B.L.D.E Association"s

VACHANA PITAMAHA DR.P.G.HALAKATTI

COLLEGE OF ENGINEERING AND TECHNOLOGY ,VIJAYPUR

LIBRARY AND INFORMATION CENTER

QUESTION PAPERS

3rd, 4th, 5th 6th, 7th AND 8th SEMESTER

ELECTRICAL ENGINEERING

DEC.2016-JAN.2017

INDEX

USN | | | | | | | | | | |

10EE36

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Electric Power Generation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With a neat block diagram, explain the working of a geothermal power plant. **(06 Marks)**

b. What is co-generation? Explain with necessary block diagrams the concept of cogeneration. **(08 Marks)**

c. Write a brief note on combined heat and power distributed generation. **(06 Marks)**

2 a. Explain gas turbine power plant with a neat sketch. **(08 Marks)**

b. How do you classify the hydro electric plants? Explain clearly. **(08 Marks)**

c. What are the points to be considered for the selection of diesel power plant? **(04 Marks)**

3 a. Explain working of hydro-electric power plant, with a neat sketch. **(10 Marks)**

b. Discuss the function of elements present in thermal power plant and sketch the structure of thermal power plant. **(10 Marks)**

4 a. With a neat sketch, explain clearly the main parts of a nuclear reactor. **(10 Marks)**

b. Explain the advantages and disadvantages of nuclear power plant. Also explain the various methods of nuclear waste disposal. **(10 Marks)**

PART – B

5 a. Define the following terms as applied to power system.
i) Load Factor
ii) Demand Factor
iii) Diversity Factor
iv) Plant Capacity Factor
v) Plant Use Factor **(10 Marks)**

b. A generating station supplied the following loads: 150 MW, 120 MW, 85 MW, 60 MW and 5 MW. The station has a maximum demand of 220 MW. The annual load factor of the station is 48 percent. Calculate
i) the number of units supplied annually.
ii) the diversity factor
iii) the demand factor. **(05 Marks)**

c. A generating station has a maximum demand of 500 MW. The annual load factor is 50% and capacity factor is 40%. Find the reserve capacity of the plant. **(05 Marks)**

6 a. What is meant by tariff? Mention its objectives. **(06 Marks)**

b. With a neat sketch, explain single bus bar with sectionalizing scheme. **(06 Marks)**

c. A capital cost of a hydro-power station of 100 MW capacity is 1000 per KW. The annual depreciation charges are 15% of the capital cost. The royalty of ₹ 2 per KW per year and 0.03 per kwh generated is to be paid for using the river water for generation of power. The maximum demand on the power station is 70 MW and annual load factor is 60%. Annual cost of salaries, maintenance charges etc. is 10,00,000. If 20% of this expense is also chargeable as fixed charges, calculate the generation cost in two part form. **(08 Marks)**

7 a. With a neat sketch and phasor diagram, explain resonant grounding. **(12 Marks)**

b. With a neat sketch, explain the grounding system through an earthing transformer. **(08 Marks)**

8 a. With a neat sketch, explain ungrounded system in power system. **(10 Marks)**

b. With a neat sketch, explain solid grounding. **(10 Marks)**

* * * * *

CBCS Scheme

USN | | | | | | | | | | |

15EE32

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Electric Circuit Analysis

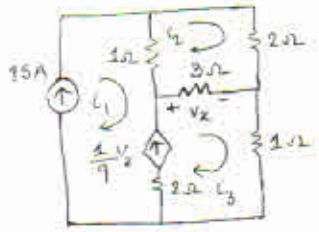
Time: 3 hrs. Max. Marks: 80

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

Module-1

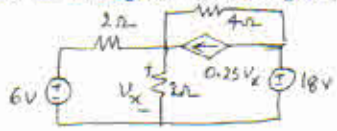
1 a. Find the three unknown currents in the circuit shown in Fig.Q.1(a) using mesh analysis. **(08 Marks)**

Fig.Q.1(a)



b. Find V_x in the circuit diagram shown in Fig.Q.1(b) using source transformation. **(08 Marks)**

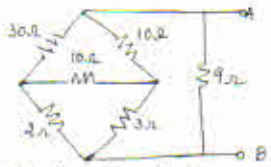
Fig.Q.1(b)



OR

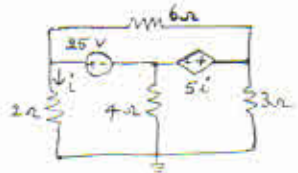
2 a. Determine the equivalent resistance between the terminals AB for the network shown in Fig.Q.2(a). **(05 Marks)**

Fig.Q.2(a)



b. Find the node voltage V_1, V_2 and V_3 in circuit diagram shown in Fig.Q.2(b) using nodal analysis. **(06 Marks)**

Fig.Q.2(b)

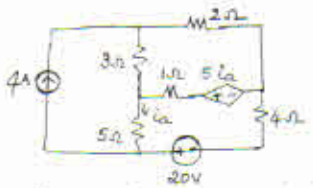


c. A series connected RLC circuit has R = 4Ω, L = 25mH. Calculate the value of C such that Q = 50. Also find resonant frequency, half power frequencies. **(05 Marks)**

Module-2

3 a. Find the current i_a in the circuit show in Fig.Q.3(a) by applying superposition theorem. **(06 Marks)**

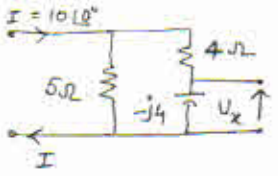
Fig.Q.3(a)



b. Obtain the condition for an alternating voltage source to transfer maximum power to the load when the load impedance is the complex conjugate of the source impedance. **(04 Marks)**

c. Find the voltage 'V_x' and apply reciprocity theorem to the network shown in Fig.Q.3(c). **(06 Marks)**

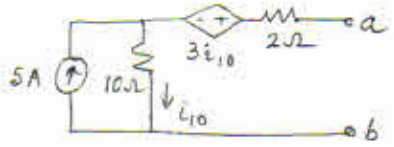
Fig.Q.3(c)



OR

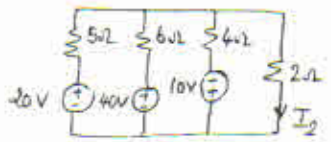
4 .a. For the network shown in Fig.Q.4(a), obtain the Norton's equivalent as seen from the terminals a – b. **(08 Marks)**

Fig.Q.4(a)



b. Determine the current I_2 by applying Millman's theorem for the network shown in Fig.Q.4(b). **(08 Marks)**

Fig.Q.4(b)

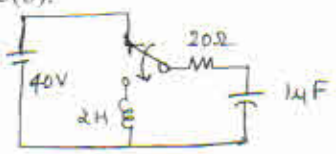


Module-3

5 a. Show the behaviour of R, L, C elements at the time of switching at $t = 0$ both at $t = 0^+$ and $t = \infty$. **(08 Marks)**

b. Determine i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$ when the switch K is moved from position 1 to 2 at $t = 0$ for the network shown in Fig.Q.5(b). **(08 Marks)**

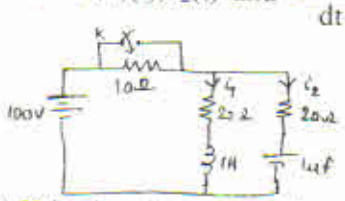
Fig.Q.5(b)



OR

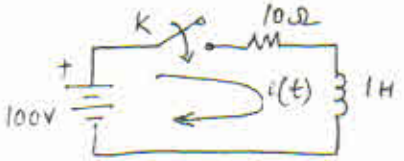
6 a. In the network shown in Fig.Q.6(a) a steady state is reached with switch 'K' open. At time $t = 0$, the switch is closed. Find at $t = 0^+$, $i_1(t)$, $i_2(t)$ and $\frac{di_1(t)}{dt}$. **(08 Marks)**

Fig.Q.6(a)



b. In the network shown Fig.Q.6(b) K is closed at $t = 0$ with zero current in the inductor. Find: i(t), $\frac{di(t)}{dt}$ at $t = 0^+$ and obtain an expression for i(t) at $t \geq 0^+$ by classical method. **(08 Marks)**

Fig.Q.6(b)

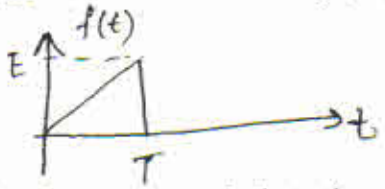


Module-4

7 a. State and prove shifting theorem. **(06 Marks)**

b. Find the Laplace transform of the waveform shown in Fig.Q.7(b). **(06 Marks)**

Fig.Q.7(b)



c. Apply the initial and final value theorem respectively to the s-domain equations of $I_1(s)$ and $I_2(s)$ given,

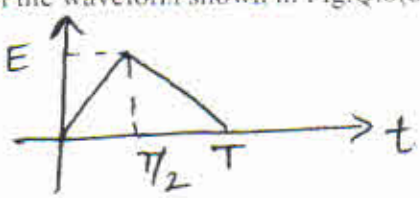
i) $I_1(s) = \dfrac{6.67(s+250)}{s(s+166.7)}$ ii) $I_2(s) = \dfrac{6.67}{s+166.7}$ **(04 Marks)**

OR

8 a. Find the Laplace transform of the shifted function given i) $10\,u(t-2)$ ii) $10\,\delta(t-2)$ iii) $10\,r(t-2)\,u(t-2)$ iv) $10\sin(t-2)\,u(t-2)$. Also sketch these functions. **(08 Marks)**

b. Find the Laplace transform of the waveform shown in Fig.Q.8(b). **(08 Marks)**

Fig.Q.8(b)



Module-5

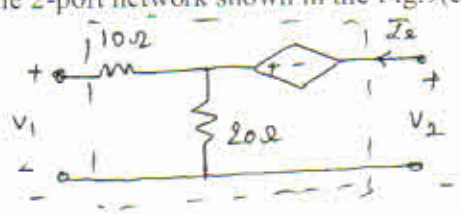
9 a. An unbalanced 3-phase, 4-wire star connected load, has balanced voltages of 208V with ABC phase sequence. Calculate the line currents and the neutral current.

