$ and $y[-1] = 1$, $y[-2] = 2$. **(10 Marks)**

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Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Transmission and Distribution

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1 a. Draw a line diagram of a typical power scheme indicating the standard voltages used at different voltage levels. Explain : i) Feeders ii) distributors iii) service mains. **(12 Marks)**

b. For the same power transmitted over the some distance, show that increase in transmission voltage of a transmission line results in :
i) increased efficiency ii) decreased line loss iii) reduced weight of conductor martial. **(08 Marks)**

2 a. Derive an expression for sag when the supports are at equal level for catenary configuration. **(10 Marks)**

b. A transmission line at a river crossing is supported from two towers at height of 40m and 30m above water level. The horizontal distance between two towers is 300m. If the tension in the conductor is 1500kg, find : i) minimum clearance ii) the clearance of the conductor at a point midway between the supports. Weight of conductor is 0.8 kg/m. **(06 Marks)**

c. Discuss the required properties for a conductor material for overhead line conductor. **(04 Marks)**

3 a. With a neat diagram explain Hewlett type suspension insulators. **(05 Marks)**

b. Define string efficiency. Explain the use of guard ring for improving string efficiency. **(06 Marks)**

c. A string of suspension insulator consists of 6 units. If the maximum voltage per unit is 33KV, calculate : i) the maximum voltage for which this string can be used ii) the string efficiency.
Assume capacitance between each link pin and earth as 15% of the self capacitance of each unit. **(09 Marks)**

4 a. Explain the phenomenon of corona on transmission line. Derive the expression for disruptive critical voltage. **(08 Marks)**

b. With a neat diagram, explain the general construction of an underground cable. **(06 Marks)**

c. Derive an expression for insulation resistance of a single core cable. **(06 Marks)**

PART – B

5 a. Derive an expression for inductance of a single phase two wire line. **(08 Marks)**

b. Discuss transposition of transmission line. **(04 Marks)**

c. A two wire single phase line operators at 50Hz. The diameter of each conductor is 20mm and the spacing between the conductor is 3m. Calculate : i) the loop inductance of the line per km ii) the inductance of the line per km iii) the inductive reactance per km. **(08 Marks)**

6 a. Derive an expression for capacitance of a 3 phase line with equilateral spacing. **(12 Marks)**

b. A 3-phase, 3 wire system has its conductors arranged at the corners of an equilateral triangle of 2m side. The diameter of each conductor is 2.5cm. Calculate the inductance and capacitance of each conductor. **(08 Marks)**

7 a. Obtain expression for ABCD constants for a nominal PIE model of a medium transmission line. **(10 Marks)**

b. A 3-phase, 50 50Hz, transmission line, 100km long delivers 20MW at 0.9pf lag and at 110KV. The resistance and reactance of the line per phase per km are 0.2 ohm and 0.4 ohm respectively, while the capacitive admittance is 2.5×10^{-6} mho/km. Calculate :
i) the voltage and current at the sending end ii) the efficiency of the transmission line. Use nominal T method. **(10 Marks)**

8 a. A 2 wire DC distributor AB is fed from both ends. At feeding point A, the voltage is maintained at 230V and at B 235V. The total length of feeder is 200m and loads are tapped off as under :
25A at 50m from A; 50A at 75m from A; 30A at 100m from A; 40A at 150m from A. The resistance per km of one conductor is 0.3ohm. i) the current in various sections of the distributors ii) minimum voltage and the point at which it occurs. **(10 Marks)**

b. A single phase distributor 2km long supplies a load of 120A at 0.8 pf lag at its far end and a load of 80A at 0.9pf lag at its mid point. Both power factors are referred to the voltage at the far end. The resistance and reactance/km (go and return) are 0.05 ohm and 0.1 ohm respectively. if the voltage at the far end is maintained at 230V, calculate : i) voltage at the sending end ii) phase angle between voltages at the two ends. **(10 Marks)**

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10EE54

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
DC Machines and Synchronous Machines

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1 a. Derive the emf equation of DC generator. (06 Marks)

b. Define Commutations and explain in detail any one method of commutation. (08 Marks)

c. A 4 pole, dc shunt generator with a shunt field resistance of 100Ω and an armature resistance of 1Ω has 378 wane connected in its armature. The flux/pole is 0.02 web. If the load resistance of 10Ω is connected across the armature terminals and generator is driven at 1000 rpm. Calculate the power absorbed by load. (06 Marks)

2 a. Explain briefly the importance of Back - emf. (04 Marks)

b. Discuss in detail speed control of i) DC series ii) DC compound motors. (08 Marks)

c. A 460V, series motor runs at 500 rpm taking a current of 40A. Calculate the speed and percentage change in torque, if the load is reduced so that motor is taking 30A. Total resistance of the armature and field circuit is 0.8Ω. Assume the flux is proportional to the field current. (08 Marks)

3 a. Describe the various losses occur in DC machine. (06 Marks)

b. Derive the conditions for max efficiency in DC machines. (08 Marks)

c. A, 500V shunt generator has a full load current of 200A. Its armature resistance is 0.1Ω and field resistance 100Ω and constant losses including stray – load losses and field copper loss are 4000W. Calculate its efficiency at half – full load. (06 Marks)

4 a. Explain with a neat sketch Regeneration method of testing in case of DC machines. (10 Marks)

b. A 500V, DC shunt motor takes 4A on no load. The armature resistance including that of brushes is 0.2Ω and field current is 1.0A. Estimate the output and efficiency when the input current is 100A. (10 Marks)

PART – B

5 a. List out the differences between salient pole and non salient pole alternators. (06 Marks)

b. Derive the e.m.f equations of Alternator considering the winding factors. (06 Marks)

c. A 3 phase, 8 pole 50Hz star connected alternator has 4 slot/pole on it stator with 10 conductor/slot. The air gap flux is distributed sinusoidaly and equal to 0.04 web. The stator has a double layer windings with the full pitch coil. Calculate
i) Pitch factor ii) Distributer factor iii) emf genetared/phase iv) the line voltage at no load. (08 Marks)

6 a. Define the voltage regulation of Alternator and explain briefly A.S.A method of finding Regulation in Alternator. (10 Marks)

b. Define Short Circuit Ratio (S.C.R) and its importance in Alternators. (04 Marks)

c. A 3 phase alternator has a direct axis synchronous reactance of 0.7 PU and quadrature axis synchronous reactance of 0.4 PU. Calculate i) Load angle ii) No load per unit voltage, at full load at 0.8 p.f lag. (06 Marks)

7 a. Explain briefly i) Synchronizing current ii) Synchronizing power iii) Synchronizing torque. **(06 Marks)**

b. Derive the equation for power output / phase for a salient pole alternator. **(08 Marks)**

c. A 750 KVA, 11KV , 4 pole 3 phase star connected has a % resistance and % reactance of 1 and 15 ohms respectively. Calculate the synchronizing power per mechanical degree of displacement at i) No load ii) at full load of 0.8 p.f lag. The terminal voltage in each case is 11KV. **(06 Marks)**

8 a. Explain briefly the basic principle of operation of synchronous motor. **(06 Marks)**

b. A 3 phase, 400V 50Hz star connected synchronous motor has per phase synchronous impedance of $(0.5 + j4.0)\ \Omega$. It takes a current of 15A at unity power factor for a certain field current. Calculate the excitation voltage and power angle. **(06 Marks)**

c. Write short notes on any two :
i) V and A curves ii) Synchronous condenser iii) Damping. **(08 Marks)**

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10EE55

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Modern Control Theory

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. Assume suitable missing data.

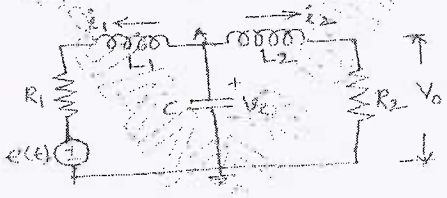
PART – A

1 a. Compare Modern control theory with Conventional control theory. **(04 Marks)**

b. Define the concept of i) State ii) State variables iii) State space iv) State model. **(06 Marks)**

c. Obtain the state model for the circuit shown in fig. Q1(c), by choosing i_1, i_2 and V_c as state variables. The voltage across R_2 is the output (V_0). **(10 Marks)**

Fig.Q1(c)



2 a. Obtain the State model using phase variables if a system is described by differential equation as : **(06 Marks)**

$$5\frac{d^3y}{dt^3}+6\frac{d^2y}{dt^2}+11\frac{dy}{dt}+10y=3u(t).$$

b. Develop the state model in Jordon's canonical form for a system having transfer function as

$$T(s)=\frac{2s^2+6s+7}{(s+1)^2(s+2)}.$$ **(06 Marks)**

c. A feedback system is represented by closed loop transfer function. Draw a signal flow graph (SFG) and obtain the state model. **(08 Marks)**

$$T(s)=\frac{8}{s^3+7s^2+14s+8}.$$

3 a. Obtain the state model of the linear system by Direct decomposition method, whose transfer function is **(06 Marks)**

$$\frac{Y(s)}{U(s)}=\frac{5s^2+6s+8}{(s^3+3s^2+7s+9)}.$$

b. Find the transfer function of the system having state model as below : **(06 Marks)**

$$X=\begin{bmatrix}1 & -2\\ 4 & -5\end{bmatrix}x+\begin{bmatrix}2\\ 1\end{bmatrix}u \;;\; Y=[1\ \ 1]x.$$

c. For the system matrix given by $A=\begin{bmatrix}-4 & 1 & 0\\ 0 & -3 & 1\\ 0 & 0 & -2\end{bmatrix}$.

Determine i) Characteristic equation ii) Eigen value iii) Eigen vector iv) Modal matrix. **(08 Marks)**

4 a. What is State transition matrix $\phi(t)$. List out the properties of STM. (06 Marks)

b. Given that

$$A_1 = \begin{bmatrix} \sigma & 0 \\ 0 & \sigma \end{bmatrix} \; ; \; A_2 = \begin{bmatrix} 0 & w \\ -w & 0 \end{bmatrix} \; ; \; A = \begin{bmatrix} \sigma & w \\ -w & \sigma \end{bmatrix}. \text{ Compute } e^{At}. \quad \text{(06 Marks)}$$

c. Determine the State transition matrix by Caley – Hamilton method for the system described by $\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ -2 & 0 \end{bmatrix} x(t)$. (08 Marks)

PART – B

5 a. Define Controllability and Observability. A system is describe by (10 Marks)

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ 9 & 0 \end{bmatrix} x + \begin{bmatrix} 0 \\ 9 \end{bmatrix} u .$$

Determine the state feedback gain matrix (k), so that control law u = -kx will place the closed loop poles at $-3 \pm j3$ by using Ackerman's formula.

b. Design a full order state observer for the system with

$$\dot{x}(t) = \begin{bmatrix} -1 & 1 \\ 1 & 2 \end{bmatrix} x \quad ; \quad y(t) = [1 \;\; 0]x.$$

The desired eigen values for the observer matrix are $\mu_1 = -5$ and $\mu_2 = -5$. (10 Marks)

6 a. What are P, PI and PID controllers? What are their effects on system performance? (06 Marks)

b. Explain the following non – linearities as : i) Saturation ii) Dead zone iii) Friction and iv) Backlash. (08 Marks)

c. Explain the properties of the non linear system. (06 Marks)

7 a. What are Singular Points? Explain the types of a singular points. (06 Marks)

b. Explain the construction of the phase trajectory by delta method. (08 Marks)

c. Identify and classify the singular points of the system with differential equation as $\ddot{y} + \dot{y} + y^3$. (06 Marks)

8 a. Define the following : i) Stability ii) Asymptotic stability iii) Asymptotic stability in the large. (06 Marks)

b. Determine whether the following quadratic form is positive definite :

$Q(x_1\, x_2\, x_3) = 10x_1^2 + 4x_2^2 + x_3^2 + 2x_1x_2 - x_2x_3 - 4x_1x_2$. (06 Marks)

c. Examine the stability of the system described by the differential equation using Krasovskii's method.

$\dot{x}_1 = x_1$

$\dot{x}_2 = x_1 - x_2 - x_2^3$ (08 Marks)

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10EE56

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Linear IC's & Application

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer any FIVE full questions, selecting at least TWO questions from each part.*
2. *Use of resistor and capacitors standard value lists are permitted.*
3. *Missing data may be suitably assumed.*

PART – A

1 a. With a neat circuit diagram, explain the operation of a high input impedance capacitor coupled non-inverting amplifier. Develop the expression for input impedance of the circuit. **(08 Marks)**

b. Briefly discuss the upeer cut off frequency of an op-amp circuit and show how the cut off frequency can be set for inverting amplifier. **(06 Marks)**

c. Using a 741 op-amp, design a high Z_{in} non-inverting amplifier to operate with a +36 V power supply, a voltage gain of 100, an output amplitude of 6 V, a lower cut off frequency of 150 Hz, and a minimum load resistance is 12 KΩ. Use a 741 op-amp with maximum input bias current $I_{B(max)}$= 500 nA. **(06 Marks)**

2 a. Sketch typical gain/frequency response and phase/frequency response graphs for an operational amplifier at the high frequency end of the frequency band. Identify the pole frequecncies and rates of fall of voltage gain. Also state the typical phase shift at each pole frequency. Briefly explain. **(08 Marks)**

b. If the maximum amplitude of a sine wave is 5 V, calculate the slew rate–limited cut-off frequency for a voltage follower using op-amp 741. If the unity gain cut-off frequency is 800 kHz, determine the maximum peak value of the sine wave output.
(For 741S=0.5 V/μsec) **(04 Marks)**

c. List the precautions that should be observed for operational amplifier circuit stability, briefly explain each one. **(08 Marks)**

3 a. Show how a dead zone circuit can be combined with a summing circuit to produce precision limiting on the positive half cycle of the output waveform. Draw the voltage waveforms throughout the circuit and explain its operation. **(10 Marks)**

b. A non-saturating precision half wave rectifier using BIPOLAR op-amp with V_{CC} = ±15V is to produce a 2 V peak output. The input signal has a 0.5 V peak amplitude and a frequency of 1 MHz. Calculate the resistor values and specify the diode reverse recovery time. **(05 Marks)**

c. With a neat circuit diagram, explain the working of a voltage follower type peak detector. **(05 Marks)**

4 a. Sketch the circuit of a capacitor coupled zero crossing detector. Show the waveforms at various points in the circuit and explain its operation. **(06 Marks)**

b. Draw the circuit of an op-amp mono stable multivibrator. Show the voltage waveforms throughout the circuit and explain its operation. **(08 Marks)**

c. Using a 741 op-amp with a supply of ±14V , design a inverting Schmitt trigger circuit to have trigger points of ± 2 V. **(06 Marks)**

PART – B

5 a. Draw the circuit of a phase shift oscillator. Sketch the output and feedback voltage waveforms and explain the circuit operation. (06 Marks)

b. Name the following circuit, determine whether the circuit shown in the Fig.5 (b) will work as an oscillator or not. If yes, determine the frequency of the oscillation. (04 Marks)

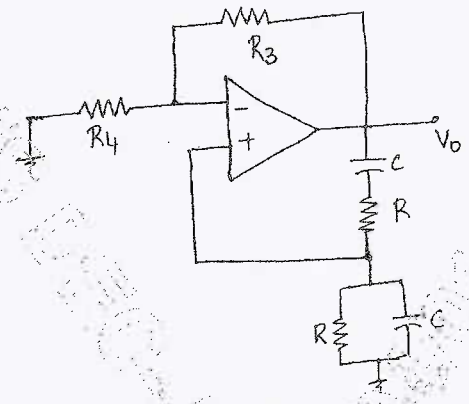

Fig. Q5 (b)

c. With a neat sketch explain a triangular / rectangular waveform generator, explain how to vary frequency and duty cycle of the output. (10 Marks)

6 a. Sketch typical frequency responses for Butterworth and chebyshev second-order active high pass filters. Write the equations required for designing a second order Butterworth high pass filter. (08 Marks)

b. Using a 741 op-amp, design a first order active low pass filter to have a cut-off frequency of 3 kHz. (06 Marks)

c. Show how a band-stop filter circuit can be constructed by the use of low pass and high pass filters. Sketch the expected frequency response, and briefly explain. (06 Marks)

7 a. What is dc voltage regulator? Explain the term line regulation, load regulation and ripple rejection for a dc voltage regulator. (08 Marks)

b. Sketch the circuit of a precision voltage regulator. Explain its operation and discuss how it differs from voltage follower regulator? (08 Marks)

c. Calculate the resistances R_1 and R_2 for the LM217 voltage regulator, to produce an output voltage of 9 V. (04 Marks)

8 a. With the block diagram, explain the operation of a PLL. (06 Marks)

b. List the advantages of the switched capacitor filter. (04 Marks)

c. Write short notes on:
   (i) Universal active filter.
   (ii) IC power amplifier. (10 Marks)

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CBCS Scheme

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15EE52

Fifth Semester B.E. Degree Examination, June/July 2018
Microcontroller

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain the various internal blocks of a CPU with necessary block diagram. **(08 Marks)**

b. Explain the various addressing modes of 8051 with an example for each. **(08 Marks)**

OR

2 a. Discuss the internal memory organization of 8051 microcontroller. **(06 Marks)**

b. Identify the addressing modes of source operand in the following instructions:
i) MOV A, #2CH ii) MOV A, @R0
iii) ADD A, 50h iv) MOVC A, @A+dptr **(04 Marks)**

c. Design an memory interface to correct 4 KB ROM memory using 74L5138 decoder with address space 4000h-4fffh. **(06 Marks)**

Module-2

3 a. Explain the operation of following instructions of 8051:
i) MOVX A, @dptr
ii) DJN2 R3, rpt
iii) ADDC A, 40h **(06 Marks)**

b. Write an 8051 ALP to find average of marks scored by student in 6 subjects [Max per subject = 20]. Assume the marks are stored from location 40h and the average is to be stored at location 50h. **(06 Marks)**

c. Write an 8051 ALP to read content of Port 1 and send it to Port 2 after inversion. The operation should be continuous. **(04 Marks)**

OR

4 a. Discuss call and jump instruction types and ranges of branching in each case. **(06 Marks)**

b. Write an 8051 ALP to convert a 2 digit BCD number to its equivalent binary (Hexadecimal) value. **(06 Marks)**

c. How many IO ports are available in 8051? Give the usage of all the IO ports mentioning any alternate use if they have. **(04 Marks)**

Module-3

5 a. What are the various data types supported by 8051 C? Mention the range of representation in each case. **(06 Marks)**

b. Explain TMOD-SFR with necessary format. **(04 Marks)**

c. Write an 8051-C program to realize a square wave of frequency 2 kHz on P2.0. Use timer 1, mode 1 for the operation. Take crystal frequency as 11.0592 MHz. **(06 Marks)**

OR

6 a. Write an 8051 C program to toggle bits of port 1 with arbitrary delay. The operation has to be continuous. **(06 Marks)**

b. Write a program segment to configure timer 1 in 16-bit counting mode to count internal clock and timer 0 in 8-bit auto reload mode to count internal clock. Assume software control for the operation. **(04 Marks)**

c. Write on 8051 C program to generate square wave of frequency 2.5 kHz on P1.0 using Timer 1 mode 2. Take crystal frequency of 12 MHz. **(06 Marks)**

Module-4

7 a. Explain the use of various bits of SCON-SFR. **(04 Marks)**

b. Write an 8051 C program to transmit a message "VTU Belagavi" serially at a baud rate of 9600. Use 8 bit data with one stop and one start. **(08 Marks)**

c. What are the various interrupt available in 8051? Mention vector ROM address and priority of each of the interrupts. **(04 Marks)**

OR

8 a. Explain the need for MAX 232 line driver for connecting RS232 to 8051. Show the interface of RS232 to 8051 using MAX 232. **(06 Marks)**

b. The value of IP-SFR is 00001100b. Explain the priority of interrupts. **(04 Marks)**

c. Write an 8051 program to receive a data byte serially and send to P1. Use baud rate of 4800. **(06 Marks)**

Module-5

9 a. Interface an DAC to 8051 and write an program to generate triangular wave using DAC interface. **(08 Marks)**

b. The direction of a DC motor is controlled by using a H-bridge as shown below in Fig.Q9(b).

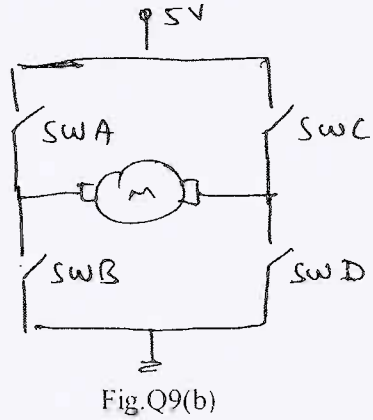

Fig.Q9(b)

SW A is connected to P1.0, SW B to P1.1, SW C to P1.2 and SW D to P1.3. Write a program to monitor a switch at P2.0.

If switch = 0 rotate motor in a direction

= 1 rotate motor in opposite direction. **(08 Marks)**

OR

10 a. Explain the various fields of 8255 control word format. Draw the control word format. **(06 Marks)**

b. Interface an LCD to 8051 and write a program using 8051-C to display message "Good day". **(10 Marks)**

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CBCS Scheme

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15EE53

Fifth Semester B.E. Degree Examination, June/July 2018
Power Electronics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. With neat circuit diagram, input and output wave form, explain the different types of power electronic converters. **(08 Marks)**

b. Discuss the peripheral effects of power electronics equipments. **(04 Marks)**

c. Discuss the major industrial applications of power electronic converter circuits. **(04 Marks)**

OR

2 a. With the help of neat waveform, explain the reverse recovery characteristics of a power diode. And also obtain an expression for peak reverse current. **(08 Marks)**

b. With neat circuit diagram and waveforms, explain the operation of single phase full wave rectifier with RL load. Derive the expression for rms output current for continuous load current. **(08 Marks)**

Module-2

3 a. With neat circuit diagram and switching times explain steady state and switching characteristics of power MOSFET. **(08 Marks)**

b. Give the list of base drive control circuits for BJT. With a neat diagram explain Anti saturation control. **(08 Marks)**

OR

4 a. With necessary waveforms explain the switching characteristics of an IGBT. **(05 Marks)**

b. In the bipolar transistor circuit shown in Fig Q4(b) β varies between 10 to 60. The load resistance $R_c = 5\Omega$, $V_{CC} = 100V$, $V_{BB} = 8V$, if $V_{CE(sat)} = 2.5V$ and $V_{BE(sat)} = 1.75V$, calculate :

i) The value of R_B that results in saturation with an ODF of 5

ii) The forced β value and

iii) Power loss in the transistor. **(05 Marks)**

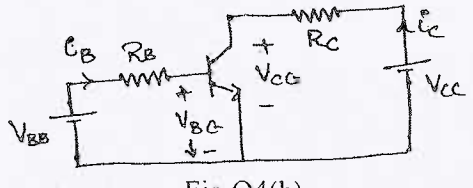

Fig Q4(b)

c. Discuss the importance of providing isolation of gate 1 base drive from power circuit and explain the two methods. **(06 Marks)**

Module-3

5 a. Derive an expression for the anode current of thyristor with help of two transistors analogy. **(05 Marks)**

b. With the current diagram and waveforms explain the working of UJT triggering technique of SCR. **(05 Marks)**

c. Design the values of di/dt inductor and RG snubber components for an SCR working in a 230V system. Given di/dt rating is 90A/μs and dV/dt rating is 200V/μs. Effective series resistance is 1.5Ω and damping factor is 0.6. **(06 Marks)**

OR

6 a. With the help of neat sketch, explain the static V-I characteristics of an SCR. Define latching current, holding current and breakover voltage. **(06 Marks)**

b. Ten thyristors are used in string to with stand a D.C voltage of V_s = 15kV. The maximum leakage current and recovery charge differences of thyristors are 10mA and 150μC respectively. Each thyristor has a voltage sharing resistor of R = 56kΩ and capacitance of C_1 = 0.5μF. Determine :

i) The maximum steady state voltage sharing
ii) Steady state voltage derating factor
iii) The maximum transient voltage sharing
iv) The transient voltage derating factor **(06 Marks)**

c. Explain the V-I characteristics of TRIAC. **(04 Marks)**

Module-4

7 a. With necessary waveforms, explain the operation of a single phase AC voltage controller with RL load. Derive the expression for rms output voltage. **(08 Marks)**

b. A single phase full wave A.C voltage controller has an input voltage of 230V and a load resistance of 10Ω. The firing angle is 45°. Calculate :

i) RMS output voltage ii) The output power iii) The input p.f **(08 Marks)**

OR

8 a. With circuit diagram and waveforms, explain the operation of a three phase dual converter. **(08 Marks)**

b. The single phase dual converter is operated from a 120V, 60Hz supply and the load resistance is R = 10Ω. The circulating inductance is L_r = 40mH, delay angle are $\alpha_1 = 60°$ and $\alpha_2 = 120°$. Calculate the peak circulating current and the peak current of converter – 1. **(04 Marks)**

c. What are the significance of circulating current in dual converters. **(04 Marks)**

Module-5

9 a. Classify the different types of choppers the help of circuit and quadrant diagram. Explain the operation of four quadrant chopper. **(08 Marks)**

b. For the chopper circuit shown in Fig. 9(b), the duty cycle is 0.5 and chopping frequency f = 5KHz. Determine :

i) Minimum instantaneous load current
ii) Peak instantaneous load current
iii) Maximum peak – to – peak current in load
iv) Average and rms load current. **(08 Marks)**

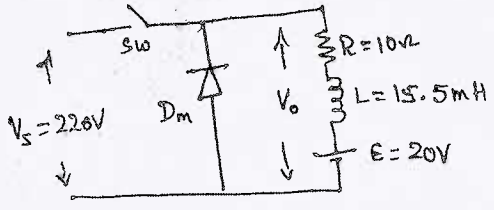

Fig Q9(b)

OR

10 a. With a neat circuit diagram and waveforms explain 180° mode of operation of a three phase's inverter. Give the expression for line and phase voltages for one cycle. **(08 Marks)**

b. Explain sinusoidal pulse width modulation technique of voltage control of single phase inverter. **(04 Marks)**

c. Discuss the advantages of the current source inverter over voltage source inverter. **(04 Marks)**

CBCS SCHEME

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15EE54

Fifth Semester B.E. Degree Examination, June/July 2018
Signals and Systems

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Prove that

i) $\int_{-a}^{a} x(t)dt = 2\int_{0}^{a} x(t)dt$; if x(t) is even

ii) $\int_{-a}^{a} x(t)dt = 0$; if x(t) is odd. **(06 Marks)**

b. What is the total energy of the rectangular pulse shown in Fig.Q.1(b)? **(05 Marks)**

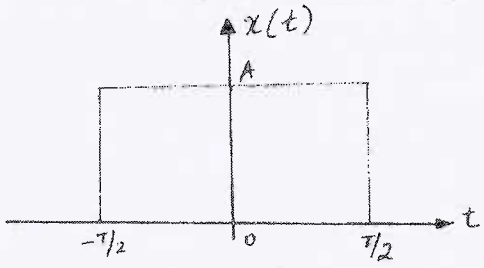


Fig.Q.1(b)

c. Determine whether the system $y(t) = x^{(t-2)}$ is i) Linear ii) Time-invariant iii) Memory iv) Causal v) Stable. **(05 Marks)**

OR

2 a. Check whether the following signals are periodic or not. If periodic, find the fundamental period: i) $x_1[n] = \cos 2\pi n$ ii) $x_2[n] = \cos 2n$. **(06 Marks)**

b. For the continuous-time signal x(t) shown in Fig.Q.2(b), sketch the signal y(t) = x(3t + 2). **(05 Marks)**