$Z_A = 10\Omega$, $Z_B = 15\angle 30^\circ\ \Omega$, $Z_C = 10\angle -30^\circ\ \Omega$. **(06 Marks)**

b. Define Z and Y parameters. **(04 Marks)**

c. Find the T parameters for the 2-port network shown in the Fig.9(c). **(06 Marks)**

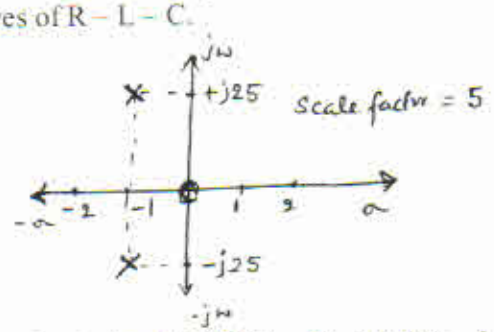
Fig.Q.9(c)



OR

10 a. A series RLC circuit has for its driving point admittance pole-zero diagram as shown in Fig.Q.10(a). Find the valves of R – L – C. **(08 Marks)**

Fig.Q.10(a)



b. Find the response i(t) when input signal i) $5\delta(t-2)$ ii) $5u(t-2)$ is given to a R – L series circuit. Assume initial current through the inductor to be zero. **(08 Marks)**

* * * * *

CBCS Scheme

USN | | | | | | | | | | |

15EE33

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Transformers and Generators

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Draw and explain the Full load phasor diagrams of single phase transformer for lagging, leading and unity power factor loads. **(06 Marks)**

b. Develop the equivalent circuit of a single phase transformer and show that the parameters of the primary and secondary winding may be combined to give a simplified equivalent circuit referred to primary side. **(05 Marks)**

c. Find the all day efficiency of single phase transformer having maximum efficiency of 98% at 15KVA at uPF and loaded as follows.
12 hours – 2kW at 0.5 pf lagging
6 hours – 2kW at 0.8 pf lagging
6 hours – No Load. **(05 Marks)**

OR

2 a. State the advantages of single three phase transformers over bank of single phase transformers. **(05 Marks)**

b. Explain with circuit diagram and phasor diagram, how two transformers connected in open delta can supply the power successfully. **(05 Marks)**

c. Two electric furnaces are supplied with 1 phase current at 80V from a 3ϕ, 1100V system by means of two single phase scott connected transformers with similar secondary windings, when the load on one furnace is 500kW and on the other 800kW, what current will flow in each of the 3 lines
i) At UPF and ii) 0.8pf lagging. **(06 Marks)**

Module-2

3 a. Discuss the necessary conditions for the parallel operation of 2 transformers. **(05 Marks)**

b. Derive an expression for the currents shared by between 2 transformers connected in parallel supplying a common load when no load voltages of these transformers are unequal. **(06 Marks)**

c. How stabilization is achieved due to the tertiary winding? **(05 Marks)**

OR

4 a. What is an Auto transformer? Derive an expression for the saving of copper in an Auto transformer as compared to an equivalent two winding transformers. What are advantages and limitations? **(08 Marks)**

b. Explain the operation of on load tap changer. **(08 Marks)**

Module-3

5 a. Discuss the harmonics in transformers. **(05 Marks)**

b. What are the sources of Noise in transformers? How to reduce the noise problem in transformers? **(05 Marks)**

c. With a circuit diagram explain in detail sumpners test for determining the efficiency and voltage regulation of transformer. **(06 Marks)**

OR

6 a. What is an armature reaction? With neat figures, explain armature reaction in DC machines under normal working conditions. **(05 Marks)**

b. What is commutation? With a neat diagram, explain the process of commutation in DC machines and explain any one method of improving commutation. **(06 Marks)**

c. Derive EMF equation of synchronous generator. **(05 Marks)**

Module-4

7 a. What is synchronization of alternators? What are the conditions for proper synchronization of alternators? How 3ϕ alternators are synchronized? **(08 Marks)**

b. Define voltage Regulation of an alternator and explain the load characteristics of alternator. **(05 Marks)**

c. Write a note on V-curves of synchronous Generator. **(03 Marks)**

OR

8 a. With a neat circuit diagram, explain the slip test on salient pole synchronous machines and indicate how X_d and X_Q can be determined from slip test. **(08 Marks)**

b. With a phasor diagram, explain the concept of two reaction theory in a salient pole synchronous machine. **(08 Marks)**

Module-5

9 a. Name the various methods for determining the voltage regulation for 3ϕ alternator and describe any one method in detail. **(08 Marks)**

b. A 2300V, 50Hz, 3ϕ star connected alternator has an effective armature resistance of 0.2Ω. A field current of 35A produces a current of 150A on short circuit and open circuit emf 780V (line). Calculate the voltage regulation at 0.8 pf lagging and 0.8pf leading for the full load current of 25A. **(08 Marks)**

OR

10 a. Write a note on capability curves of synchronous generator. **(05 Marks)**

b. What is hunting in synchronous machines? Explain the role of damper winding. **(05 Marks)**

c. With a neat sketch explain OCC and SCC characteristics of an alternator. **(06 Marks)**

* * * * *

CBCS Scheme

USN | | | | | | | | | | |

15EE34

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Analog Electronic Circuits

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Design a collector to base bias circuit for the following specifications : $V_{CC} = 10V$, $V_{CE} = 5V$, $I_C = 1mA$, $\beta = 50$. If β varies from 25 to 75, find the change in collector current. **(07 Marks)**

b. What are the different biasing circuits? Find an expression for stability factor 'S' of each biasing circuit. **(09 Marks)**

OR

2 a. Design a voltage divider biasing circuit with a supply voltage of 10V and $V_{CE} = \frac{V_{CC}}{2}$. The load resistance is 2KΩ. Take $\beta = 100$. **(09 Marks)**

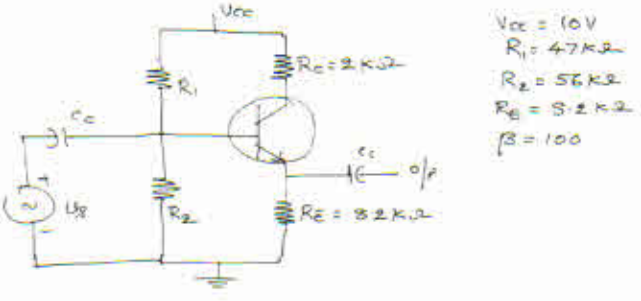
b. Explain the operation of transistor as switch along with suitable circuit and necessary waveforms. Highlight the design procedure. **(07 Marks)**

Module-2

3 a. Draw the circuit of common emitter amplifier with voltage divider biasing. Derive the expression for current gain, voltage gain, input and output impedance using the model. **(08 Marks)**

b. For the following circuit, find current gain, voltage gain, input and output impedance. **(08 Marks)**

Fig.Q3(b)



OR

4 a. Starting from fundamentals, define h parameters and obtain an h – parameter equivalent circuit of common emitter configuration. **(08 Marks)**

b. Derive suitable expressions to explain the effect of cascading of amplifiers on lower and upper cut off frequencies. **(08 Marks)**

Module-3

5 a. What is a Cascade amplifier? Draw a practical circuit with cascade connection and derive the expressions for current gain, voltage gain, input and output impedance using r_e model. **(10 Marks)**

b. Explain the block diagram of a feedback amplifier. **(06 Marks)**

OR

6 a. Draw the circuit of Darlington emitter follower with voltage divider bias. Calculate input impedance, voltage gain and output impedance. Take $\beta_1 = \beta_2 = 100$. **(08 Marks)**
$R_1 = R_2 = 100K$, $R_F = 5k\Omega$. Take $r_e = 0.1K\Omega$.

b. Draw the block diagram of voltage series feedback amplifier and find the effect of feedback on input and output impedances. **(08 Marks)**

Module-4

7 a. Draw the circuit of class – A transformer coupled power amplifier. Explain the operation of the circuit with the help of neat waveforms. Also derive an expression for maximum efficiency of conversion. **(08 Marks)**

b. Draw the circuit of Wien bridge oscillator and derive an expression for frequency of oscillator. **(08 Marks)**

OR

8 a. Explain the classification of power amplifier with neat circuit diagram and waveforms of collector current and collector voltage for each type of power amplifier. **(10 Marks)**

b. Explain the principle of operation of oscillator and the effect of loop gain ($A\beta$) on the output of oscillator. **(06 Marks)**

Module-5

9 a. With the help of neat diagrams, explain the construction, working and characteristics of n – channel JFET. **(08 Marks)**

b. For the following circuit, find voltage gain and output impedance
i) If $r_d = 20K\Omega$ ii) If $r_d = \infty$. **(08 Marks)**

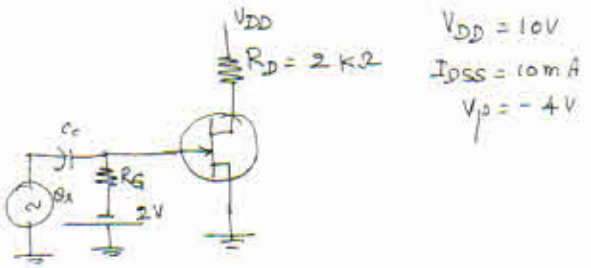


Fig.Q9(b)

OR

10 a. Explain the construction, working and characteristics of n – channel depletion MOSFET. **(08 Marks)**

b. Draw the circuit of common source amplifier using JFET, with the help of small signal model derive an expression for current gain, input impedance, voltage gain and output impedance. **(08 Marks)**

* * * * *

CBCS Scheme

USN | | | | | | | | | | |

15EE35

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Digital System Design

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Simplify the following Boolean function using K-map.
$f(v, w, x, y, z) = \Sigma m (3, 7, 8, 10, 11, 12, 14, 15, 17, 19, 21, 23, 25, 27, 29, 31) + \Sigma d (2, 6, 26, 30)$. **(08 Marks)**

b. Simplify the boolean expression using a 3-variable VEM with 'd' as MEV.
$f(a, b, c, d) = \Sigma m (1, 3, 7, 11, 15) + \Sigma d (0, 2, 5)$. **(08 Marks)**

OR

2 a. Using Quine –McCluskey method, obtain a minimal sop expression of.
$f(w, x, y, z) = \pi m (0, 4, 5, 9) \cdot d (1, 7, 13)$. **(10 Marks)**

b. Find minimal sop expression using VEM with 'c' as MEV.
$f(a, b, c, d) = \Sigma m (3, 4, 5, 7, 8, 11, 12, 13, 15)$. **(06 Marks)**

Module-2

3 a. Realize the following Boolean function using a 8:1 MUX with wyz as select inputs.
$f(w, x, y, z) = \Sigma m (0, 1, 2, 5, 7, 8, 9, 12, 13)$. **(06 Marks)**

b. Design a 1-bit comparator using 2-4 decoder giving three outputs, G, E and L. **(04 Marks)**

c. Design a carry look ahead 4-bit parallel adder. Show that the time for addition is independent of the length of operands. **(06 Marks)**

OR

4 a. Implement a full subtractor using a 4:1 multiplexer. **(06 Marks)**

b. Design a 4 to 16 decoder by cascading 2 to 4 decoders. **(05 Marks)**

c. Explain a 4 to 2 line priority encoder with active high inputs and outputs using function table. **(05 Marks)**

Module-3

5 a. Analyse the application of SRFF as switch debouncer with waveforms. **(03 Marks)**

b. Applying 4-bit shift register, design a 4-bit twisted ring counter. **(05 Marks)**

c. Design a synchronous counter with counting sequence 3, 2, 5, 1, 0, 3 . . . . Using T.FF. **(08 Marks)**

OR

6 a. Explain race around condition. How is it eliminated? **(04 Marks)**

b. Design and implement a divide by -10 asynchronous counter using T-FFs. **(05 Marks)**

c. Design a synchronous counter to give a counting sequence 0, 2, 3, 1, 0 . . . using J.K FF. **(07 Marks)**

Module-4

7 a. Construct a sequential logic circuit with single input and single output by obtaining the state and excitation table for the given state diagram using JK FF. **(08 Marks)**

b. Analyze the following sequential circuit and obtain excitation, transition and state table. Also write the state diagram. **(08 Marks)**

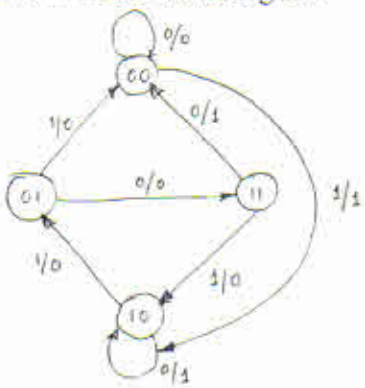


Fig Q7(a)

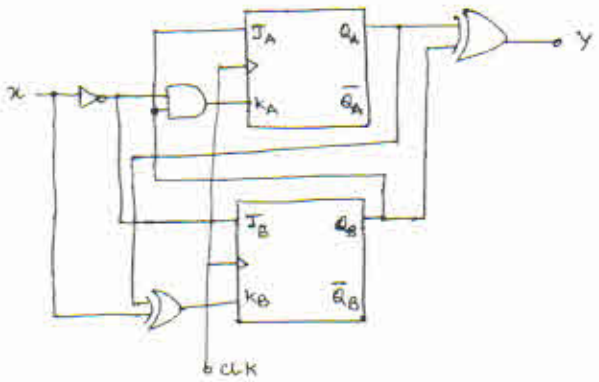


Fig Q7(b)

OR

8 a. By analyzing the sequential circuit obtain the equations for input a hence determine the excitation table, state table and state diagram. **(06 Marks)**

b. Design the sequential logic circuit for a single input and single output system from the state diagram using JKFF. Analyze through state table and excitation table **(10 Marks)**

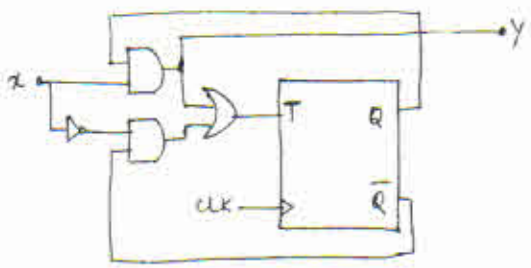


Fig Q8(a)

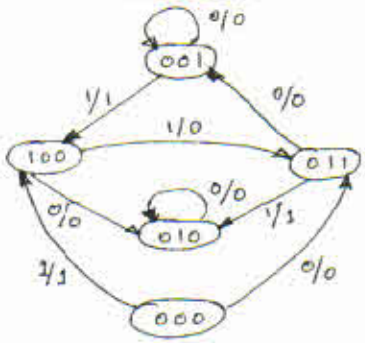


Fig Q8(b)

Module-5

9 a. Explain entity and architecture with reference to VHDL code of full adder circuit. **(06 Marks)**

b. Write VHDL code using a process and case statement to implement 4:1 multiplexer. **(04 Marks)**

c. Implement a T-FF with active low asynchronous inputs and clock input in VHDL. **(06 Marks)**

OR

10 a. Explain various data types available in VHDL. **(06 Marks)**

b. Implement a single – bit comparator for all input combinations in VHDL. **(04 Marks)**

c. Write VHDL code for edge triggered JKFF with active low asynchronous inputs. **(06 Marks)**

* * * * *

CBCS Scheme

USN | | | | | | | | | | |

15EE36

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Electrical & Electronic Measurement

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Derive the dimensions of resistance, inductance and capacitance in LMTI systems. **(06 Marks)**

b. Define the sensitivity of wheat stone's bridge, with the necessary circuit diagram. Hence deduce the expression for sensitivity of the bridge 'SB'. **(06 Marks)**

c. Explain sources and detectors used in AC bridges. **(04 Marks)**

OR

2 a. Expression for mean torque of an electrodynamometer type of wattmeter is given by $T_d \alpha M^a E^b Z^c$.
M – Mutual inductarce between fixed and moving coil.
E – applied voltage
Z – Impedance of load circuit.
Determine value of a, b and c using dimensional analysis. **(05 Marks)**

b. Derive the balancing equation for Kelvin's double bridge. **(06 Marks)**

c. A sheet of Bakelite 4.5 mm thick is tested at 50 Hz between electrodes 0.12 m in diameter. The schering bridge employs a standard air capacitor C_2 of 106 p.f. capacitance, a non reactive resistance R_4 of $\frac{1000}{\pi}\Omega$ in parallel with a variable capacitor C_4 and non-inductive variable resistance R_3. Balance is obtained with $C_4 = 0.5\ \mu F$ and $R_3 = 260\ \Omega$. Calculate the capacitance, power factor and relative permittivity of the sheet. **(05 Marks)**

Module-2

3 a. Derive the torque equation of single phase electrodynamometer type wattmeter. **(06 Marks)**

b. Explain the principle of operation of 10 W power factor wattmeter. **(06 Marks)**

c. If the reading on two wattmeters in 3-phase balanced load are 836 and 224 W, the latter reading being obtained after the reversal of current coil connections, calculate the power p.f. of the load. **(04 Marks)**

OR

4 a. Discuss the various adjustments required in energy meter for the accurate reading. **(06 Marks)**

b. A single phase kwhr meter makes 500 revolutions per kwhr. It is found on testing as making 40 revolutions in 58.1 seconds at 5 kw full load. Find out the percentage error. **(04 Marks)**

c. With the help of neat sketch, explain the construction and working of Weston frequency meter. **(06 Marks)**

Module-3

5 a. What is shunt? How it is used to extend the range of an ammeter? **(05 Marks)**

b. A moving coil meter gives a full scale deflection with a current of 5 mA. If the coil of the instrument has the resistance of 10 Ω, how it can be adopted to work as, (i) Ammeter of range 0 – 10 A (ii) Voltmeter of range (0 – 10 V). **(06 Marks)**

c. Write a note on turns compensation used in instrument transformers. **(05 Marks)**

OR

6 a. With neat circuit diagram, explain Silsbee's method of testing C.T. **(06 Marks)**

b. Explain the wattmeter method of measuring the iron loss. **(05 Marks)**

c. Explain Hop Kinson's permeameter. **(05 Marks)**

Module-4

7 a. With a block diagram, explain the working of a true R.M.S responding voltmeter. **(06 Marks)**

b. With a neat diagram, explain the working of an electronic multimeter. **(06 Marks)**

c. What are the errors in the measurement of Q-factor of a coil? Explain. **(04 Marks)**

OR

8 a. With a block diagram, explain the working of a Ramp type DVM. **(06 Marks)**

b. A coil with a resistance of 12 Ω is connected in the direct connection mode of Q meter. Resonance occurs when the oscillator frequency is 1 MHz and the resonating capacitor is set at 75 pf. Calculate the % error introduced in the calculated value of Q by the 0.02 Ω insertion resistance. **(05 Marks)**

c. With a neat block diagram, explain the principle of working of electronic energy meter. **(05 Marks)**

Module-5

9 a. Explain LED and LCD displays. **(08 Marks)**

b. Write a short note on nixie tube. **(04 Marks)**

c. Write a short note on stripchart recorder. **(04 Marks)**

OR

10 a. With a neat sketch, explain the working of a X-Y recorder. **(06 Marks)**

b. With the help of neat block diagram, explain ECG machine. Write important features of ECG machine. **(08 Marks)**

c. Write the features of EEG. **(02 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE44

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Field Theory

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State and explain Coulomb's law in vector form. **(05 Marks)**

b. Two point charges $Q_1 = -0.3nC$ at [25, –30, –15], and $Q_2 = 0.5nC$ at [–10, 8, 12] present in free space determine $\vec{E}$ at P(15, 20, 50). **(05 Marks)**

c. Given $D = 4y^2\hat{a}_x + 3x^2y\hat{a}_y + 15\hat{a}_z\ C/m^2$ verify both sides of Divergence theorem and evaluate charge enclosed within region $0 < x, y, z < 2$. **(10 Marks)**

2 a. Find out the work done in moving a charge $\rho = a$ to $\rho = b$ along with radial direction due to infinite line charge. **(06 Marks)**

b. Given a potential $V = 3x^2 + 4y^2(V)$, find the energy stored in volume described by $0 \le x \le 1m$, $0 \le y \le 1m$ and $0 \le z \le 1m$. **(06 Marks)**

c. Obtain the boundary condition between conductor and free space. **(08 Marks)**

3 a. State and prove uniqueness theorem. **(08 Marks)**

b. In spherical co-ordinates V = 0 at r = 0.1 m and V = 100 V at r = 2m. Assuming free space between the concentric spherical shell find $\vec{E}$ and $\vec{D}$. **(06 Marks)**

c. Use Laplace equation to find the capacitance between two plate of a parallel plate capacitor, separated by distance 'd" and maintained at potential "o" and "V_0" respectively. **(06 Marks)**

4 a. Find the magnetic field intensity and flux density at the centre, of a circular wire carrying a current 'I' and of radius 'a' by using Biot – Savart's law. **(06 Marks)**

b. In cylindrical co-ordinates a magnetic field is given as $\vec{H} = [4\rho - 2\rho^2]\hat{a}_\phi\ A/m\ 0 \le \rho \le 1$

i) Find the current density as a function of ρ within the cylinder

ii) Find the total current that passes through the surface $z = 0$ and $0 \le \rho \le 1m$ in $\hat{a}_z$ direction. **(06 Marks)**

c. Define vector magnetic potential and prove that $A = \frac{\mu_0}{4\pi}\int_v \frac{J}{r}\cdot dv$. **(08 Marks)**

PART – B

5 a. Derive an expression for the force between two differential current elements. **(06 Marks)**

b. The z = 0 marks the boundary between two magnetic materials. For region 1, $(z > 0)$, $\mu_1 = 4$ μH and region 2, $(z < 0)$, $\mu_2 = 6$ μH. The surface current density at the boundary is given as $\vec{K} = 12\hat{a}_x\ A/m$, find $\vec{H}_2$ if $\vec{H}_1 = 40\hat{a}_x + 50\hat{a}_y + 12\hat{a}_z\ kA/m$. **(06 Marks)**

c. Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical type of length 60 cm and of diameter 6 cm. Given that the medium is air. Derive the expression used. **(08 Marks)**

6 a. List Maxwell's equations for time varyirg field in point and integral form. **(06 Marks)**

b. Starting from Ampere's circuital law derive an expression for displacement current density for time varying fields. **(06 Marks)**

c. What is retarded potential? Obtain an expression for retarded potential V and A. **(08 Marks)**

7 a. State and prove Poynting's theorem. **(10 Marks)**

b. With respect to wave propagation in good conductors, describe what is skin effect, derive an expression for the depth of penetration. If $\sigma = 58 \times 10^6$ ℧/m at frequency 10 MHz determine depth of penetration. **(10 Marks)**

8 a. The plane $x = 0$ is the boundary between two perfect dielectric. For $x < 0$, $\mu_1 = \mu_0$, $\varepsilon_1 = 3.6\pi$ pf/m and $\sigma_1 = 0$; for $x > 0$, $\mu_2 = \mu_0$, $\varepsilon_2 = 14.4\pi$ pf/m and $\sigma_2 = 0$.