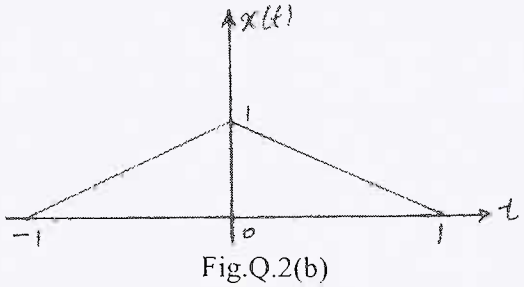


Fig.Q.2(b)

c. Sketch the signal, x(t) = -u(t + 3) + 2u(t + 1) – 2u (t – 1) + u (t – 3). **(05 Marks)**

Module-2

3 a. Consider the input signal x[n] and the impulse response h(n) given below:

$$x[n]=\begin{cases}1 & 0\le n\le 4\\ 0 & \text{elsewhere}\end{cases} \qquad h[n]=\begin{cases}\alpha^n & 0\le n\le 6\\ 0 & \text{elsewhere}\end{cases}$$

Compute the output signal y[n]. **(05 Marks)**

b. Evaluate the system response of the system

$\ddot{y}(t)+5\dot{y}(t)+6y(t)=2e^{-t}u(t)$ with $y(0)=0,\ \dot{y}(0)=1$. **(05 Marks)**

c. Draw direct form I and direct form II implementation for the following difference equations:

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

ii) $y(n)-\frac{1}{9}y(n-2)=x(n)+2x(n-1)$. **(06 Marks)**

OR

4 a. For each of the impulse response listed below,

i) $h(t)=e^{-2t}$ ii) $h(t)=e^{2t}u(t-1)$

Determine whether the corresponding system is i) Memory less ii) Causal and iii) Stable. **(06 Marks)**

b. Evaluate the continuous-time convolution integral given below:

$y(t)=e^{-2t}u(t)*u(t+2)$. **(05 Marks)**

c. For the system given below, compute the zero-input, zero-state and total response, assuming

$x[n]=u[n]$ and $y[-1]=y[-2]=1$, $y(n)-\frac{3}{4}y(n-1)+\frac{1}{8}y(n-2)=x(n-1)$. **(05 Marks)**

Module-3

5 a. Prove the following properties of Fourier transform:

i) Frequency shifting property ii) Time-differentiation. **(06 Marks)**

b. For the rectangular pulse shown in Fig.Q.5(b), draw the spectrum. **(05 Marks)**

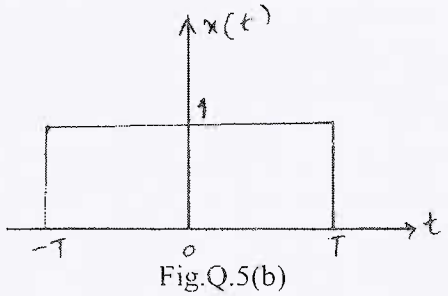
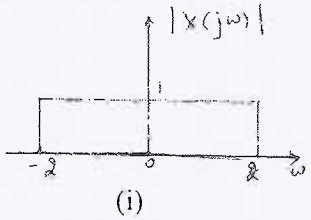
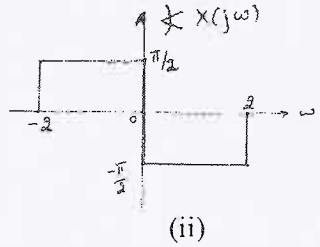


Fig.Q.5(b)

c. Determine the time-domain signal corresponding to the spectrum shown in Fig.Q.5(c) (i) and (ii) respectively. **(05 Marks)**



(i)



(ii)

Fig.Q.5(c)

OR

6 a. The impulse response of a continuous-time LTI system is given by $h(t)=\frac{1}{RC}e^{-t/RC}u(t)$. Find the frequency response and plot the magnitude and phase response. **(05 Marks)**

b. Prove that, if $x(t)\xleftrightarrow{FT}x(jw)$ then, $\int_{-\infty}^{t}x(\tau)d\tau\xleftrightarrow{FT}\frac{x(jw)}{jw}+\pi x(jo)\delta(w)$. **(05 Marks)**

c. Obtain the frequency response and the impulse response of the following system described by the differential equations:

i) $\frac{dy(t)}{dt}+8y(t)=x(t)$

ii) $\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+6y(t)=\frac{-dx(t)}{dt}$. **(06 Marks)**

Module-4

7 a. Compute the DTFT of the following signals:

i) $x(n)=2^n u(-n)$

ii) $x(n)=a^{|n|}\ ;\ |a|<1$

iii) $x(n)=(\alpha^n\sin\Omega_0 n)u(n)\ ;\ |\alpha|<1$. **(06 Marks)**

b. Obtain the frequency response and the impulse response of the system having the output y(n) for the input x(n) as given below.

$x(n)=\left(\frac{1}{2}\right)^n u(n)\ ;\ y(n)=\frac{1}{4}\left(\frac{1}{2}\right)^n u(n)+\left(\frac{1}{4}\right)^n u(n)$. **(05 Marks)**

c. A discrete-time LTI system described by $y(n)-\frac{1}{2}y(n-1)=x(n)+\frac{1}{2}x(n-1)$

i) Determine the frequency response H(Ω).

ii) Find the impulse response h(n) of the spectrum. **(05 Marks)**

OR

8 a. Find the inverse DTFT of

i) $x(\Omega)=e^{-j4\Omega},\ \frac{\pi}{2}<|\Omega|<\pi$

ii) $x(\Omega)=\frac{3-\frac{5}{4}e^{-j\Omega}}{\frac{1}{8}e^{-j2\Omega}-\frac{3}{4}e^{-j\Omega}+1}$. **(08 Marks)**

b. State and explain Parseval's theorem of discrete time Fourier transform. **(04 Marks)**

c. Obtain the difference equation for the system with frequency response. **(04 Marks)**

$H(e^{j\Omega})=1+\frac{e^{-j\Omega}}{\left(1-\frac{1}{2}e^{-j\Omega}\right)\left(1+\frac{1}{4}e^{j\Omega}\right)}$.

Module-5

9 a. Find the Z-transform of the following:

i) $x(n) = n\sin\left(\frac{\pi}{2}n\right)u(-n)$

ii) $x(n) = \left(\frac{1}{2}\right)^n u(n) * \left(\frac{1}{3}\right)^n u(n)$. **(07 Marks)**

b. List the properties of ROC. **(04 Marks)**

c. Find the inverse Z-transform of the following using partial fraction expansion:

$$X(Z) = \frac{1 - \frac{1}{2}z^{-1}}{1 + \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}}; \quad |z| > \frac{1}{2}.$$ **(05 Marks)**

OR

10 a. A causal LTI system is described by the difference equation $y(n) = y(n-1) + y(n-2) + x(n-1)$.

i) Find the system function.
ii) Plot the poles and zeros.
iii) Indicate the ROC.
iv) Find the unit sample response of this system.
v) Find the stable (non causal) unit sample that satisfies the difference equation. **(06 Marks)**

b. Solve the following equation using unilateral Z-transform $y(n) - \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = x(n)$ for $n \geq 0$ with initial conditions y(-1) = 4, y(-2) = 10 and $x(n) = \left(\frac{1}{4}\right)^n u(n)$. **(05 Marks)**

c. Determine the step response of the system $y(n) = \alpha y(n-1) + x(n)$; $-1 < \alpha < 1$ with initial conditions y(-1) = 1. **(05 Marks)**

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10AL51

Fifth Semester B.E. Degree Examination, June/July 2018
Management and Entrepreneurship

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Explain the term management and discuss the functions of management. **(08 Marks)**
b. Explain modern management approaches. **(12 Marks)**

2 a. Explain the steps involved in planning process with an example. **(08 Marks)**
b. Explain the hierarchy of plans of a organization. **(12 Marks)**

3 a. Explain with a block diagram line and matrix type of organization. **(08 Marks)**
b. Explain the principles of organization. **(12 Marks)**

4 a. Explain the requirements of effective direction. **(06 Marks)**
b. Explain Maslaw's hierarchy of needs theory. **(08 Marks)**
c. Differentiate between co-ordination and cooperation. **(06 Marks)**

PART – B

5 a. Explain the concept of entrepreneurship and its evolution. **(08 Marks)**
b. Explain the types of entrepreneur. **(12 Marks)**

6 a. Explain the characteristics of small enterprises. **(08 Marks)**
b. Explain the advantages of small enterprises. **(12 Marks)**

7 a. Explain the activities of Karnataka Industrial Area Development Board (KIADB). **(10 Marks)**
b. Explain the activities of Karnataka State Small Industries Development Corporation (KSSIDC). **(10 Marks)**

8 Explain various details which should be included in a project work. **(20 Marks)**

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10EE52

Fifth Semester B.E. Degree Examination, June/July 2018
Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Sketch the even and odd components of the following signals.

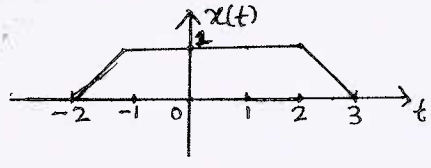

Fig Q1 a (i)

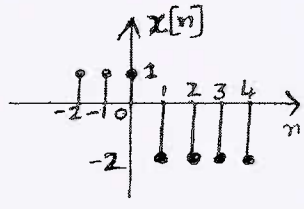

Fig Q1 a (ii) **(08 Marks)**

b. A continuous time signal x(t) shown below. Draw the signal $y(t) = \{x(t) + x(2-t)\}u(1-t)$

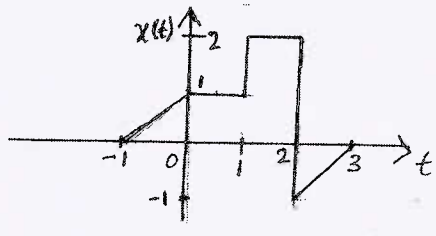

Fig Q1 (b) **(06 Marks)**

c. i) What is the average power of the triangular wave shown below?
ii) For the trapezoidal pulse shown below, find the total energy.

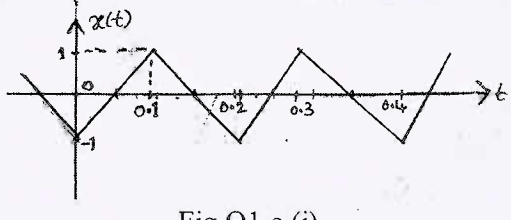

Fig Q1 c (i)

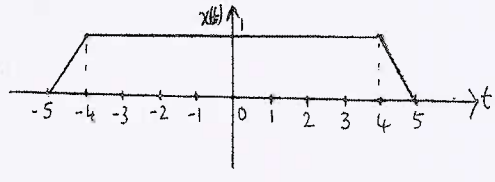

Fig Q1 c (ii) **(06 Marks)**

2 a. Derive an expression for convolution sum. **(06 Marks)**

b. If h(t) = u(t) – u(t – 3) and x(t) = u(t) – u (t – 1), determine the output y(t) = x(t) * h(t). **(10 Marks)**

c. Determine the convolution of the two sequence $x[n] = \{1, \underset{\uparrow}{2}, 3, 4\}$ and $h[n] = \{\underset{\uparrow}{1}, 1, 3, 2\}$. **(04 Marks)**

3 a. Two LTI systems whose impulse responses are given by $h_1(t) = e^{-2t}\,u(t)$ and $h_2(t) = e^{-t}\,u(t)$ are connected in cascade. Find the overall impulse response h(t) and check for stability. **(06 Marks)**

b. Find the natural and forced responses of the system described by the differential equation. $\frac{d^2y(t)}{dt^2}+3\frac{dy(t)}{dt}+2y(t)=x(t)+\frac{dx(t)}{dt}$ With $y(0)=0, \left.\frac{dy(t)}{dt}\right|_{t=0}=1, x(t)=5u(t)$. **(08 Marks)**

c. Draw the direct form I and direct form II for LTI system described by the difference equation $y[n]+\frac{1}{2}y[n-1]-\frac{1}{3}y[n-3]=x[n]+2x[n-2]$ **(06 Marks)**

4 a. State and prove frequency and time shift properties of Fourier series. **(08 Marks)**

b. Determine the DTFS representation for the sequence $x[n]=\cos^2\left[\frac{\pi}{4}n\right]$ **(06 Marks)**

c. Find the Fourier series coefficient of the signal x(t) shown below and draw its spectra.

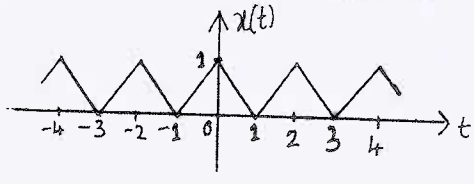

Fig Q4(c) **(06 Marks)**

PART – B

5 a. State and prove convolution property of the Discrete Time Fourier Transform (DTFT). **(06 Marks)**

b. Find DTFT of the sequence $x[n]=a^{|n|};|aK|$. **(04 Marks)**

c. Using appropriate properties, Find the DTFT of the signal $x[n]=\text{Sin}\left[\frac{\pi}{4}n\right]\left[\frac{1}{4}\right]^n u[n-1]$. **(10 Marks)**

6 a. State and prove Time differentiation and Frequency differentiation properties of the Fourier Transform (FT). **(08 Marks)**

b. Find the Fourier Transform of the following :

i) $x(t)=e^{-3t}u(t-1)$ ii) $x(t)=t\,e^{-2t}u(t)$ **(06 Marks)**

c. Find the Fourier Transform of the following signal using appropriate properties $x(t)=\text{Sin}(\pi t)e^{-2t}u(t)$. **(06 Marks)**

7 a. What is Region of Convergence (ROC)? List the properties of ROC. **(06 Marks)**

b. Determine the z – Transform of the following :

i) $x[n]=\left[\frac{1}{3}\right]^n \text{Sin}\left[\frac{\pi}{4}n\right]u[n]$ ii) $x[n]=\left[\frac{1}{2}\right]^{|n|}$ **(08 Marks)**

c. Using appropriate properties, find the z-transform of $x[n]=n\left[\frac{1}{2}\right]^n u[n-3]$. **(06 Marks)**

8 a. Solve the following difference equation using unilateral z-transform.

$y[n]-\frac{3}{2}y[n-1]+\frac{1}{2}y[n-2]=x[n],\ n>0$ With initial conditions $y[-1]=4$, $y[-2]=10$ and $x[n]=\left[\frac{1}{4}\right]^n u[n]$. **(10 Marks)**

b. If a system is described by the following equation $y[n]-\frac{3}{4}y[n-1]+\frac{1}{8}y[n-2]=x[n]$, Find the impulse response and step response. **(10 Marks)**

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10EE53

Fifth Semester B.E. Degree Examination, June/July 2018
Transmission & Distribution

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Draw and explain the line diagram of a typical power supply scheme indicating the standard voltages. **(10 Marks)**

b. Why it is necessary to use high voltage for power transmission? **(05 Marks)**

c. What are the effects of Sag and tension on the conductor of a transmission line? **(05 Marks)**

2 a. Obtain the expression for sag in a freely suspended conductor when the supports are at different levels considering ice and wind affects. **(10 Marks)**

b. The towers of height 30 m and 90 m respectively support a transmission line conductor at water crossing. The horizontal distance between the towers is 500 m. If the tension in the conductor is 1600 kg, find the maximum clearance of the conductor and water and also clearance midway between the supports. weight of the conductor is 1.5 kg/m. Bases of the towers can be considered to be at water level. **(10 Marks)**

3 a. Define string efficiency. How the string efficiency of an insulator is improved by using different methods? **(10 Marks)**

b. A string of 4 insulators has a self capacitance equal to 10 times pin to earth capacitance. Find the voltage distribution across various units as a percentage of total voltage across the string. **(10 Marks)**

4 a. Explain capacitance grading of cables with appropriate derivation. **(10 Marks)**

b. A single core cable has a conductor diameter of 2.5 cm and a sheath of inside diameter 6 cm. Calculate the maximum stress. It is desired to reduce the maximum stress by using two intersheath. Determine maximum stress by using two intersheath. **(05 Marks)**

c. Write a note on testing of cables. **(05 Marks)**

PART – B

5 a. Show that the inductance of a double circuit 3 phase line can be calculated by method of GMD and GMR. Assume complete transposition. **(08 Marks)**

b. The 3 conductors of a 3 phase line are arranged at the corners of a triangle of size 2 m, 2.5 m, and 4.5 m. Calculate the inductance per km of the line when conductors are regularly transposed. The diameter of each conductor is 1.24 cm. **(07 Marks)**

c. Explain the terms self GMD and mutual GMD. **(05 Marks)**

6 a. Explain with reasons the presence of ground on the capacitance can be taken into account by the method of images. Hence find the earth effect on the capacitance of single phase line. **(10 Marks)**

b. Derive the expression for capacitance of a 3 phase line with unsymmetrical spacing. **(10 Marks)**

7 a. Two transmission line having generalized circuit constants A_1 B_1 C_1 D_1 and A_2 B_2 C_2 D_2 are connected in (i) series (ii) parallel. Develop expression for overall constants ABCD in terms of A_1 B_1 C_1 D_1 and A_2 B_2 C_2 D_2. **(10 Marks)**

b. Derive an expression for ABCD constants of a medium transmission line using nominal π-method. Show that AD – BC = 1. **(10 Marks)**

8 a. What are the requirements of a good distribution system? **(05 Marks)**

b. Compare radial and ring main distribution system. **(05 Marks)**

c. Explain how a 2-wire DC distribution with concentrated load fed at one end can be represented by a single line diagram. **(10 Marks)**

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10EE54

Fifth Semester B.E. Degree Examination, June/July 2018
DC Machines and Synchronous Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Derive the e.m.f. equation of a d.c. generator. **(06 Marks)**

b. Define commutation. Explain the process of commutation in d.c. generators with neat sketches. **(07 Marks)**

c. A 4-pole, 50 KW, 250 V wave-wound shunt generator has 400 armature conductors. Brushes are given a lead of 36/5 degrees. Calculate the demagnetizing amp-turns/pole if shunt field resistance is 50 Ω. Also calculate extra shunt field turns/pole to neutralize the demagnetization. **(07 Marks)**

2 a. Explain what is meant by back emf. Explain the principle of torque production in a d.c. motor. **(05 Marks)**

b. Explain with neat sketch, the working of three point starter. **(05 Marks)**

c. Discuss two methods of speed control of d.c. shunt motor. **(05 Marks)**

d. A d.c. motor takes an armature current of 110 A at 480 V. The armature circuit resistance is 0.2 ohm. The machine has 6-poles and armature is lap connects with 864 conductors. The flux per pole is 0.05 wb. Calculate: (i) speed (ii) torque developed by the armature. **(05 Marks)**

3 a. What are the losses that occur in d.c. machines? Derive the condition for maximum efficiency. **(05 Marks)**

b. Explain briefly Hopkinson's test for determination of efficiency of d.c. shunt machines. **(08 Marks)**

c. When running on no load, a 400 V, shunt motor takes 5A. Armature resistance is 0.5 ohm and field resistance 200Ω. Find the efficiency when running on full load and taking full load current of 50A. **(07 Marks)**

4 Write short notes on:

a. External characteristics of D.C. shunt, series and compound generators.

b. D.C. motor applications

c. Power flow diagram in d.c. machine

d. Field test **(20 Marks)**

PART – B

5 a. Explain the phenomena of armature reaction when alternator delivering to upf, lagging power factors, leading power factor load. **(07 Marks)**

b. Draw the phasor diagram of a loaded generator for the following conditions:

i) Lagging power factor

ii) Leading power factor

iii) UPF **(06 Marks)**

c. A 3-phase, 50 Hz, 2-pole, star connected alternator has 54 slots with 4 conductors per slot. The pitch of the coil is 2 slots less than the pole pitch. If the machine gives 3300 V between lines on open circuit with sinusoidal flux distribution, determine the useful flux per pole. **(07 Marks)**

6 a. Explain the mmf method of determining the voltage regulation of alternator. **(07 Marks)**

b. Describe the slip test method for the measurement of X_d and X_q of synchronous machine. **(05 Marks)**

c. A 100 KVA, 3000 V, 50 Hz, 3-phase star connected alternator has effective armature resistance of 0.2 ohm. The field current of 40 A produces short circuit current of 200 A and open circuit emf of 1040 V (line). Calculate the full load voltage regulation at 0.8 p.f. lag and lead. **(08 Marks)**

7 a. For a cylindrical rotor synchronous machine, neglecting the effect at armature resistance, derive an expression for power developed as a function of load angle. **(06 Marks)**

b. What is the capability curve of a synchronous generator? What informations are available from this curve? **(07 Marks)**

c. A 2 MVA, 3-phase, 8-pole alternator is connected to 6000 V, 50 Hz bus bars and has a synchronous reactance of 4Ω per phase. Calculate the synchronizing power and the synchronizing torque per mechanical degree of rotor displacement at no load. Assume normal excitation. **(07 Marks)**

8 a. Describe briefly the effect of varying excitation upon armature current and power factor of a synchronous motor, when input power to the motor is maintain constant. **(07 Marks)**

b. Why is synchronous motor not self starting and what methods are generally used to start the synchronous motor? **(07 Marks)**

c. Explain hunting of synchronous machine. What is the purpose of damper windings in a synchronous machine? **(06 Marks)**

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10EE55

Ffith Semester B.E. Degree Examination, June/July 2018

Modern Control Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Mention five advantages of modern control theory (MCT), over classical control theory. **(05 Marks)**

b. Consider a system given by $G(s) = \frac{s+3}{s^2+3s+2}$, obtain the state space representation in:

i) Controllable canonical form
ii) Observable canonical form **(05 Marks)**

c. Write the state variable formulation of the network shown in Fig.Q1(c), where all components are of unity magnitude.

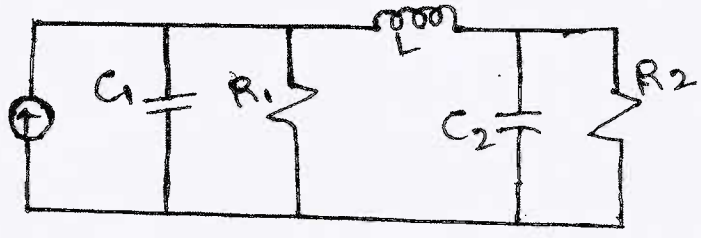

Fig.Q1(c) **(10 Marks)**

2 a. Derive the transfer function from state model. **(05 Marks)**

b. Consider a system having state model $\dot{X} = AX + BU$ and $Y = CX + DU$ where $A = \begin{bmatrix} -2 & -3 \\ 4 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 3 \\ 5 \end{bmatrix}$, $C = [1 \quad 1]$, $D = [0]$, obtain its transfer function. **(05 Marks)**

c. Reduce the given state model into its canonical form by diagonalising matrix A. $\dot{X} = AX + BU$; $Y = CX + DU$ where $A = \begin{bmatrix} 0 & 1 & -1 \\ -6 & -11 & 6 \\ -6 & -11 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$, $C = [1 \quad 0 \quad 0]$, $D = [0]$. **(10 Marks)**

3 a. Diagonalize the matrix A where $A = \begin{bmatrix} 4 & 1 & -2 \\ 1 & 0 & 2 \\ 1 & -1 & 3 \end{bmatrix}$. **(06 Marks)**

b. For the transfer function T(S), obtain the state model in canonical form $T(S) = \frac{s(s+2)(s+3)}{(s+1)^2(s+4)}$ **(08 Marks)**

c. A system is described by the following differential equations. Represent the system in state space. $X^{(3)} + 3X^{(2)} + 4\dot{X} + 4X = U_1 + 3U_2 + 4U_3$ and the outputs are $Y_1 = 4\dot{X} + 3U_1$; $Y_2 = X^{(2)} + 4U_2 + U_3$. **(06 Marks)**

4 a. What is STM? State atleast five properties of STM. **(06 Marks)**

b. Find the STM of $A = \begin{bmatrix} 0 & 0 & -2 \\ 0 & 1 & 0 \\ 1 & 0 & 3 \end{bmatrix}$ by Caley Hamilton method. **(06 Marks)**

c. Given the state model of the system $\dot{X} = AX + BU$ and $Y = CX + DU$ where $A = \begin{bmatrix} 0 & 1 \\ -4 & -5 \end{bmatrix}$ $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ $C = [1 \quad 0]$, $D = [0]$ with initial conditions $X(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$. Determine:

i) The state transition matrix (STM).

ii) The state and output X(t) and Y(t) for a unit step input.

iii) Inverse state transition matrix. **(08 Marks)**

PART – B

5 a. Determine the controllability and observability of $\dot{X} = AX + BU$ and $Y = CX + DU$ where $A = \begin{bmatrix} -3 & 1 & 0 \\ 1 & -2 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ $B = \begin{bmatrix} 0 \\ 2 \\ 2 \end{bmatrix}$ $C = \begin{bmatrix} 1 & 2 & -1 \end{bmatrix}$, $D = [0]$ using (i) Kalman's test and (ii) Gilbert's test. **(10 Marks)**

b. For a homogeneous equation $\dot{X} = AX$ the following three different initial conditions are $\begin{bmatrix} e^{-t} \\ -e^{-t} \\ 2e^{-t} \end{bmatrix}$; $\begin{bmatrix} e^{-2t} \\ -2e^{-2t} \\ 0 \end{bmatrix}$; $\begin{bmatrix} -2e^{-3t} \\ -6e^{-3t} \\ 0 \end{bmatrix}$.

i) Identify the initial conditions ii) Find the system matrix A iii) Find STM. **(10 Marks)**

6 a. Consider a system defined by $\dot{X} = AX + BU$ where $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -6 \end{bmatrix}$; $B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$. It is desired to have closed loop poles at -1±j2 and -10. Determine the state feedback gain matrix K using (i) Direct substitution method and (ii) Ackerman's method. **(10 Marks)**

b. For a system defined by $\dot{X} = AX + BU$ and $Y = CX + DU$ where $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}$; $B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$; $C = [1 \quad 0 \quad 0]$. Determine the observer gain matrix by (i) Direct substitution method and (ii) Ackerman's method. **(10 Marks)**

7 a. Mention five properties of non linear systems and explain (i) dead zone (ii) backlash. **(10 Marks)**

b. Explain the concept of limit cycles used in non linear systems. **(10 Marks)**

8 a. Determine the stability of a nonlinear system governed by the equations $\dot{X}_1 = -X_1 + 2X_1^2X_2$, $\dot{X}_2 = -X_2$ using Lyapunov's method. **(08 Marks)**

b. Determine the stability of a system described by $A = \begin{bmatrix} -1 & 1 \\ -2 & -4 \end{bmatrix}$. **(08 Marks)**

c. Explain: i) Asymptotic stability, ii) Stability in the sense of Lyapunov. **(04 Marks)**

CBCS Scheme

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15EE61

Sixth Semester B.E. Degree Examination, June/July 2018
Control System

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. With the help of neat block diagram, define open loop and closed loop control system. Mention any four difference between open loop and closed loop control system. **(08 Marks)**

b. Construct mathematical model for the mechanical system shown in Fig. Q1 (b). Draw electrical equivalent network based on force voltage analogy. **(08 Marks)**

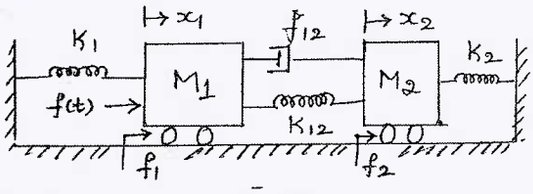

Fig. Q1 (b)