If $E_i^+ = 60\cos(10^9 t - \beta_1 x) V/m$ find :

i) Incident magnetic field H_i

ii) Reflected electric and magnetic field E_r and H_r

iii) Transmitted electric and magnetic field E_t and H_t **(10 Marks)**

b. What is a standing wave? Derive an expression for standing wave ratio. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE45

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Power Electronics

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the various types of power electronic converter circuits. Draw the input and output characteristics. **(10 Marks)**

b. Draw and explain the V-I characteristic of the following power electronic devices:
i) SCR; ii) IGBT; iii) GTO; iv) TRIAC; v) BJT. **(10 Marks)**

2 a. What is the need of a base drive control in a power transistor? Explain anti-saturation control. **(08 Marks)**

b. In the bipolar transistor shown in Fig.Q.2(b) β varies between 5 and 50. The load resistance $R_C = 10\Omega$, $V_{CC} = 180V$, $V_{BB} = 10V$. If $V_{CE(sat)} = 1.0V$ and $V_{BE(sat)} = 1.4V$. Find:
i) The value of R_B that results in saturation with an overdrive factor of 6.
ii) Forced β_F.
iii) Power loss P_T in the transistor. **(06 Marks)**

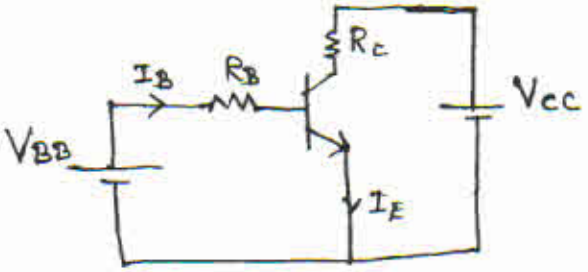


Fig.Q.2(b)

c. Draw and explain the switching characteristics of power MOSFET. **(06 Marks)**

3 a. Derive an expression for the anode current of thyristor with the help of two transistor analogy. **(08 Marks)**

b. A string of thyristor is connected to withstand a d.c. voltage of $V_S = 15kV$. The maximum leakage current and recovery charge difference of thyristor are 10mA and 150μC respectively. A derating factor of 20% is applied for the steady state and transient voltage sharing of thyristor. If the maximum steady state voltage sharing is 1000V. Find:
i) The steady state voltage sharing resistance R for each thyristor and
ii) The transient voltage capacitance C for each thyristor. **(08 Marks)**

c. Differentiate latching current and holding current of a thyristor. **(04 Marks)**

4 a. What is meant by commutation? Differentiate natural and forced commutation. **(06 Marks)**

b. With neat circuit diagram and waveforms explain complimentary commutation. **(10 Marks)**

c. For the commutation circuit shown in Fig.Q.4(c). Calculate the value of the capacitance C to provide the circuit turn-off time of 20μsec. DC source voltage is 100V and current through R_1 and R_2 is 10A. **(04 Marks)**

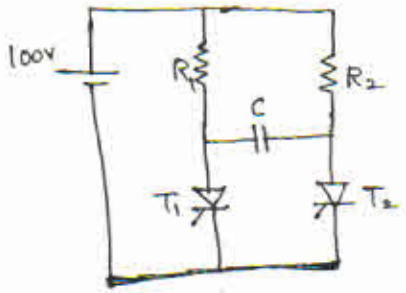


Fig.Q.4(c)

PART – B

5 a. Explain with neat diagram and waveforms, the operation of single phase semi-controlled rectifier feeding resistive load. **(10 Marks)**

b. In a single phase half wave controlled circuit shown in Fig.Q.5(b) with pure resistive load $R = 1\Omega$ and $\alpha = \pi/2$. Determine:

i) Rectification efficiency
ii) Form factor
iii) Ripple factor
iv) Transform utilization factor
v) Peak inverse voltage. **(10 Marks)**

Given $V_s = V_m \sin \omega t$

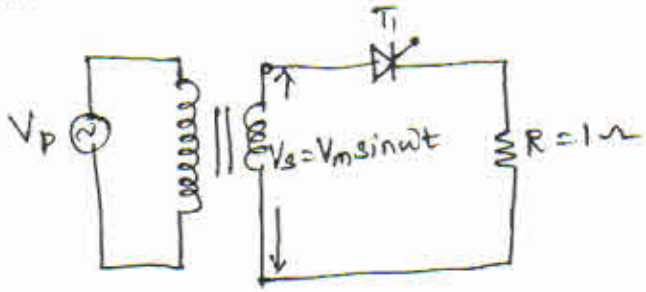


Fig.Q.5(b)

6 a. Explain the various classifications of chopper circuits. **(10 Marks)**

b. With a neat circuit diagram and waveforms, explain the analysis of impulse commutated thyristor chopper. **(10 Marks)**

7 a. Explain the operation of a single phase full bridge inverter supplying a resistive load. **(10 Marks)**

b. Explain: i) Sinusoidal pulse width modulation; ii) Performance parameters of an inverter. **(10 Marks)**

8 a. With the help of neat circuit diagram and waveforms, explain the operation of a bidirectional controller with resistive load. Derive the equation for V_{rms}. **(10 Marks)**

b. Describe the effect of power electronic converters. What are the remedial measures? **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE46

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Transformers & Induction Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Derive the emf equation of a single phase transformer. **(04 Marks)**

b. Explain the operation of a single phase transformer on inductive load with a phasor diagram. **(08 Marks)**

c. The maximum efficiency of a 100 kW transformer is 98% and occurs at $\frac{3}{4}$ full load. The transformer is on full load for 4 hrs, on $\frac{3}{4}$ load for 6 hrs half load for 6 hrs and $\frac{1}{10}$ load for remaining part of the day. Determine its all-day efficiency. **(08 Marks)**

2 a. Explain OC and SC test for predetermination of efficiency and regulation. **(06 Marks)**

b. Define voltage regulation and derive an expression for voltage regulation. What is the condition for zero regulation? **(06 Marks)**

c. The efficiency at 0.8 pf lag of a 6600/384 V, 200 KVA, 1 ϕ transformer is 98% both at full load and $\frac{1}{2}$ full load. The pf. on no load is 0.2 and full load regulation at a lagging pf of 0.8 is 4.5%. Draw the equivalent circuit referred to LV side and insert all values. **(08 Marks)**

3 a. Show that an auto transformer will result in saving of copper instead of 2-winding transformer. **(06 Marks)**

b. List out and explain the conditions for parallel operation of single phase transformers. **(06 Marks)**

c. Two transformers having equivalent impedances referred to secondary of $(0.3+j3)\Omega$ and $(0.2+j1)\Omega$ are sharing a common load of impedance $(8+j6)\Omega$. Determine the current delivered by each transformer if the open circuit emf are 6600 V and 6400 V. **(08 Marks)**

4 a. Explain the operation of scott connections for balanced and unbalanced load with the help of phasor diagrams. **(12 Marks)**

b. A Δ - Δ bank consisting of three 1ϕ transformers, 20 KVA, 2300/230 V ratings supplies a load of 40 KVA. If one transformer is removed, find for the resulting V – V connection,
i) KVA load carried by each transformer.
ii) Total KVA rating of the V-V bank.
iii) Ratio of the V-V bank to Δ-Δ bank transformer ratings. **(08 Marks)**

PART – B

5 a. Explain the constructional details of different types of 3ϕ Induction motors. **(08 Marks)**

b. Explain the different regions of torque-slip characteristics of a 3ϕ induction motor and mark all the points on the characteristics. **(08 Marks)**

c. An 8-pole 50 Hz induction motor has a full load slip of $2\frac{1}{2}$% and a maximum torque of twice full-load torque. At what value of slip does maximum torque occur? **(04 Marks)**

6 a. Develop the phasor diagram and equivalent circuit of a 3φ induction motor. **(06 Marks)**

b. Draw the circle diagram for a 5 h.p. 200 V, 50 Hz, 4 pole, 3φ star connected induction motor from the following test data:
No load : 200 V, 5 A, 350 W
SC test : 100 V, 26 A, 1700 W
Estimate the line current and power factor for full load and also maximum torque and starting torque interms of full load torque. The rotor copper loss at stand still is half the total copper loss. **(14 Marks)**

7 a. Explain the construction and operation of a double cage induction motor. **(08 Marks)**

b. Explain the phasor diagram and torque – slip characteristics of an induction generator. **(08 Marks)**

c. Why a starter is required for starting a 3φ IM? **(04 Marks)**

8 a. Explain briefly the operation of a Y-Δ starter with a neat diagram. **(08 Marks)**

b. Give a comparison between speed control of a 3φ induction motor by stator voltage control and rotor resistance control. **(04 Marks)**

c. Explain the constructional and operational features of a capacitor start and run single phase induction motor. **(08 Marks)**

* * * * *

USN | | | | | | | | | | |

10ES42

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Microcontrollers

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Distinguish Harvard and Von-Neumann (Princeton) architectures with diagrams. **(06 Marks)**

b. Explain with block diagram the architectural feature of 8051 and list out salient features of 8051 microcontroller. **(08 Marks)**

c. Discuss the need for stack memory in microcontrollers. Explain with examples the PUSH and POP instructions. **(06 Marks)**

2 a. What are the addressing modes supported by 8051 μC? Explain with examples. **(08 Marks)**

b. Explain the different types of conditional and unconditional jump instructions of 8051. Specify the different ranges associated with jump instructions. **(08 Marks)**

c. Differentiate between the following instructions:
i) SWAP and XCH ii) SJMP and LJMP. **(04 Marks)**

3 a. Write a ALP to copy the most significant nibble of A in both nibbles of RAM address 3Ch. Also write the algorithm for example if A = 36h, then 3Ch = 33h. **(06 Marks)**

b. Write an ALP to add the unsigned numbers found in internal RAM locations 25h, 26h and 27h together and put the result in RAM locations 31L (MSB) and 30h (LSB). **(08 Marks)**

c. For a machine cycle of 1.085 μsec find the time delay in the following subroutine:

```
DELAY: MOV R2, # 200
AGAIN: MOV R3, # 250
HERE: NOP
      NOP
      DJNZ R3, HERE
      DJNZ R2, AGAIN
      RET.
```

(06 Marks)

4 a. With a relevant figure write a sequence of events that occur in 8051 microcontroller when the CALL and RET instructions are executed. **(06 Marks)**

b. What are the ways to create time delay? Discuss the factors affecting the accuracy of the time delay. **(07 Marks)**

c. What are the differences between timer and counter? Explain with the formats of the SFR. **(07 Marks)**

PART – B

5 a. In what way timer/counter mode 2 programming is different from mode 0 and mode 1? **(06 Marks)**

b. Write an ALP to generate square wave on pin 3.4 of ON Time 4 msec and OFF Time 3 msec, using timer 0, mode 0. Assume that crystal frequency of 8051 is 11.0592 Hz. **(08 Marks)**

c. Explain the importance of interrupt priority (IP) SFR and the beginning fixed address of the interrupt handler subroutines. **(06 Marks)**