OR

2 a. Draw an equivalent mechanical network using force voltage analogy as shown in Fig. Q2 (a). **(08 Marks)**

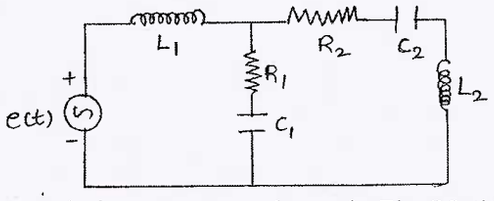

Fig. Q2 (a)

b. For the mechanical translation system as shown in Fig.Q2 (b). Draw the electrical network based on torque current analogy. Write its performance equations. **(08 Marks)**

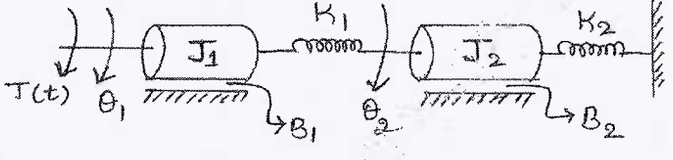

Fig. Q2 (b)

Module-2

3 a. Illustrate how to perform the following connection with block diagram reduction technique.
(i) Shifting summing point after a block (ii) Shifting take off point ahead of a block. **(04 Marks)**

b. Draw a signal flow graph and find its transfer function as shown in Fig. Q3 (b). **(06 Marks)**

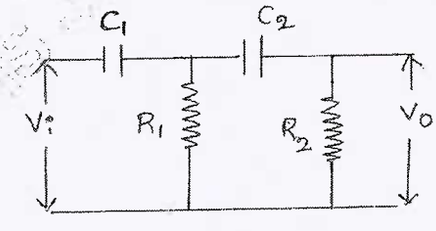

Fig. Q3 (b)

c. Determine the transfer function, $\frac{C(s)}{R(s)}$ of a system shown in Fig. Q3 (c). **(06 Marks)**

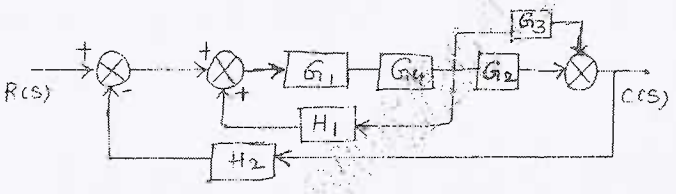

Fig. Q3 (c)

OR

4 a. Obtain $\frac{C(s)}{R(s)}$ using block diagram reduction rule. **(08 Marks)**

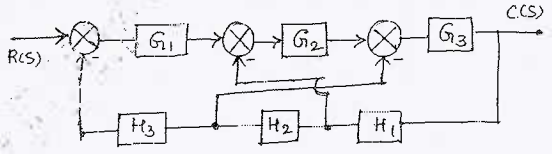

Fig. Q4 (a)

b. Find the transfer function $\frac{X_5}{X_1}$ to the signal flow graph shown in Fig. Q4 (b). Apply the Mason's gain formula. **(08 Marks)**

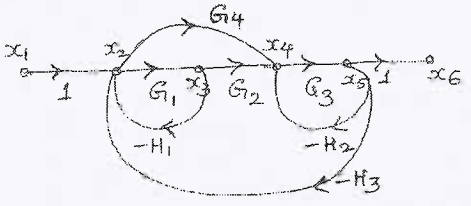

Fig. Q4 (b)

Module-3

5 a. What are necessary and sufficient condition for a system to be stable according to RH criteria. **(04 Marks)**

b. Determine the stability of the system represent by following characteristic equation, $s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$. **(04 Marks)**

c. The system shown in Fig. Q5 (c) when subjected to a unit step input gives an output response shown in Fig. Q5 (c). Determine the value of K and T from response curve. **(08 Marks)**

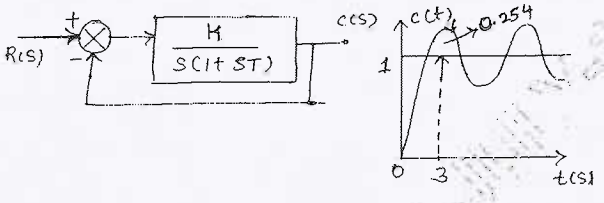

Fig. Q5 (c)

OR

6 a. A system oscillate with frequency "ω" if it has a pole at $s = \pm j\omega$ and no pole in right half of s plane. Determine the value of K and 'a' so that the system shown in Fig. Q6 (a). Oscillate at a frequency of 2 rad/sec. **(08 Marks)**

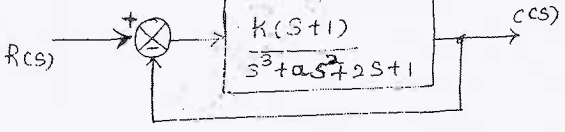

Fig. Q6 (a)

b. For the system $G(s)H(s) = \frac{K}{s^2(s+2)(s+3)}$ find the value of K to limit steady state error to 10 unit when input to the system is $1 + 10t + \frac{40t^2}{2}$. **(08 Marks)**

Module-4

7 a. For a single loop unity feedback system whose open loop transfer function is $G(s) = \frac{K(s+3)}{s(s+2)}$ show that complex part of root locus is a circle and identify center and radius. **(06 Marks)**

b. Draw the bode plot for the system having $G(s) = \frac{10}{s(1+0.01s)(1+0.1s)}$, $H(s) = 1$.

Determine :

(i) Gain crossover frequency and phase margin.

(ii) Phase cross over frequency and gain margin. **(10 Marks)**

OR

8 a. Sketch complete root locus of system having $G(s)H(s) = \frac{K}{s(s+1)(s+2)(s+3)}$. **(10 Marks)**

b. Find the open loop transfer function of a system whose approximate plot is as shown in Fig. Q8 (b). **(06 Marks)**

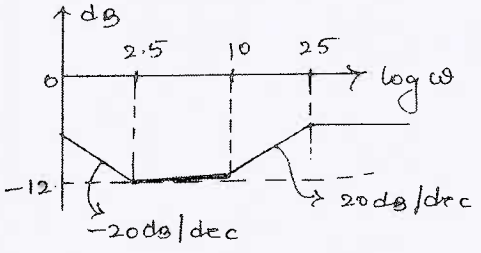

Fig. Q8 (b)

Module-5

9 a. Explain the step by step design procedure of lead compensation network. **(08 Marks)**

b. Sketch the Nyquist plot by unity feedback system whose open loop transfer function, $G(s) = \frac{5}{s(1-s)}$. Determine stability of a system using Nyquist stability criteria. **(08 Marks)**

OR

10 a. Explain Nyquist stability criteria. **(04 Marks)**

b. What is controller? Explain the effect of PI and PD controller on second order system. **(06 Marks)**

c. Explain the principle of Argument in Nyquist stability criteria. **(06 Marks)**

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CBCS Scheme

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15EE62

Sixth Semester B.E. Degree Examination, June/July 2018
Power System Analysis – I

Time: 3 hrs. Max. Marks: 80

Note: *Answer FIVE full questions, choosing one full question from each module.*

Module-1

1 a. With suitable example explain one line diagram and discuss the elements represented. **(06 Marks)**

b. Draw the per unit reactions diagram for the power system shown in Fig. Q1 (b). Selecting the generator rating as the base. Also find the generator terminal voltage.

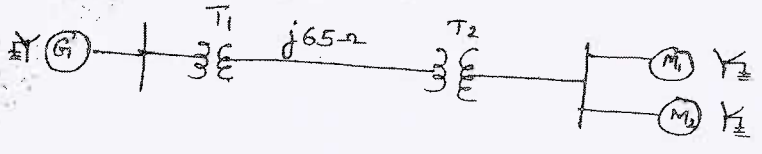

Fig. Q1 (b)

The ratings of the various components are,
G = 13.8 kV, 25 MVA, X″ = j0.15 pu ;
T_1 = 13.2/69 kV, 25 MVA, X = j0.11 pu; T_2 = 69/13.2 kV, 25 MVA, X = j0.11 pu;
M_1 = 13 kV, 15 MVA, X″ = j0.15 pu ; M_2 = 13 kV, 10 MVA, X″ = j0.15 pu
Determine the generator terminal voltage when both the motors operate at 12 kV 75% full load and unity power factor. **(10 Marks)**

OR

2 a. With help of typical electrical power system, explain impedance and reactance diagram and mention the assumptions made in that. **(06 Marks)**

b. The schematic diagram of a radial transmission system is shown in Fig. Q2 (b). The ratings and reactance of the various components are show there in. A load of 60 MW at 0.9 p.f lagging is tapped from 66 kV sub station which is to be maintained at 60 kV. Calculate the terminal voltages of the machine. Represent the transmission line and transformer by series reactance only. **(10 Marks)**

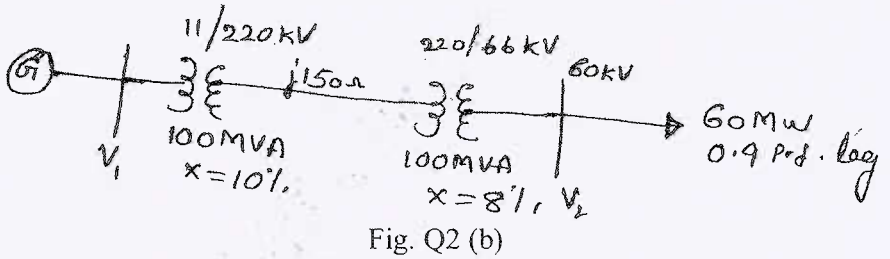

Fig. Q2 (b)

Module-2

3 a. What is the significance of transient and subtransient reactances in short circuit studies. Distinguish between transient and subtransient reactances of a synchronous machine. **(06 Marks)**

b. For the radial network shown in Fig. Q3 (b) a 3 phase fault occurs at point F. Determine the fault current, choose the generator ratings as base values:
Generator G_1: 10 MVA, 11 kV, X″ = 15% ; Generator G_2: 10 MVA, 11 kV, X″ = 12.5%
Transformer T_1 : 10 MVA, 11/33 kV, X = 10%; Transformer T_2 : 5 MVA, 33/6.6 kV, X= 8%
Overhead line impedance z = +j Ω; Feeder impedance z = (0.135 + j0.08) Ω/km **(10 Marks)**

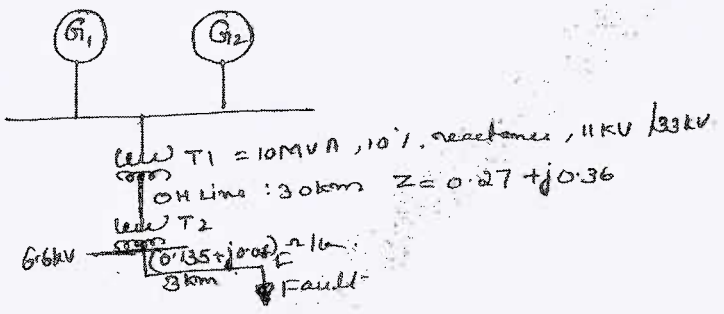

Fig. Q3 (b)

OR

4 a. What is doubling effect in a transmission line? Substantiate with equations. **(06 Marks)**

b. Generator G_1 and G_2 are identical and rated 11 kV, 20 MVA and have a transient reactance of 0.25 pu at own MVA base. The transformer T_1 and T_2 are also identical and are rated 11/66 kV, 5 MVA and have a reactance of 0.06 p.u. to their own MVA base. The tie line is 50 km long each conductor has a reactance of 0.848 Ω/km. The three phase fault is assumed at F, 20 km from generator G_1, as shown in Fig. Q4 (b). Find the short circuit current. **(10 Marks)**

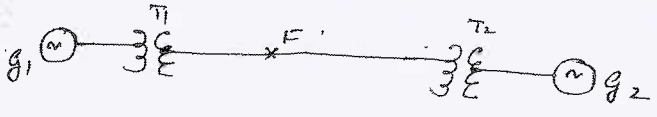

Fig. Q4 (b)

Module-3

5 a. What are symmetrical components and explain how they are useful in solving the power system problems. **(04 Marks)**

b. Prove that : (i) $(1+\alpha+\alpha^2)=0$ (ii) $(\alpha-\alpha^2)=j\sqrt{3}$ (iii) $(\alpha^2-\alpha)=-j\sqrt{3}$ **(04 Marks)**

c. A balanced delta connected load is connected to a 3 phase symmetrical supply. The line currents are each 10 A in magnitude. If fuse in one of the lines blows out. Determine the sequence components of line currents. **(08 Marks)**

OR

6 a. Explain the concept of phase shift in star delta transformer bank. **(06 Marks)**

b. Draw the positive, negative and zero sequence networks for the power system shown in Fig Q6 (b).

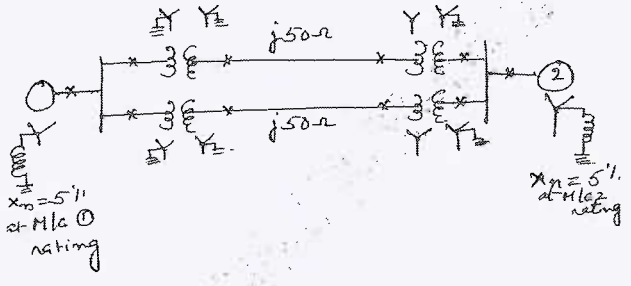

Fig. Q6 (b)

Choose a base of 50 MVA, 220 kV in the 50 Ω transmission lines and mark all reactances in p.u. The ratings of the generators and transformers are:

Generator 1 : 25 MVA, 11 kV, $X'' = 20\%$; Generator 2 : 25 MVA, 11 kV, $X'' = 20\%$

Three phase transformer (each) : 20 MVA, $^{11Y}/_{220Y}$ kV, X = 15%

The negative sequences reactance of each syn machine is equal to the sub transient reactance. The zero sequence of each machine is 8%. Assume that the zero sequence of lines of lines are 250% of their positive sequence reactance. **(10 Marks)**

Module-4

7 a. Derive an expression for fault current when single line to ground fault occurs through a fault impedance Z_f in a power system. Draw the sequence network to represent the fault. **(10 Marks)**

b. For one conductor open fault in a power system, derive an expression for fault current. **(06 Marks)**

OR

8 a. What are the boundary/terminal condition in relation to the unsymmetrical faults. Mention the boundary conditions for LG, LL, LLL and LLG fault. **(06 Marks)**

b. A syn motor is receiving 10 MW of power at 0.8 pf lag at 6 kV. A LG fault takes place at the middle point of the transmission line as shown in Fig. Q8 (b), find the fault current. The ratings of the generator motor and transformer are as under.