6 a. Write the steps required for programming 8051 to transfer data serially and what is the role of PCON register in serial communication? **(07 Marks)**

b. Write a C program to interface 8051 to LCD. Draw the hardware schematic. **(07 Marks)**

c. Write a 'ALP' program to interface stepper motor to 8051, with a neat diagram of 8051 connection to stepper motor. **(06 Marks)**

7 a. Tabulate the different data types in 'C', bits and the data range. **(05 Marks)**

b. Write an 8051 C program to send two different strings to the serial port. Assuming that SW is connected to pin P2.0, monitor its status and make a decision as follows:
SW = 0, send your first name
SW = 1, send your last name.
Assume XTAL = 11.0592 MHz, baud rate of 9600, 8 bit data 1 stop bit. **(10 Marks)**

c. Write a 'C' program to serially transmit the message "HELLO" continuously at baud rate of 9600, 8-bit data and 1 stop bit. **(05 Marks)**

8 a. Briefly discuss the features of MSP 430 microcontrollers. **(06 Marks)**

b. Explain different addressing modes of MSP 430 with examples. **(08 Marks)**

c. Write a MSP 430 assembly program to find the largest in the given array of 'n' bytes. **(06 Marks)**

* * * * *

6 a. Write the steps required for programming 8051 to transfer data serially and what is the role of PCON register in serial communication? **(07 Marks)**

b. Write a C program to interface 8051 to LCD. Draw the hardware schematic. **(07 Marks)**

c. Write a 'ALP' program to interface stepper motor to 8051, with a neat diagram of 8051 connection to stepper motor. **(06 Marks)**

7 a. Tabulate the different data types in 'C', bits and the data range. **(05 Marks)**

b. Write an 8051 C program to send two different strings to the serial port. Assuming that SW is connected to pin P2.0, monitor its status and make a decision as follows:
SW = 0, send your first name
SW = 1, send your last name.
Assume XTAL = 11.0592 MHz, baud rate of 9600, 8 bit data 1 stop bit. **(10 Marks)**

c. Write a 'C' program to serially transmit the message "HELLO" continuously at baud rate of 9600, 8-bit data and 1 stop bit. **(05 Marks)**

8 a. Briefly discuss the features of MSP 430 microcontrollers. **(06 Marks)**

b. Explain different addressing modes of MSP 430 with examples. **(08 Marks)**

c. Write a MSP 430 assembly program to find the largest in the given array of 'n' bytes. **(06 Marks)**

* * * * *

USN | | | | | | | | | | |

10ES43

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Control Systems

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. A mechanical system is shown in the Fig.Q.1(a).
   i) Obtain the performance equations.
   ii) Draw the electrical analog based on force-current analogy. **(08 Marks)**

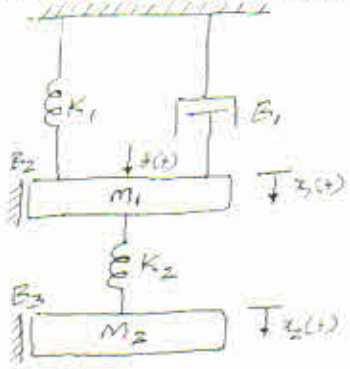


Fig.Q.1(a)

b. For the mechanical system shown in Fig.Q.1(b), draw the electrical network based on torque current analogy. Write the performance equations. **(08 Marks)**

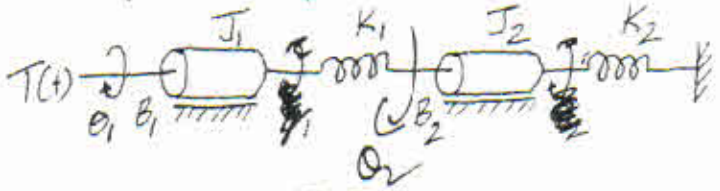


Fig.Q.1(b)

c. Write an explanatory note on gear trains. **(04 Marks)**

2 a. Define the term transfer function of a linear time invariant system. Derive the expression for the transfer function of a closed loop negative feedback system. **(06 Marks)**

b. For the block diagram shown in the Fig.Q.2(b), determine the overall transfer function using block diagram reduction rules. **(06 Marks)**

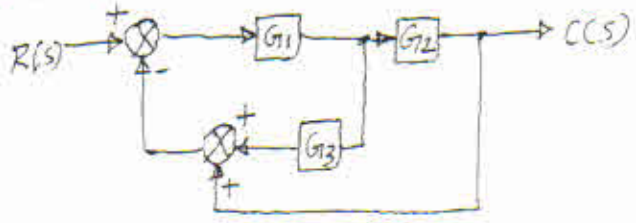


Fig.Q.2(b)

c. Consider the electrical circuit shown in Fig.Q.2(c). Find $\frac{V_0(s)}{V_i(s)}$ using Mason's gain formula. **(08 Marks)**

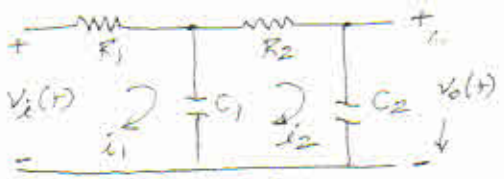


Fig.Q.2(c)

3 a. Define the following terms with respect to an underdamped second order system: i) Peak time; ii) Settling time; iii) Steady state error. **(06 Marks)**

b. A unity feedback system is characterized by an open loop transfer function $G(s) = \frac{K}{s(s+10)}$.

Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K, determine settling time, peak over shoot and time to peak overshoot for a unit step input. **(08 Marks)**

c. For a unity feedback system whose open loop transfer function is $G(s) = \frac{50}{(1+0.1s)(1+2s)}$.

Find the error constants K_p, K_v, K_a. **(06 Marks)**

4 a. State the Routh's stability criterion and mention its limitation. **(04 Marks)**

b. Consider the characteristic equation $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$. Using Routh's criterion, determine the stability of the system. **(08 Marks)**

c. The closed loop system shown in Fig.Q.4(c) has $G(s) = \frac{K(s+30)}{s(s+5)}$ and $H(s) = \frac{1}{(s+15)}$.

Find the range of K for which system is stable. **(08 Marks)**

Fig.Q.4(c)

PART – B

5 a. Discuss the various rules for construction of root loci. **(08 Marks)**

b. A negative feedback control system is characterized by $G(s)H(s) = \frac{K}{s(s+1)(s+2)(s+3)}$.

Sketch the root locus plot for values of K ranging from 0 to ∞, Mark all the salient points on the root locus. **(12 Marks)**

6 a. Discuss the procedure to evaluate Gain margin and phase margin using Bode plots. **(06 Marks)**

b. Sketch the Bode plot for the transfer function $G(s) = \frac{Ks^2}{(1+0.2s)(1+0.02s)}$. Determine the system gain K for the gain cross over frequency to be 5 rad/sec. **(08 Marks)**

c. For the Bode magnitude asymptotic plot of Fig.Q.6(c), determine the transfer function in frequency domain. **(06 Marks)**

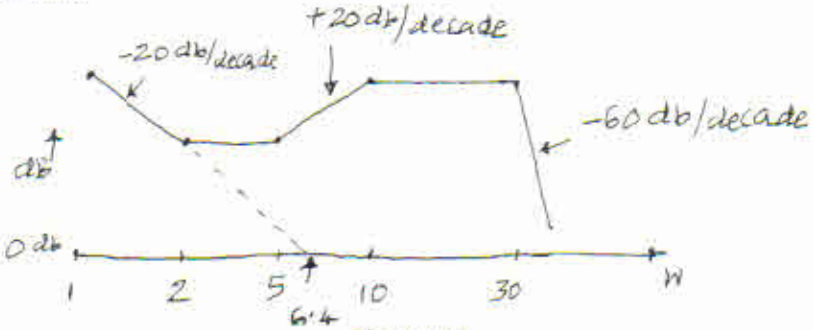


Fig.Q.6(c)

7 a. State the Nyquist stability criterion. **(06 Marks)**

b. Using the Nyquist stability criterion, investigate the stability of a closed loop system whose open loop transfer function is given by $G(s)H(s) = \frac{K}{(s+1)(s+2)}$. **(14 Marks)**

8 a. State the properties of state transition matrix. **(04 Marks)**

b. Represent the electrical circuit shown in Fig.Q.8(b) by a state model. **(08 Marks)**

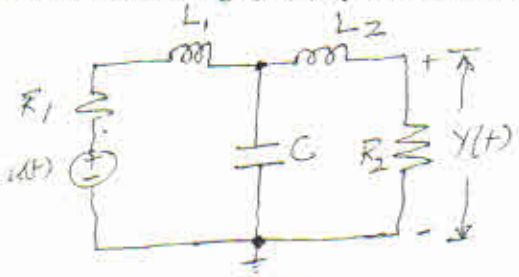


Fig.Q.8(b)

c. For the signal flow graph of Fig.Q.8(c) write the state and output equations: **(08 Marks)**

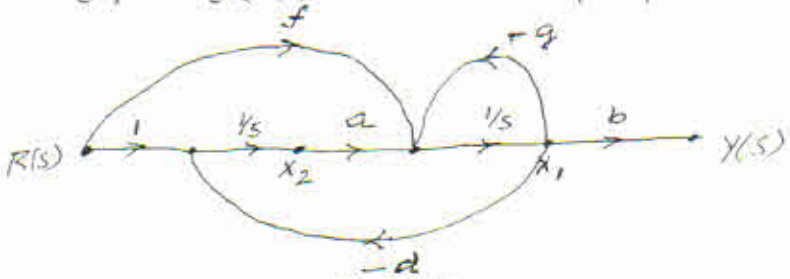


Fig.Q.8(c)

* * * * *

USN | | | | | | | | | | |

10AL51

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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. Define Management. Differentiate between Administration and Management. **(10 Marks)**
b. Briefly explain, whether management is a Science or Art. **(10 Marks)**

2 a. Explain the importance of planning. **(10 Marks)**
b. Explain the hierarchy of plans. **(10 Marks)**

3 a. Briefly explain the techniques of selection. **(10 Marks)**
b. Briefly explain the principles of organization. **(10 Marks)**

4 a. Briefly explain the Maslow's hierarchy of needs. **(10 Marks)**
b. Differentiate between Autocratic, Participative and Free – Rein leadership styles. **(10 Marks)**

PART – B

5 a. Define the term "Entrepreneur". Explain the functions of an entrepreneur. **(10 Marks)**
b. Explain the various barriers of entrepreneurship. **(10 Marks)**

6 a. Define "Small Scale Industry" and State the characteristics of a SSI. **(10 Marks)**
b. Explain the functions of WTO. **(10 Marks)**

7 a. Explain the objectives of KSFC. **(10 Marks)**
b. Explain the objectives of TECSOK. **(10 Marks)**

8 a. Define Project. State and explain the classifications of projects. **(10 Marks)**
b. Explain the criteria's for selecting a project. **(10 Marks)**

*****

USN | | | | | | | | | | |

10EE52

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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. Explain about power and energy signal with example. Determine whether signal given in Fig Q1(a) is power or energy signal, find corresponding value. **(06 Marks)**

b. Find out the even and odd component of the following signals. **(06 Marks)**

i) $x(t) = \cos t + \sin t + \sin t \cos t$ ii) $x(t) = 1 + t + 3t^2 + 6t^3 + 9t^4$

iii) $x(t) = 1 + t \cos t + t^2 \sin t + t^3 \sin t \cos t$

c. For the given signal x(t) shown in Fig Q1(c) sketch and label

(i) x(0.5t) (ii) x(t+3) (iii) x(3t+2) (vi) x(-3(t-1)) **(08 Marks)**

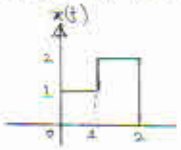


Fig Q1(a)

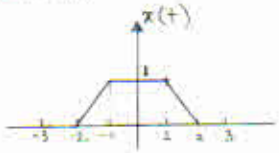


Fig Q1(c)

2 a. Impulse response of a system is given by $h[n] = \begin{cases} 1 & n = 0 \\ 1/2 & n = 1 \\ 0 & \text{otherwise} \end{cases}$

Input for the given system is $x[n] = \begin{cases} 2 & n = 0 \\ 4 & n = 1 \\ -2 & n = 2 \\ 0 & \text{otherwise} \end{cases}$

Find out the output y[n] of the system. **(06 Marks)**

b. Given impulse response of the system $h[n] = \left[\frac{1}{2}\right]^n u[n-2]$. Find out step response of the system. **(08 Marks)**

c. Draw direct form – I and direct form – II implementation for the following difference equation. $y[n] + \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = 2x[n] + 3x[n-1]$ **(06 Marks)**

3 a. Obtain the convolution integral for a system with input x(t) and impulse response h(t), as shown in Fig Q3(a). **(08 Marks)**

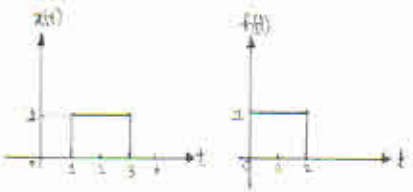


Fig Q3(a)

b. For the given impulse response determine whether system is memory less, stable and causal, justify your answer. $h[n] = [2]^n u[-n]$. **(04 Marks)**

c. Find out the complete solution for the system described by the following differential equation.

$\frac{d^2y(t)}{dt^2} + 5\frac{d}{dt}y(t) + 6y(t) = x(t)$, Where $x(t) = e^{-t}u(t)$

With initial conditions $y(0) = -\frac{1}{2}, \frac{d}{dt}y(t)\Big|_{t=0} = \frac{1}{2}$ **(08 Marks)**

4 a. Determine the Fourier series representation of the square wave shown in Fig Q4(a)

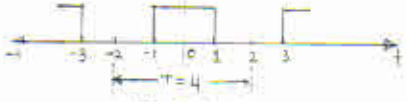


Fig Q4(a) **(08 Marks)**

b. Determine the discrete Fourier series representation for the following signal.

$x[n] = \cos \pi/3\, n + \sin \pi/4\, n$ **(06 Marks)**

c. State and prove the time shift and frecuency shift property of Fourier series. **(06 Marks)**

PART – B

5 a. Using the properties of Fourier Transform find out Fourier transform of the following signals.

i) $x(t) = \sin(\pi t)e^{-2t}u(t)$ ii) $x(t) = e^{-3(t-2)}$ **(12 Marks)**

b. Obtain the Fourier Transform of the following signals.

i) $x(t) = u(t)$ ii) $x(t) = e^{-at}u(t)$

iii) $x(t) = 1 \quad -0.5 \le t \le 0.5$

$= 0$ elsewhere. **(08 Marks)**

6 a. Find DTFT of the following signal

i) $x[n] = \left[\frac{1}{2}\right]^{n+2}u[n]$ ii) $x[n] = n\left[\frac{1}{2}\right]^{2n}u[n]$ iii) $x[n] = -\left[\frac{1}{2}\right]^{n}u(-n-1)$ **(12 Marks)**

b. An LTI causal system is having a frequency response as $H(e^{j\Omega}) = \frac{e^{j\Omega}}{1+\cos\Omega}$. Obtain linear constant difference equation of the system. **(08 Marks)**

7 a. Obtain z transform and the ROC and location of poles and zero's of x(z), for the following x[n].

i) $x[n] = \left[\frac{1}{2}\right]^{n}u[n] + \left(-\frac{1}{3}\right)^{n}u[n]$ ii) $x[n] = -\left(\frac{3}{4}\right)^{n}u(-n-1) + \left(-\frac{1}{3}\right)^{n}u[n]$ **(10 Marks)**

b. Obtain inverse 'z' transform of the given x(z) using partial fraction expansion

$x(z) = \frac{1 - z^{-1} + z^{-2}}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - 2z^{-1}\right)\left(1 - z^{-1}\right)}$ i) with ROC $1 < |z| < 2$ ii) with ROC $|z| < \frac{1}{2}$ **(10 Marks)**

8 a. Use convolution property of 'z' transform to obtain x(z) for the given x(n)

$x(n) = u(n-2) * \left(\frac{2}{3}\right)^{n}u(n)$ **(06 Marks)**

b. Obtain inverse z transform of $x(z) = \frac{2 + z^{-1}}{1 - \frac{1}{2}z^{-1}}$ with ROC $|z| > \frac{1}{2}$ **(06 Marks)**

c. Solve the following linear constant coefficient difference equation using z transform method

$y[n] - \frac{1}{2}y[n-1] = x[n]$ with given input $x[n] = \left(\frac{1}{3}\right)^{n}$ and initial condition $y[-1] = 1$ **(08 Marks)**

USN | | | | | | | | | | |

10EE53

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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 the line diagram of a typical power supply scheme indicating the standard voltages. **(06 Marks)**

b. Explain the following components of distribution:
(i) Substation (ii) Distribution substation (iii) Feeder (iv) Distributor
(v) Service mains **(10 Marks)**

c. State the advantages of high voltage transmission. **(04 Marks)**

2 a. Prove that the conductor takes the shape of a catenary when the sag and span are comparable. **(10 Marks)**

b. An overhead transmission line conductor is supported between two towers 300 m apart, having a difference in level of 10 m. The conductor diameter is 2.0 cm and weight is 2.3 kg/m. Calculate the sag under lower support if factor of safety is 3. The maximum tensile strength of conductor material is 4200 kg/m^2. **(10 Marks)**

3 a. (i) Discuss the desirable properties of insulators.
(ii) Compare pin type insulator and suspension type insulator.
(iii) Why string efficiency should be as high as possible? What are different methods used in practice for improving the string efficiency? **(12 Marks)**

b. Each line of a three phase system is suspended by a string of three similar insulators. If the voltage across the line unit is 20 KV, calculate the line to neutral voltage and string efficiency. Assume that the shunt capacitance between each insulator and earthed metal work of tower to be $\frac{1}{10}^{th}$ of the capacitance of the insulator. **(08 Marks)**

4 a. State and explain factors affecting corona and corona loss. **(06 Marks)**

b. A 132 KV, 3-phase line with 1.956 cm diameter conductor is built so that corona takes place if the line voltage exceeds 210 KV (rms). If the value of potential gradient at which ionization occurs can be taken as 30 KV per cm, find the spacing between the conductors. (Assume $\delta = 1$, $m_0 = 1$). **(04 Marks)**

c. What is meant by grading of cables? Briefly explain various methods of grading. **(10 Marks)**

PART – B

5 a. Calculate the inductance of conductor due to internal flux and external flux. **(10 Marks)**

b. Write short note on transposition of transmission line. **(05 Marks)**

c. Calculate the inductance of each conductor in a 3-phase-3wire system. Conductors are arranged in a horizontal plane with spacing $d_{31} = 4m$, $d_{12} = d_{23} = 2$ m. The conductors are transposed and have a diameter of 2.5 cm. **(05 Marks)**

6 a. Find the capacitance of single phase line 40 km long consisting of 2 parallel wires each 4 mm in diameter and 2 m apart. Determine the capacitance of the same line taking into account effect of ground. The height of conductor above ground is 5 m. **(08 Marks)**

b. Derive expression for the capacitance per phase of a 3-phase line with
(i) Equilateral spacing.
(ii) Unsymmetrical spacing (single circuit) transposed. **(12 Marks)**

7 a. What are generalized circuit constants of a transmission line? Determine the ABCD constants of a medium transmission line using nominal T-model and prove AD – BC = 1. **(10 Marks)**

b. A 3-phase 50 Hz overhead transmission line has the following constants per phase R = 28 Ω, X = 63 Ω, $Y = 4 \times 10^{-4}$ ℧. If the load at receiving end is 75 MVA at 0.8 p.f. lag with 132 KV between lines. Calculate the voltage, current and p.f. at the sending end. Use nominal π method. **(10 Marks)**

8 a. Write short note on radial and ring main distribution system. **(06 Marks)**

b. What are the requirements of a good distribution system? **(04 Marks)**

c. A two wire DC distributor AB 600 m long is loaded as under.

Distance from A (meters)	150	300	350	450
Load in amperes	100	200	250	300

The feeding point A is maintained at 440 V while B maintained at 430 V. If each conductor has resistance of 0.01 Ω per 100 m.
Calculate :
(i) The current supplied from A and B.
(ii) The power dissipated in the distributor. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE54

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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. Mention the types of armature windings and derive the EMF equation of a d.c. generator. **(06 Marks)**

b. With neat diagrams, explain the process of commutation in d.c. machines. **(08 Marks)**

c. A lap wound d.c. generator has 1000 armature conductors and 10 poles. The rated armature current is 800 A. Find the number of conductors of compensating winding per pole to give full armature reaction compensation, if the pole face covers two-third of pole pitch. **(06 Marks)**

2 a. With neat diagrams, explain the characteristics of a d.c. series motor. **(06 Marks)**

b. With the help of a neat diagram, explain the Ward-Leonard method of speed control. **(07 Marks)**

c. A 4-pole series wound fan motor draws an armature current of 50A, when running at 2000 rpm on a 230 V dc supply with four coils connected in series. Now these coils are connected in two parallel groups of two coils in series. Assuming the flux per pole to be proportional to the exciting current and load torque proportional to the square of speed, find the new speed and armature current with armature resistance of 0.2 Ω and resistance of each field coil is 0.05 Ω. **(07 Marks)**

3 a. Draw and explain the power flow diagram and derive the condition for maximum efficiency in a d.c. motor. **(06 Marks)**

b. Explain the brake test to determine the efficiency of a d.c motor and mention its demerits. **(07 Marks)**

c. A d.c. shunt motor rated at 12.5 kW output runs at no-load at 1000 rpm from a 250 V supply consuming an input current of 4 A. The armature resistance is 0.5 Ω and shunt field resistance is 250 Ω. Calculate efficiency of the machine when delivering full load output of 12.5 kW while operating at 250 V. **(07 Marks)**