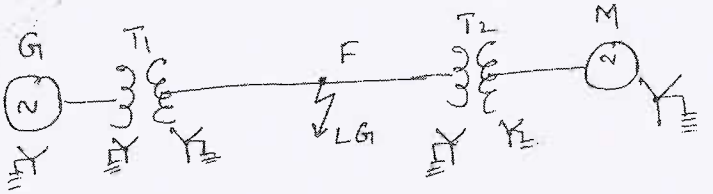

Fig. Q8 (b)

Generator: 20 MVA, 11 kV, $X_1 = 0.2$ pu, $X_2 = 0.1$ pu, $X_0 = 0.1$ pu

T_1 : 18 MVA, $^{11.5}/_{34.5}$ kV , X = 0.1 pu

T_2 : 15 MVA, $^{6.9}/_{34.5}$ kV , X = 0.1 pu

M : 15 MVA, 6.9 kV, $X_1 = 0.2$ pu, $X_2 = X_0 = 0.1$ pu

Transmission line : $X_1 = X_2 = 5\ \Omega$, $X_0 = 10\ \Omega$ **(10 Marks)**

Module-5

9 a. Briefly explain (i) Steady state stability (ii) Transient stability. **(06 Marks)**

b. A loss free alternator supplies 50 MW to an infinite bus, the SSSL being 100 MW. Determine if the alternator will remains stable if the input to the prime moves of the alternator is abruptly increased by 40 MW. **(10 Marks)**

OR

10 a. State and explain equal area criteria. What are the assumptions made in applying EAC? Discuss. **(06 Marks)**

b. The transfer reactances between a generator and an infinite bus bar operating at 200 kV under various conditions on inter connection are:

Prefault : 150 Ω per phase.

During fault : 400 Ω per phase

Past fault : 200 Ω per phase

If the fault is cleared when the rotor has advanced 60° electrical from the prefault position, determine the maximum load that could be transferred without loss of stability. **(10 Marks)**

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CBCS Scheme

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15EE62

Sixth Semester B.E. Degree Examination, June/July 2018
Power System Analysis – I

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. With suitable example explain one line diagram and discuss the elements represented. **(06 Marks)**

b. Draw the per unit reactions diagram for the power system shown in Fig. Q1 (b). Selecting the generator rating as the base. Also find the generator terminal voltage.

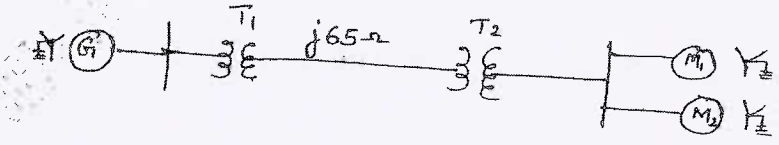

Fig. Q1 (b)

The ratings of the various components are,
G = 13.8 kV, 25 MVA, X″ = j0.15 pu ;
T_1 = 13.2/69 kV, 25 MVA, X = j0.11 pu; T_2 = 69/13.2 kV, 25 MVA, X = j0.11 pu;
M_1 = 13 kV, 15 MVA, X″ = j0.15 pu ; M_2 = 13 kV, 10 MVA, X″ = j0.15 pu
Determine the generator terminal voltage when both the motors operate at 12 kV 75% full load and unity power factor. **(10 Marks)**

OR

2 a. With help of typical electrical power system, explain impedance and reactance diagram and mention the assumptions made in that. **(06 Marks)**

b. The schematic diagram of a radial transmission system is shown in Fig. Q2 (b). The ratings and reactance of the various components are show there in. A load of 60 MW at 0.9 p.f lagging is tapped from 66 kV sub station which is to be maintained at 60 kV. Calculate the terminal voltages of the machine. Represent the transmission line and transformer by series reactance only. **(10 Marks)**

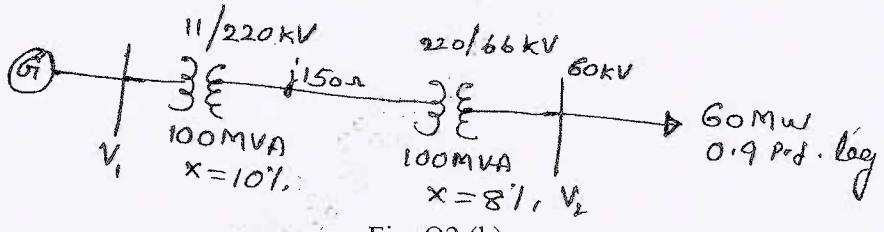

Fig. Q2 (b)

Module-2

3 a. What is the significance of transient and subtransient reactances in short circuit studies. Distinguish between transient and subtransient reactances of a synchronous machine. **(06 Marks)**

b. For the radial network shown in Fig. Q3 (b) a 3 phase fault occurs at point F. Determine the fault current, choose the generator ratings as base values:
Generator G_1: 10 MVA, 11 kV, X″ = 15% ; Generator G_2: 10 MVA, 11 kV, X″ = 12.5%
Transformer T_1 : 10 MVA, 11/33 kV, X = 10%; Transformer T_2 : 5 MVA, 33/6.6 kV, X= 8%
Overhead line impedance z = +j Ω; Feeder impedance z = (0.135 + j0.08) Ω/km **(10 Marks)**

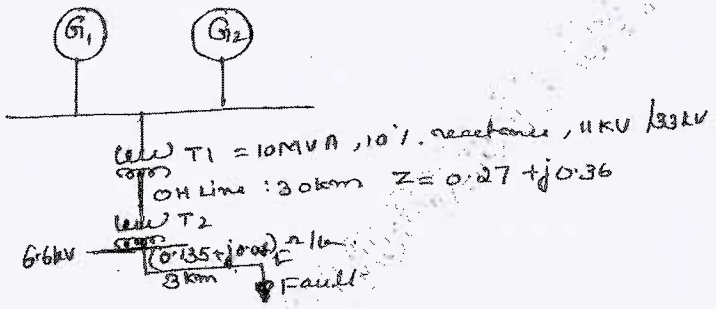

Fig. Q3 (b)

OR

4 a. What is doubling effect in a transmission line? Substantiate with equations. **(06 Marks)**

b. Generator G_1 and G_2 are identical and rated 11 kV, 20 MVA and have a transient reactance of 0.25 pu at own MVA base. The transformer T_1 and T_2 are also identical and are rated 11/66 kV, 5 MVA and have a reactance of 0.06 p.u. to their own MVA base. The tie line is 50 km long each conductor has a reactance of 0.848 Ω/km. The three phase fault is assumed at F, 20 km from generator G_1, as shown in Fig. Q4 (b). Find the short circuit current. **(10 Marks)**

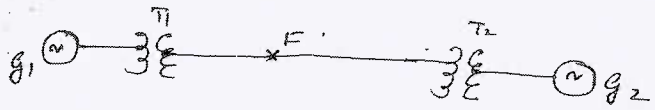

Fig. Q4 (b)

Module-3

5 a. What are symmetrical components and explain how they are useful in solving the power system problems. **(04 Marks)**

b. Prove that : (i) $(1+\alpha+\alpha^2)=0$ (ii) $(\alpha-\alpha^2)=j\sqrt{3}$ (iii) $(\alpha^2-\alpha)=-j\sqrt{3}$ **(04 Marks)**

c. A balanced delta connected load is connected to a 3 phase symmetrical supply. The line currents are each 10 A in magnitude. If fuse in one of the lines blows out. Determine the sequence components of line currents. **(08 Marks)**

OR

6 a. Explain the concept of phase shift in star delta transformer bank. **(06 Marks)**

b. Draw the positive, negative and zero sequence networks for the power system shown in Fig Q6 (b).

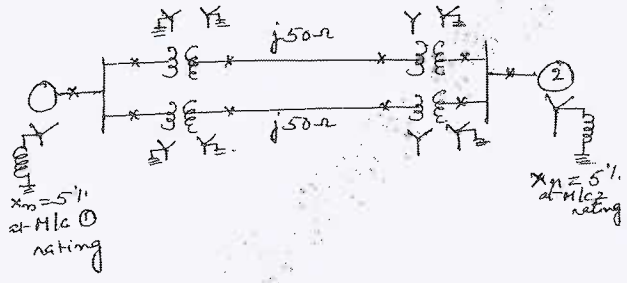

Fig. Q6 (b)

Choose a base of 50 MVA, 220 kV in the 50 Ω transmission lines and mark all reactances in p.u. The ratings of the generators and transformers are:

Generator 1 : 25 MVA, 11 kV, X″ = 20 % ; Generator 2 : 25 MVA, 11 kV, X″ = 20 %

Three phase transformer (each) : 20 MVA, $^{11Y}/_{220Y}$ kV, X = 15%

The negative sequences reactance of each syn machine is equal to the sub transient reactance. The zero sequence of each machine is 8%. Assume that the zero sequence of lines of lines are 250% of their positive sequence reactance. **(10 Marks)**

Module-4

7 a. Derive an expression for fault current when single line to ground fault occurs through a fault impedance Z_f in a power system. Draw the sequence network to represent the fault. **(10 Marks)**

b. For one conductor open fault in a power system, derive an expression for fault current. **(06 Marks)**

OR

8 a. What are the boundary/terminal condition in relation to the unsymmetrical faults. Mention the boundary conditions for LG, LL, LLL and LLG fault. **(06 Marks)**

b. A syn motor is receiving 10 MW of power at 0.8 pf lag at 6 kV. A LG fault takes place at the middle point of the transmission line as shown in Fig. Q8 (b), find the fault current. The ratings of the generator motor and transformer are as under.

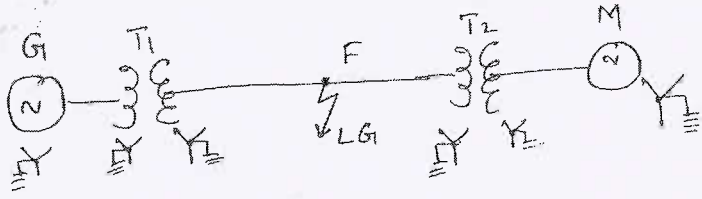

Fig. Q8 (b)

Generator: 20 MVA, 11 kV, $X_1 = 0.2$ pu, $X_2 = 0.1$ pu, $X_0 = 0.1$ pu

T_1 : 18 MVA, $^{11.5}/_{34.5}$ kV , X = 0.1 pu

T_2 : 15 MVA, $^{6.9}/_{34.5}$ kV , X = 0.1 pu

M : 15 MVA, 6.9 kV, $X_1 = 0.2$ pu, $X_2 = X_0 = 0.1$ pu

Transmission line : $X_1 = X_2 = 5\ \Omega$, $X_0 = 10\ \Omega$ **(10 Marks)**

Module-5

9 a. Briefly explain (i) Steady state stability (ii) Transient stability. **(06 Marks)**

b. A loss free alternator supplies 50 MW to an infinite bus, the SSSL being 100 MW. Determine if the alternator will remains stable if the input to the prime moves of the alternator is abruptly increased by 40 MW. **(10 Marks)**

OR

10 a. State and explain equal area criteria. What are the assumptions made in applying EAC? Discuss. **(06 Marks)**

b. The transfer reactances between a generator and an infinite bus bar operating at 200 kV under various conditions on inter connection are:

Prefault : 150 Ω per phase.