4 a. With a neat diagram, explain the field's test on d.c series motors. **(06 Marks)**

b. What are the merits and demerits of Hopkinson's test? **(06 Marks)**

c. The Hopkinson's test on two similar d.c. shunt machines gave the following full load data: Line voltage = 110 V, Line current = 48A, Motor armature current = 230 A. Field currents are 3 A and 3.5 A. The armature resistance of each machine is 0.035 Ω. Calculate the efficiency of each machine assuming a brush contact drop of 1 V per brush. **(08 Marks)**

PART – B

5 a. Define pitch factor and distribution factor. What are the effects of distribution and chording of winding? **(07 Marks)**

b. Explain the armature reaction in a synchronous machine with different power factor loads. **(06 Marks)**

c. A three phase, 16 pole, star connected alternator has 192 slots with 8 conductors per slot. The coil span is 160° (ele), speed of the alternator is 375 rpm and flux per pole is 55 mWb. Calculate the phase and line voltages. **(07 Marks)**

6 a. Define voltage regulation of a 3ϕ alternator and explain the ZPF method of determining the voltage regulation for lagging p.f. load. **(10 Marks)**

b. A 415 V, 30 kVA, 50 Hz, 3ϕ star connected alternator has the following O.C. test data:

I_f in Amps	6	12	18	24	28
E_L in Volts	282	408	435	459	474

An excitation of 8A produced full load current in the armature on short circuit. If R_a = 0.5 Ω/phase, calculate the voltage regulation at full-load, 0.707 p.f. lagging by a) EMF method and b) MMF method. **(10 Marks)**

7 a. Explain slip test for the determination of direct axis and quadrature axis reactances. **(06 Marks)**

b. Derive the power flow equations including armature resistance and draw power angle characteristics of a synchronous machine. **(07 Marks)**

c. Two, 15 kVA, 400 V, 3ϕ alternators in parallel supply a total load of 25 kVA at 0.8 p.f. lagging. If one alternator shares half the power at unity p.f., determine the p.f. and kVA shared by the other alternator. **(07 Marks)**

8 a. With phasor diagram, explain the effect of operation at constant load with variable excitation of a synchronous motor. **(07 Marks)**

b. Explain the V and inverted V curves of a synchronous motor. **(06 Marks)**

c. A 20 MVA, 3ϕ, star connected, 11 kV, 2 pole, 50 Hz salient-pole synchronous motor has reactances of X_d = 5 Ω, X_q = 3 Ω. At full-load, unity p.f. and rated voltage find the excitation voltage and the active power. **(07 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE55

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Modern Control Theory

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Obtain the state model of the system whose transfer function is given by,

$$G(s) = \frac{s^2 + 2s + 1}{s^3 + 3s^2 + 4s + 5}$$ **(06 Marks)**

b. Obtain the state model of armature controlled DC motor. **(10 Marks)**

c. Mention the advantages of modern control theory. **(04 Marks)**

2 a. A system is described by the, $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -4 & -3 \end{bmatrix}$. Find eigen values, eigen vector and modal matrix. **(08 Marks)**

b. Obtain the state model of mechanical system shown in Fig. Q2 (b) by using minimum number of state variables. **(06 Marks)**

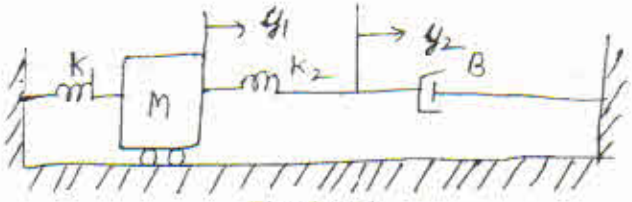


Fig. Q2 (b)

c. Obtain the state model of the electrical network shown in Fig. Q2 (c) by choosing $v_1(t)$ and $v_2(t)$ as state variables. **(06 Marks)**

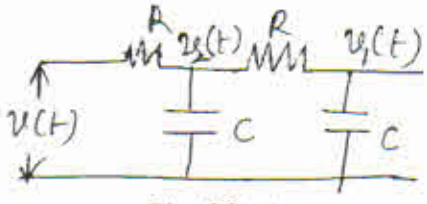


Fig. Q2 (c)

3 a. What are the properties of state transition matrix? **(04 Marks)**

b. Obtain state transition matrix for the system described by $\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ -4 & -4 \end{bmatrix} x(t)$ by,

(i) L.T. method (ii) C-H technique. **(10 Marks)**

c. Obtain the transfer function of the following system:

$$A = \begin{bmatrix} -1 & 0 & 1 \\ 1 & -2 & 0 \\ 0 & 0 & 3 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, C = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}^T$$ **(06 Marks)**

4 a. Define controllability and observability. **(04 Marks)**

b. Find the step-response for the system represented by state equation,

$\dot{X} = AX + BU$ and $Y = CX$ where

$A = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix}$; $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$; $C = \begin{bmatrix} 1 & 0 \end{bmatrix}$ **(10 Marks)**

c. Check controllability and observability of the following model:

$A = \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & -3 \\ 0 & 1 & -4 \end{bmatrix}$, $B = \begin{bmatrix} 40 \\ 10 \\ 0 \end{bmatrix}$, $C = \begin{bmatrix} 0 & 0 & 1 \end{bmatrix}$ **(06 Marks)**

PART – B

5 a. Explain the following:

(i) P + D controller (ii) P + I controller (iii) P + I + D controller **(06 Marks)**

b. Consider the system defined by,

$\dot{x} = Ax + Bu$, where $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -6 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$. By using state feedback control $u = -Kx$ it is desired to have closed loop poles at $s = -1 \pm j1$, $s = -10$. Determine the state feedback gain matrix K. **(08 Marks)**

c. Design full order state observer with the block diagram. **(06 Marks)**

6 a. What is non-linear system? What are the properties of non-linear system? Explain them. **(08 Marks)**

b. Explain the following non linearities :

(i) Relay with dead zone (ii) Backlash (iii) Saturation (iv) Friction. **(12 Marks)**

7 a. What are singular points? Explain them. **(06 Marks)**

b. Explain isoclines method of sending phase trajectories. **(06 Marks)**

c. Construct phase trajectory by delta method for non linear system represented by differential equation $\ddot{x} + 4|x|\dot{x} + 4x = 0$. Choose initial conditions as $x(0) = 1.0$ and $\dot{x}(0) = 0$. **(08 Marks)**

8 a. Define (i) Positive definiteness (ii) Negative definiteness (iii) Indefiniteness **(06 Marks)**

b. Explain Liapunov stability theorem. **(06 Marks)**

c. Use Krasookii's method to show that the equilibrium state $x = 0$ of the system described by,

$\dot{x}_1 = -3x_1 + x_2$

$\dot{x}_2 = x_1 - x_2 - x_2^3$

is asymptotically stable in large. **(08 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE56

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Linear IC's and Applications

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Standard resistance and capacitance data table may be used.***
3. ***741 Datasheet allowed.***

PART – A

1 a. With a neat circuit diagram, explain the operation of a capacitor coupled voltage follower. **(06 Marks)**

b. Design a high Z_{in} capacitor –coupled non investing amplifier to have a low cutoff frequency of 200Hz. The input and output voltages are to be 15mV and 3V respectively and the minimum load resistance is 12kΩ [using BIFET operational Amplifier]. **(08 Marks)**

c. With a neat sketch, briefly explain the circuit of a capacitor coupled inverting amplifier. **(06 Marks)**

2 a. Define: i) Loop gain ii) Loop phase shift iii) Unity gain band width. **(06 Marks)**

b. Sketch circuit for lag compensation, lead compensation and miller effect compensation. Explain the operation of each circuit, and each affects the op-amp frequency response. **(10 Marks)**

c. Briefly explain stray capacitance effect, load capacitance effect. **(04 Marks)**

3 a. With a neat circuit diagram, show how a half wave precision rectifier can be combined with a summing circuit to produce a full wave precision rectifier. Draw the voltage wave form for a relevant stage. Write a equation to show that full wave rectifier is performed. **(08 Marks)**

b. Draw the diagram for an op-amp sample – and – hold circuit. Sketch the signal, control and output voltage waveforms carefully explain the circuit operation. **(06 Marks)**

c. A ±5V 10KHz square wave from a signal generator with source resistance of 100Ω is to have its positive peak clamped at ground level. The tilt on the output is not to exceed 1% of peak amplitude of the wave. Design a suitable op-amp circuit using ±12V supply. **(06 Marks)**

4 a. Sketch the circuit diagram of an op-amp monostable multi-vibrator, draw the circuit wave forms and explain its operation. **(08 Marks)**

b. Analyse the Schmitt trigger circuit in figure to determine the UTP and LTP. Assume that the op-amp is rail to rail operated and that the diode forward voltage drop is 0.7V. **(06 Marks)**

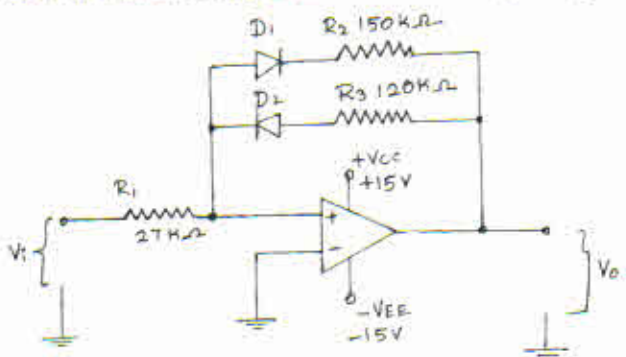


Fig Q4(b)

c. Design a zero crossing detector using 741 op-amp with $\pm 15V$ supply. Determine the typical output voltage swing and the typical input voltage level above and below the ground level at which the output switches, Also calculate the rise time of the output voltage. **(06 Marks)**

PART – B

5 a. Draw the circuit diagram of triangular/rectangular wave form generator using op-amps. Sketch the circuit waveforms, and explain its circuit operation. **(08 Marks)**

b. Design a Wein bridge oscillator to have frequency of 1KHz. Use a 741 op-amp with $V_0 \pm 9V$. **(06 Marks)**

c. Show how the output amplitude of a phase shift oscillator can be stabilized by means of inverse parallel connected diodes. Explain how the circuit limits the output amplitude. **(06 Marks)**

6 a. Derive expression for gain and angle of first order low pass butter worth filter. Draw the frequency response curve. Explain its operation. **(08 Marks)**

b. Design a single stage band pass filter have unity voltage gain and a pass band from 300Hz to 30KHz. **(06 Marks)**

c. Show how the circuit of a single stage wide band pass filter can be modified for narrow band operation. Briefly explain. **(06 Marks)**

7 a. Draw the basic block diagram and waveforms for a PLL system, Indentify each component part ad explain its function. **(08 Marks)**

b. Explain the theory of operation of the switched capacitor filter. **(08 Marks)**

c. Distinguish between small signal amplifier and power amplifier. **(04 Marks)**