During fault : 400 Ω per phase

Past fault : 200 Ω per phase

If the fault is cleared when the rotor has advanced 60° electrical from the prefault position, determine the maximum load that could be transferred without loss of stability. **(10 Marks)**

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CBCS SCHEME

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15EE63

Sixth Semester B.E. Degree Examination, June/July 2018
Digital Signal Processing

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Compute the N-point DFT of the signal
$x(n) = a^n$; $0 \le n \le N-1$ **(04 Marks)**

b. Using formula to find DFT, compute 4-point DFT of causal signal given by ,
$x(n) = \frac{1}{3}$; $0 \le n \le 2$
$= 0$; elsewhere
Also sketch the magnitude and phase spectra. **(08 Marks)**

c. Consider a length – 12 sequence defined for $0 \le n \le 11$; x(n) = (8, 4, 7, –1, 2, 0, –2, – 4. –5, 1, 4, 3) with 12-point DFT given by X(k) ; $0 \le k \le 11$. Evaluate the following function without computing the DFT $\sum_{k=0}^{11} e^{\frac{-j4\pi}{6}K} X(k)$. **(04 Marks)**

OR

2 a. A discrete time LTI system has impulse response $h(n) = 2\delta(n) - \delta(n-1)$. Determine the output of the system if the input is $x(n) = \delta(n) + 3\delta(n-1) + 2\delta(n-2) - \delta(n-3) + \delta(n-4)$ using circular convolution by circular array method. Verify the result using formula based method. **(08 Marks)**

b. Find the output y(n) of a filter whose impulse response is given by h(n) = (3, 2, 1, 1) and input signal is given by x(n) = (1, 2, 3, 3, 2, 1, –1, –2, –3, 5, 6, –1, 2, 0, 2, 1) using Overlap – Add method. Use 7-point circular convolution in your approach. **(08 Marks)**

Module-2

3 a. An 8-point sequence is given by
x(n) = (2, 2, 2, 2, 1, 1, 1, 1).
Compute its DFT by a Radix-2 DIT-FFT algorithm. **(08 Marks)**

b. Derive the algorithm for N = 8 and write the complete signal flow graph. **(08 Marks)**

OR

4 a. The first 5-points of the 8-point DFT of a real valued sequence is given by X(0) = 4, X(1) = 1– j2.414, X(2) = 0, X(3) = 1 – j0.414 and X(4) = 0. Write the remaining points and hence find the sequence x(n) using inverse radix-2 DIT-FFT algorithm. **(08 Marks)**

b. If $x_1(n) = (1, 2, 0, 1)$ and $x_2(n) = (1, 3, 3, 1)$, obtain $x_1(n)$ Ⓝ $x_2(n)$ by using DIF-FFT algorithm. **(08 Marks)**

Module-3

5 a. Convert the following second order analog filter with system transfer function $H(s) = \frac{b}{(s+a)^2 + b^2}$ into a digital filter with infinite impulse response by the use of impulse invariance mapping technique. Also find H(z) if $H_a(s) = \frac{1}{s^2 + 2s + 2}$ **(08 Marks)**

b. Explain bilinear transformation method of converting analog filter into digital filter. Show the mapping from s-plane to z-plane. Also obtain the relation between ω and Ω. **(08 Marks)**

OR

6 a. A digital lowpass filter is required to meet the following specifications :
(i) Monotonic pass band and stop band (ii) –3.01 dB cutoff frequency of 0.5π rad
(iii) Stopband attenuation of atleast 15 dB at 0.75π rad. Find the system function H(z). Use bilinear transformation technique. **(08 Marks)**

b. Design a second order bandpass digital Butterworth filter with passband of 200 Hz to 300 Hz and sampling frequency of 2000 Hz using bilinear transformation method. **(08 Marks)**

Module-4

7 a. Design a digital Chebyshev type-I filter that satisfies the following constraints:

$0.8 \le |H(w)| \le 1 \quad ; \quad 0 \le w \le 0.2\pi$

$|H(w)| \le 0.2 \quad ; \quad 0.6\pi \le w \le \pi$

Use impulse invariant transformation. **(08 Marks)**

b. Design a high pass filter H(z) to be used to meets the specifications shown in Fig.Q7(b) below. The sampling rate is fixed at 1000 samples/sec. Use bilinear transformation.

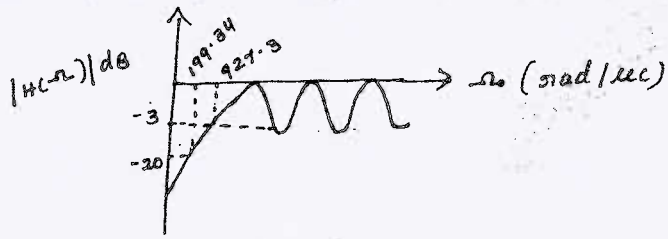

Fig.Q7(b) **(08 Marks)**

OR

8 a. Obtain the direct form-I and direct form-II structure for the system given by

$$H(z) = \frac{z^{-1} - 3z^{-2}}{(10 - z^{-1})(1 + 0.5z^{-1} + 0.5z^{-2})}$$ **(08 Marks)**

b. Draw the cascade form structure for the system given by

$$H(z) = \frac{\left(1 - \frac{1}{2}z^{-1}\right)}{\left(1 - \frac{1}{4}z^{-1} + \frac{1}{2}z^{-2}\right)\left(1 - \frac{1}{5}z^{-1} + \frac{1}{6}z^{-2}\right)}$$ **(04 Marks)**

c. A digital system is given by $H(z) = \frac{1 - \frac{1}{2}z^{-1}}{\left(1 - \frac{1}{3}z^{-1}\right)\left(1 - \frac{1}{4}z^{-1}\right)}$

Obtain the parallel form structure. **(04 Marks)**

Module-5

9 a. Explain why windows are necessary in FIR filter design. What are the different windows used in practice? Explain in brief. **(08 Marks)**

b. The desired frequency response of a lowpass filter is given by

$$H_d(w) = \begin{cases} e^{-j3w} & ; \quad |w| < 3\pi/4 \\ 0 & ; \ 3\pi/4 < |w| < \pi \end{cases}$$

Determine the coefficients of impulse response and also determine the frequency response of the FIR filter if Hamming window is used with N = 7. **(08 Marks)**

OR

10 a. Design a normalized linear phase FIR filter having the phase delay of $\tau = 4$ and atleast 40 dB attenuation in the stopband. Also obtain the magnitude/frequency response of the filter **(08 Marks)**

b. Realize the system function given by $H(z) = 1 + \frac{5}{2}z^{-1} + 2z^{-2} + 2z^{-3}$ in direct form. **(04 Marks)**

c. Realize the digital filter with system function given by,

$H(z) = 1 + \frac{1}{2}z^{-1} + \frac{1}{3}z^{-2} + \frac{1}{7}z^{-3} + \frac{1}{3}z^{-4} + \frac{1}{2}z^{-5} + z^{-6}$ in linear phase form. **(04 Marks)**

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CBCS SCHEME

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15EE64

Sixth Semester B.E. Degree Examination, June/July 2018
Electrical Machine Design

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. What are the limitations involved, in design of electrical machines? **(08 Marks)**

b. List the insulating materials and how they classified based on thermal consideration and list the properties of insulting materials. **(08 Marks)**

OR

2 a. What are the advantages of modern trends in design and manufacturing technique? **(08 Marks)**

b. Distinguish between aluminum and copper wires. **(08 Marks)**

Module-2

3 a. Discuss how specific magnetic and specific electric loading plays an important role in the design of electrical machine. **(08 Marks)**

b. A 5KW, 250V, 4pole, 1500rpm, shunt generation is designed to have a square pole face. The loadings are average flux density in the gap = 0.42 wb/m^2 and ampere conductors per meter is 15000. Find the main dimensions of the machine. Assume full load efficiency = 0.87 ratio of pole arc to pole pitch = 0.66. **(08 Marks)**

OR

4 a. With usual notations, derive output equation for a DC machine. **(06 Marks)**

b. A design is required for a 50KW, 4pole, 600rpm DC shunt generator, the full load terminal voltage being 220V, if the maximum gap density is 0.83 wb/m^2 and the armature ampere conductors per meter are 30000, calculate suitable dimensions of armature core to give a square pole face. Assume that the full load armature voltage drop is 3% of the rated terminal voltage and that the field current is 1% of rated full load current, ratio of pole arc to pole pitch is 0.67. **(10 Marks)**

Module-3

5 a. What is windows space factor? Find the width of the window for the optimum output of a transformer. **(08 Marks)**

b. Calculate the core and window arc as required for a 1000KVA, 6600/400V, 50Hz 1ϕ core type transformer. Assume a maximum flux density of 1.25wb/m^2 and a current density of 2.5A/mm^2. Voltage/turn = 30V windows space factor = 0.32. **(08 Marks)**

OR

6 a. Derive an expression for the leakage reactance of a core type transformer with concentric coils of equal height state clearly the assumptions made. **(09 Marks)**

b. Design a suitable cooling tank with cooling tubes for a 500KVA, 6600/440V, 50Hz, 3ϕ transformer with the following data :
Distance between centre of adjacent limbs = 0.47m
Outer dia of H.V. winding = 0.44m
Height of frame 1.24m
Core loss = 3.7KW a I^2R loss = 10.5KW
Temperature rise of oil should not exceed 35°C. Take dia of tube is 50mm and l_t = 1.4m. The specific heat dissipation form the tank wall is 6 w/m^2–°C and 6.5w/m^2 - °C due to radiation and convection respectively. Assume that the dissipation is improved by 35% due to convection. **(07 Marks)**

Module-4

7 a. Determine the main dimensions, number of stator slots, and the number of turns/phase of a 3.7KW, 400V, 3ϕ, 4pole, 50Hz, squirrel cage I.M to be started by a Y-Δ starter. Assume flux density in the gap = 0.45wb/m^2 amp conduction/meter = 23000, η = 0.85 p.F = 0.84 choose the main dimensions to give a cheap design. Winding factor 0.955, stacking factor = 0.9. **(08 Marks)**

b. Explain the factors which influence the length of air gap of 3ϕIM and write few empherical formulas for the length of air gap. **(08 Marks)**

OR

8 a. With usual notation, derive the o/p equation of a 3ϕ induction motor. **(08 Marks)**

b. A 11KW, 3ϕ. 6poles, 50Hz, 220V, star connects induction motor has 54 slots, each containing 9 conductors. Find the current in rotor bar and end rings. The number of bars is 64 η = 0.86 and pF = 0.85. Assume rotor mmf as 0.85 times stator mmf, Also find the size of each rotor bar and end ring if current density is 5A/mm^2. **(08 Marks)**

Module-5

9 a. Define short circuit ratio in connection with 3ϕ synchronous generators. Explain the factors affecting by short circuit ratio. **(08 Marks)**

b. Find the main dimensions of a 2500 KVA, 187.5rpm, 50Hz, 3ϕ salient pole synchronous generator. The generator is to be vertical water wheel type. The specific magnetic loading is 0.6wb/m^2. And specific electric loading is 34,000 Ac/m, use circular poles with ratio of core length to pole pitch = 0.65. Specify the type of pole construction used if the run away speed is about two times the normal speed. **(08 Marks)**

OR

10 a. Discuss any five factors to be considered in selection of number of slots in sync. Machines. **(08 Marks)**

b. What are steps involved, in design of field windings of a synchronous machine? **(08 Marks)**

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10EE61

Sixth Semester B.E. Degree Examination, June/July 2018
Power System Analysis & Stability

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. What is a per unit system? What are its advantages and disadvantages? **(06 Marks)**

b. Show that the pu impedance of a transformer is same either referred to primary or secondary side of it. **(06 Marks)**

c. The single line diagram of a power system is shown below. Draw its pu impedance diagram:

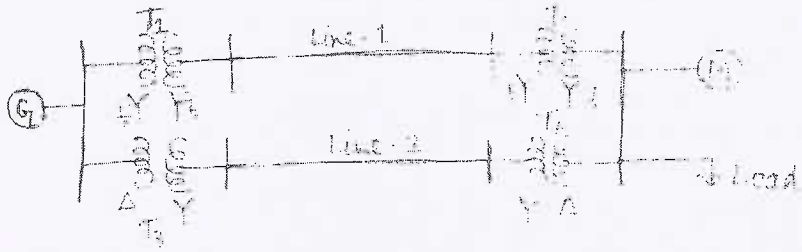

Fig. Q1 (c)

G : 90 MVA, 11 KV, X″ = 18%
T_1 : 70 MVA, 11/110 KV, X = 15%
T_2 : 60 MVA, 110/11 KV, X = 10%
T_3 : Three 1ϕ units each rated 10 MVA, 11/127 KV, X = 9%
T_4 : Three 1ϕ units each rated 16.6667 MVA, 127/11 KV, X = 12%
Line-1 : z = j80 Ω
Line-2 : z = j120Ω
M = 85 MVA, 11 KV, X″ = 13%
The load absorbs 74 MVA, 0.8 pf lagging at 6.5 KV. Select a common base of 100 MVA, 11 KV on the gen side. **(08 Marks)**

2 a. Define a fault that occur in a power system. What are the main causes for it? Also define the symmetrical faults. **(05 Marks)**

b. Briefly explain how a synchronous machine on no-load offers a timely varying reactance, when subjected to a sudden 3ϕ short circuit across its terminals. **(07 Marks)**

c. A transformer rated at 50 MVA and having a SC reactance of 5% is connected to the bus-bar which is supplied through two 66 KV feeder cables (lines) each having an impedance of (1.5+j2.5) Ω. One of the feeders is connected to a generating station rated at 80 MVA and having a SC reactance of 10% and the other feeder is connected to another generating station rated at 100 MVA and having SC reactance of 15%. Determine the MVA at the fault point in the event of a SC between the secondary terminals of the transformer. Choose base MVA as 400 and base KV as 66 on the generator side. The single line diagram of power system is shown in Fig. Q2 (c). **(08 Marks)**

Fig. Q2 (c)

3 a. Explain the three sets of symmetrical components with their phasor diagram. **(04 Marks)**

b. Define the complex operator 'α' and state its properties. **(04 Marks)**

c. A delta connected balanced resistive load is connected across an unbalanced three phase supply as shown below. Find the symmetrical components of line currents and delta currents. **(12 Marks)**

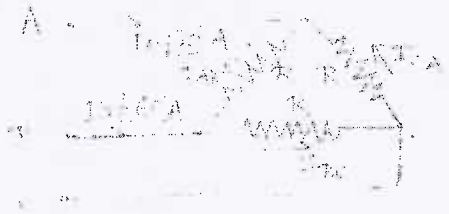

Fig. Q3 (c)

4 a. Draw the three sequence networks of an unloaded synchronous machine and transmission lines. **(05 Marks)**

b. A single line diagram of the power system is shown below. The positive, negative and zero sequence reactances of the components are given below along with their ratings. Draw the positive, negative and zero sequence networks of this power system on the base of generator ratings.

Fig. Q4 (b)

G : 30 MVA, 13.8 KV, $X'' = 0.15$ pu, $X_2 = 0.15$ pu and $X_n = 2\ \Omega$, $X_0 = 0.05$ pu

M_1 : 20 MVA, 12.5 KV, $X'' = 0.2$ pu, $X_2 = 0.15$ pu and $X_n = 2\ \Omega$, $X_0 = 0.05$ pu

M_2 : 10 MVA, 12.5 KV, $X'' = 0.2$ pu, $X_2 = 0.15$ pu and $X_0 = 0.05$ pu

T_1 : 35 MVA, 13.2/115 KV, $X = 0.1$ pu

T_2 : Three 1ϕ units each rated 10 MVA, 12.5/67 KV, $X = 0.1$ pu

Line : $X_1 = X_2 = 80\ \Omega$ and $X_0 = 250\ \Omega$ **(15 Marks)**

PART – B

5 A 25 MVA, 11 KV, 3ϕ generator has a sub transient reactance of 20%. The generator supplies two motors over a transmission line with transformers at both ends. The motors have rated inputs of 15 and 7.5 MVA, both at 10 KV with the subtransient reactance of 25%. The three phase transformers are both rated 30 MVA, 10.8/121 KV with a leakage reactance of 10% each. The series reactance of the line is 100 Ω. Assume that the negative sequence reactance of each machine is equal to its subtransient reactance. Also, assume the zero sequence reactances for the generator and motors as 0.06 pu on its own ratings. The current limiting reactors of 2.5 Ω each are connected in the neutral of the generator and motor. The zero sequence reactance of the line is 300 Ω. Select a base of 25 MVA and 11 KV in the generator circuit, then draw the positive, negative and zero sequence networks of the system. If a solid LG fault occurs at the point F as shown below, calculate the fault current at the fault point. Neglect the prefault current. **(20 Marks)**

Fig. Q5

6 a. Define an unsymmetrical fault that occur in the power system. What are its various types? **(04 Marks)**

b. Write short notes on open conductor faults in a power system. **(06 Marks)**

c. Derive an equation for fault current, if a double line to ground fault occurs with a fault impedance 'Z_f' on an unloaded synchronous generator, whose neutral is grounded through an impedance Z_n. The generator has balanced emfs and sequence impedances Z_1, Z_2 and Z_0. **(10 Marks)**

7 a. Derive a swing equation of a synchronous generator connected to an infinite bus, with usual notations. **(06 Marks)**

b. Define steady state and transient stability limits. What are the ways to improve them? **(07 Marks)**

c. A 50 Hz, four pole turbo generator rated 100 MVA, 11 KV has an inertia constant of 8.0 MJ/MVA.

(i) Find the stored energy in the rotor at synchronous.

(ii) If the mechanical input is suddenly raised speed to 80 MW for an electrical load of 50 MW, find the rotor acceleration neglecting mechanical and electrical losses.

(iii) If the above mentioned acceleration is maintained for 10 cycles, find the change in torque angle and rotor speed at the end of this period. **(07 Marks)**

8 a. What is equal area criterion? Explain the equal area criterion of stability when there is a sudden loss of one of the parallel lines shown below. **(10 Marks)**

Fig. Q8 (a)

b. Explain in detail, the measurement of negative and zero sequence impedances of synchronous machines. **(10 Marks)**

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10EE62

Sixth Semester B.E. Degree Examination, June/July 2018
Switchgear and Protection

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define and explain the following terms related to fuse i) Fusing factor ii) Prospective current iii) Cut-off current. **(08 Marks)**

b. Explain with a neat sketch the construction and working of H.R.C fuse with tripping device. **(07 Marks)**

c. Write short notes on Isolating switch and load breaking switch. **(05 Marks)**

2 a. Explain in detail the theories which explain the arc extension phenomenon. **(10 Marks)**

b. Write a note on interruption of capacitive current. **(06 Marks)**

c. Calculate the RRRV of 132kV circuit breaker with neutral earthed. S.C data as follows; Broken current is symmetrical; restriking voltage has frequency 20KHz, p.f. 0.15. Assume fault is also earthed. **(04 Marks)**

3 a. With a neat sketch, explain in brief, the working principle of Axial and cross blast air circuit breakers. **(10 Marks)**

b. With neat sketch explain the working and construction of Non-puffer type SF_6 Breaker. **(10 Marks)**

4 a. Write a note on: i) Unit testing ii) Synthetic testing. **(10 Marks)**

b. Briefly explain the classification of surge Arrester, and explain the principle of operation of a typical surge diverter. **(10 Marks)**

PART – B

5 a. Discuss the essential qualities of protective relaying. **(10 Marks)**

b. With neat diagram, explain the working principle of Non-directional induction type over current Relay. **(10 Marks)**

6 a. With a neat sketch and vector diagram, explain how a negative phase sequence relay is employed for protection of electrical power system. **(10 Marks)**

b. Explain the construction and working, principle of MHO Relay. **(10 Marks)**

7 a. With neat diagram, explain the restricted earth fault protection of Generator. **(07 Marks)**

b. Explain the rotor earth fault protection of generators. **(07 Marks)**

c. A 6,600V 3-phase tube alternator has a maximum continuous rating of 2,000kW at 0.8p.f and its reactor is 12.5%. It is equipped with merz price circulating current protection which is not set to operate at fault current not less than 200 Amperes. Find what value of the neutral earthing leaves 10% of the winding unprotected. **(06 Marks)**

8 a. With a neat sketch explain the merz price protection for γ – D transformer. **(08 Marks)**

b. With a neat sketch, explain the working of single phase preventer used for induction motor. **(08 Marks)**

c. Write a short note on phase reversal protection in Induction motor. **(04 Marks)**

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10EE63

Sixth Semester B.E. Degree Examination, June/July 2018
Electrical Machine Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Mention the desirable properties of electrical insulating materials. Also give the classification of insulation materials based on temperature with an example for each. **(10 Marks)**

b. Define specific electrical and magnetic loadings for DC machines. Derive the output equation of DC machine both as motor and generator. **(10 Marks)**

2 a. Explain factors that influence the choice of number of poles in case of a d.c. machine. **(10 Marks)**

b. A shunt field coil has to develop an mmf of 9000 A. The voltage drop in the coil is 40V, and the resistivity of round wire used is 0.021 Ω/m and mm^2. The depth of winding is 35 mm approximate and the length of mean turn is 1.4 m. Design a coil so that the power dissipated is 700 W/m^2 of the total coil surface (i.e., outer, inner, top and bottom). Take the diameter of the insulated wire 0.2 mm greater than that of bare wire. **(10 Marks)**

3 a. Derive the output equation of a 3-phase core type transformer. **(10 Marks)**

b. Calculate approximate overall dimensions for a 200 kVA, 6600/440V, 50Hz, 3-ϕ core type transformer. The following data may be assumed :
emf/turn = 10 V ; maximum flux density = 1.3 Wb/m^2 ; current density = 2.5A/mm^2.
Window space factor = 0.3 ; overall height = overall width ; stacking factor = 0.9.
Use a 3-stepped core ; Width of largest stamping = 0.9 d and net iron area = 0.6 d^2, where 'd' is the diameter of circumscribing circle. **(10 Marks)**

4 a. Derive an expression for leakage reactance of a transformer with primary and secondary cylindrical coils of equal length, stating clearly the assumptions made. **(10 Marks)**

b. A 1000 kVA, 6600/440 V, 50 Hz, 3-d Δ/Y, core type, oil immersed, natural cooled (ON) transformer. The design data of the transformer is Distance between centres of adjacent limbs = 0.47m, outer diameter of high voltage winding = 0.44 m, height of frame = 1.24 m, core loss = 3.7 kW and I^2R loss = 10.5 kW. Design a suitable tank for the transformer. The average temperature rise of oil should not exceed 35°C.

The specific heat dissipation from the tank walls is 6 W/m^2 °C and 6.5 W/m^2 °C due to radiation and convection respectively. Assume that the convection is improved by 35% due to provision of tubes. **(10 Marks)**

PART – B

5 a. Explain the factors to be considered while selecting length of airgap in an induction motor. **(10 Marks)**

b. Determine the main dimensions, number of radial ventilating ducts, number of stator slots and the number of turns per phase of a 3.7 kW, 400 V, 3 phase, 4 pole, 50 Hz, squirrel cage induction motor to be started by a star delta starter. Assume : Average flux density in the airgap = 0.45 Wb/m^2, ampere conductors per metre = 23000, efficiency = 0.85 and power factor = 0.84. Ratio of length to pole pitch = 1.5. **(10 Marks)**

6 a. A 90 kW, 500 V, 50 Hz, 3-ϕ, 8 pole induction motor has a star connected stator winding accommodated in 63 slots with 6 conductors/slot. If the slipring voltage on open circuit is to be about 400 V, find a suitable rotor winding, stating (i) Number of slots, (ii) Number of conductors/slots, (iii) Coil span, (iv) Slipring voltage on open circuit (v) Approximate full load current/phase in rotor. Assume efficiency = 0.9, p.f. = 0.86. **(10 Marks)**

b. Find the magnetizing current, no load current, no load power factor of a 15 HP, 440 V, 6 pole, delta connected slip ring induction motor having the following data :
Number of stator slots = 54, conductors/slot = 28, flux/pole = 8.25 MWb, gap area/pole = 183.5 cm^2 , gap length = 0.55 mm, iron losses = 510 W, friction and windage losses = 110 W, gap expansion coefficient = 1.33. Iron parts of magnetic circuit requires 20% of ATS required for the gap $kw_1 = 0.96$. **(10 Marks)**

7 a. Define short circuit ratio and explain the effects on the design of an alternator. **(10 Marks)**

b. Determine a suitable number of slots and conductors per slot for the stator winding of a 3-phase, 3300 V, 50 Hz, 300 rpm alternator. The diameter is 2.3 m and the axial length of core is 0.35 m. The maximum flux density in the airgap should be approximately 0.9 Wb/m^2. Assume sinusoidal flux distribution. Use single layer winding and star connection for stator. **(10 Marks)**

8 Write short notes on any four :

a. Factors to be considered in selection of number of slots in synchronous machines

b. Cooling of transformer

c. Cogging and crawling of induction motor

d. Magnetic materials used in electrical machines

e. Design procedure for designing of field winding of a salient pole alternator. **(20 Marks)**

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10EE64

Sixth Semester B.E. Degree Examination, June/July 2018
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1 a. Find the N-point DFT of sequence $x(n) = an$, $0 \le n \le N - 1$. **(06 Marks)**

b. State and prove circular convolution property. **(06 Marks)**

c. Determine the DFT of the sequence $x(n) = n^2$, $0 \le n \le 7$. **(08 Marks)**

2 a. A discrete time LTI system has impulse response $h(n) = 2\delta(n) - \delta(n-1) + 2\delta(n-2)$. Determine the output of the system if the input is $x(n) = 4\delta(n) - 4\delta(n-1) + 8\delta(n-2) - 8\delta(n-3)$; using circular convolution. **(04 Marks)**

b. Using overlap and save method, determine output y(n) of a filter whose impulse response is $h(n) = \{1, 2, 3\}$ and input $x(n) = \{1, -1, 2, -2, 3, -3, 4, -4\}$. Use 6 point circular convolution. **(10 Marks)**

c. Consider the sequence $x(n) = 2\delta(n) + 3\delta(n-1) + 4\delta(n-2) + 5\delta(n-3)$. Compute 6 point DFT of the sequence x(n). Also determine the finite length sequence y(n), that has 6 point DFT $Y(K) = W_6^{4k} X(K)$. **(06 Marks)**

3 a. Determine the 8-point DFT of sequence $x(n) = 2(n+1)$, using DIF-FFT algorithm. Also plot magnitude and phase spectra. **(12 Marks)**

b. Develop DITFFT algorithm for decomposing the DFT for N = 9 with flow diagrams. **(08 Marks)**

4 a. Determine IDFT using DIT-FFT for given frequency samples $x(k) = \{0, 2 - j4.828, 0, 2 - j0.828, 0, 2 + j0.828, 0, 2 + j4.828\}$ **(10 Marks)**

b. Explain in-place computation technique in FFT algorithm. **(05 Marks)**

c. Calculate the number of multiplications and additions required in DFT and FFT, with 32 point sequence. Also find the speed improvement factor and number of stages. **(05 Marks)**

PART – B

5 a. Compare IIR & FIR filters. **(04 Marks)**

b. Explain the transformation of an analog normalized lowpass filter into analog lowpass, high pass filter using frequency transformation methods. **(06 Marks)**

c. A digital lowpass filter is required to meet the following specifications:
(i) Monotonic passband and stopband.
(ii) – 3.01 dB cutoff frequency of 0.5π rad.
(iii) Stopband attenuation of atleast 15 dB at 0.75π rad.
Find the system function H(z) and the difference equation realization. **(10 Marks)**

6 a. Derive the bilinear transformation for transforming an analog filter to a digital filter. **(10 Marks)**

b. Design a Butterworth analog highpass filter that will meet the following specifications.
(i) maximum passband attenuation = 4 dB
(ii) passband edge frequency = 400 rad/sec
(iii) minimum stopband attenuation = 40 dB
(iv) stopband edge frequency = 200 rad/sec. **(10 Marks)**

7 a. Design a Chebyshev I filter to meet the following specifications:
(i) Passband ripple : ≤ 2 dB
(ii) Passband edge 1 rad/sec
(iii) Stopband attenuation ≥ 20 dB
(iv) Stopband edge 1.3 rad/sec **(10 Marks)**

b. Determine the Butterworth polynomial of the order N = 5. **(10 Marks)**

8 a. Obtain cascade realization for a system having the following system function :

$$H(z) = \frac{(z-1)(z-2)(z+1)z}{\left(z-\frac{1}{2}-j\frac{1}{2}\right)\left(z-\frac{1}{2}+j\frac{1}{2}\right)\left(z-j\frac{1}{4}\right)\left(z+j\frac{1}{4}\right)}$$ **(05 Marks)**

b. Obtain parallel realization for the given system

$$H(z) = \frac{\left(1+z^{-1}\right)\left(1+2z^{-1}\right)}{\left(1+\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)\left(1+\frac{1}{8}z^{-1}\right)}$$ **(05 Marks)**

c. Realize an FIR linear phase filter for N even, and hence realize the following system filter :

$$h(n) = \delta(n) + \frac{1}{16}\delta(n-1) - \frac{1}{32}\delta(n-2) + \frac{1}{16}\delta(n-3) + \delta(n-4).$$ **(10 Marks)**

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