8 a. Define :
   i) Line regulation
   ii) Ripple rejection **(04 Marks)**

b. With a neat circuit, explain working of a precision voltage regulator. **(08 Marks)**

c. Design a voltage follower type regulator circuit using 741 op-amp with following specification.
   i) Output voltage 12V
   ii) Maximum load current – 50mA. **(08 Marks)**

* * * * *

USN | | | | | | | | | | |

10EC663

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Operations Research

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. For any events A & B, prove that
$P_r(A \cup B) = P_r(A) + P_r(B) - P_r(A \cap B)$ **(04 Marks)**

b. A box of 30 diodes, is known to contain five defective diodes. If two diodes are selected at random, without replacement, what is the probability that at least one of these diodes is defective? **(08 Marks)**

c. A balanced coin is tossed 9 times. Find the probabilities of each of the following events:
(i) Exactly 3 heads occurs.
(ii) At least 3 heads occurred **(08 Marks)**

2 a. What is PMF? How is it different from a PDF? **(04 Marks)**

b. Mention all the properties of PDF. **(05 Marks)**

c. A Gaussian RV has a PDF of the form, $f_X(x)$ given by,

$$f_X(x) = \frac{1}{\sqrt{50\pi}} \exp\left[-\frac{(x-10)^2}{50}\right]$$

Write the following probabilities, in terms of Q-functions:
(i) $Pr\{|x-7| > 5\}$ (ii) $Pr(x < -2)$ (iii) $Pr\{|x-4| < 7\}$ **(11 Marks)**

3 a. For any constants a and b, prove that
$E\{ax + b\} = aE(x) + b$ **(04 Marks)**

b. Prove that for a binomial RV, $E(x) = np$ and $\sigma_x^2 = npq$. **(08 Marks)**

c. Prove that all odd central moments of a Gaussian, Random variable are equal to zero. **(08 Marks)**

4 a. Define characteristic function of a random variable. What is its physical significance? What are its uses? **(08 Marks)**

b. Assuming the source sends symbols from a three – letter alphabet with $X \in \{a, b, c\}$ and $P_a = \frac{1}{2}$, $P_b = \frac{1}{4}$ and $P_c = \frac{1}{4}$ are the source symbol probabilities:
(i) Determine the entropy of this source.
(ii) Give a source code that has an average code word length, that matches the entropy. **(12 Marks)**

PART – B

5 a. Define joint CDF of a pair of R variables {X, Y} why is it necessary to look at joint probability of events relating to both random variables? **(06 Marks)**

b. Summarize the properties of joint CDFs of two random variables {X, Y} **(04 Marks)**

c. Assuming X, Y have joint PDF, given by

$$F_{X,Y}(x,y) = \frac{1}{\pi\sqrt{3}} \exp\left[-\frac{2}{3}(x^2 - xy + y^2)\right]$$

Prove that

$$f_X(x) = \frac{1}{\sqrt{2\pi}} \exp\left[-\frac{x^2}{2}\right]$$ **(10 Marks)**

6 a. Define a mean vector, of a vector of random variables $X = [X_1, X_2 ..... X_N]^T$. **(02 Marks)**

b. Define the correlation matrix R_{XX} and the covariance matrix C_{XX}, for the above vector in Q6 (a). **(04 Marks)**

c. What are their physical significances? **(04 Marks)**

d. Prove that all correlation matrices are non-negative definite. **(10 Marks)**

7 a. What is a second order PDF of a random process X(t)? **(08 Marks)**

b. Compute the mean function of a random process $X(t) = a\sin(\omega_0 t + \Theta)$, where the random variable Θ is uniformly distributed over $(0, 2\pi)$ and "a" is constant amplitude. **(12 Marks)**

8 a. Define a Gaussian Random Process and express quantitatively the joint Gaussian PDF for the vector of n samples $X = [X_1, X_2 ..... X_N]^T$ **(10 Marks)**

b. Define transition probability matrix for a Markov chain, with finite number of states. **(04 Marks)**

c. Given a state diagram, as shown below,

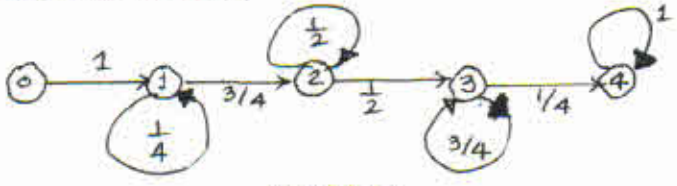


Fig. Q8 (c)

Write down, its transition probability matrix. **(06 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE61

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Power System Analysis & Stability

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What is per unit quantity? Mention the advantages of per unit quantities. **(06 Marks)**

b. What is single line diagram? Explain how to obtain impedance and reactance diagrams from single line diagram of a power system. **(06 Marks)**

c. Draw a per unit reactance diagram for the power system shown in Fig.Q1(c).

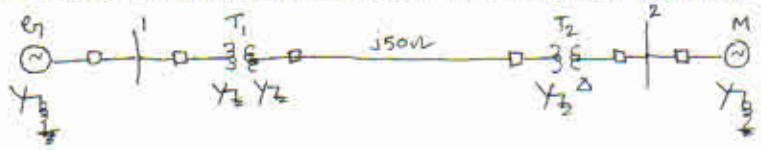


Fig.Q1(c)

Use a base of 100 MVA, 220 kV in 50Ω line.
The ratings of the generator, motor and transformers are
Generator : 40 MVA, 25 kV, X″ = 20%
Motor : 50 MVA, 11 kV, X″ = 30%
Y – Y Transformer : 40 MVA, 33Y / 220Y kV, X = 15%
Y – Δ Transformer : 30 MVA, 11Δ / 220Y kV, X = 15% **(08 Marks)**

2 a. Discuss the different types of faults in Power system. **(04 Marks)**

b. Explain clearly, how circuit breakers are rated? **(08 Marks)**

c. A generator is connected to a synchronous motor through transformer. Reduced to a common base, the per unit subtransient reactances of generator and motor are 0.15 and 0. 35 pu respectively. The leakage reactance of the transformer is 0.1 pu. A 3ϕ short circuit fault occurs at terminals of the motor when terminal voltage of generator is 0.9 pu and output current of generator is 1 pu at 0.8 p.f. leading. Find the subtransient current in the fault, generator and motor. **(08 Marks)**

3 a. What are symmetrical components? How they are useful in solution of power system? **(04 Marks)**

b. Derive an expression for the 3ϕ complex power in terms of symmetrical components. **(08 Marks)**

c. A delta connected balanced resistive load is connected across a balanced 3ϕ supply as shown in Fig.Q3(c). With currents in lines A & B specified. Find the symmetrical components of the currents. **(08 Marks)**

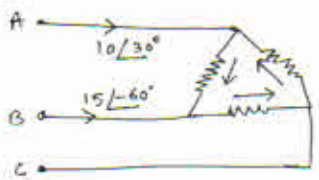


Fig.Q3(c)

4 a. With the help of relevant vector diagrams for voltages and currents establish the phase-shift of symmetrical components in Y-Δ transformer. **(12 Marks)**

b. What are sequence impedances and sequence network? Draw the zero sequence networks for different combinations of 3ϕ transformer bank. **(08 Marks)**

PART – B

5 a. Mention the different types of faults occurring in electrical power system and their probability of occurrence. **(04 Marks)**

b. A double line to ground fault occurs at the terminals of an unloaded generator. Derive an expression for the fault currents. Also draw connection of sequence networks. **(10 Marks)**

c. Discuss briefly about the open-conductor faults in power system. **(06 Marks)**

6 A single line to ground fault occurs at mid point F of transmission line in power system shown in Fig.Q6(a). Determine the fault current in pu and in amperes from generator if the system were on no load and at a voltage of 100 kV at the fault point.

Fig.Q6(a)

The ratings are

Generator : 11.5 kV, 500 MVA, $X_1 = 0.3$ pu, $X_2 = 0.2$ pu, $X_0 = 0.1$ pu

Transformer – T_1 : 11/110 kV, 45 MVA, $X = 0.1$ pu

Transformer – T_2 : Consists of 3 single phase units each rated 20 MVA, 66/6.6 kV, $X = 10\%$

Motor : 6 kV, 55 MVA, $X_1 = 0.4$ pu, $X_2 = 0.3$ pu, $X_0 = 0.2$ pu

Line : $X_1 = X_2 = 48.5\ \Omega$, $X_0 = 90\ \Omega$

Choose a base of 60 MVA, 110 kV in transmission line. **(20 Marks)**

7 a. Differentiate between steady state and transient state stability of a power system. Can these stability limits have multiple values? **(06 Marks)**

b. Derive swing equation with usual notation. **(08 Marks)**

c. Explain the equal area criterion for investigating the stability of power system. **(06 Marks)**

8 a. An ac generator is delivering 50% of maximum power to an infinite bus. Due to a sudden short circuit, the reactance between generator and infinite bus increases to 500% of the value before fault. The maximum power that can be delivered after clearance of the fault is 75% of the original value. Calculate the critical clearing angle to maintain the stability of the system. **(08 Marks)**

b. Explain the analysis of 3ϕ induction motor with one line open. **(06 Marks)**

c. Explain the analysis of 3ϕ induction motor with unbalanced voltage. **(06 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE62

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Switch Gear and Protection

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State and explain fuse law. With a neat sketch explain the time–current and cut–off characteristics of HRC fuse. **(10 Marks)**

b. Draw and explain a line diagram of substation with use of isolating switches. Mention operating instructions and applications of isolating switches. **(10 Marks)**

2 a. What are Slepian's and Cassie's theorem of arc interruption? Explain with neat sketches. Also explain low resistance or zero point extinction. **(10 Marks)**

b. How interruption of capacitive currents takes place in AC circuit breakers? Explain. **(10 Marks)**

3 a. With a neat sketch explain the construction and working of air break circuit breaker. **(10 Marks)**

b. Describe the working principle of SF_6 circuit breaker with the help of a neat sketch. mention the advantages over other type of circuit breakers. **(10 Marks)**

4 a. Explain the construction and working of a vacuum circuit breaker. **(10 Marks)**

b. Describe : i) unit testing ii) synthetic testing of a circuit breaker. **(10 Marks)**

PART – B

5 a. What are the requirements of protective relaying? And discuss i) zones of protection ii) primary and back–up protection. **(10 Marks)**

b. Briefly explain the essential qualities and classification of protective relays. **(10 Marks)**

6 a. Explain in detail with the help of a neat figure the working of non–directional induction type over–current relay. **(10 Marks)**

b. Explain the principle of working and operating characteristics of a percentage biased differential relay. **(10 Marks)**

7 a. What are the important faults that can occur in an alternator during operation? Explain in detail. **(10 Marks)**

b. A generator is protected by restricted earth fault protection. The generators ratings 13.2 KV, 10 MVA. The percentage of winding protected against phase to ground fault is 85%. The relay setting is such that it trips for 20% out of balance. Calculate the resistance to be added in the neutral to ground connection. **(10 Marks)**

8 a. With a neat sketch explain the working of a Buchholz relay for transformer protection and state its limitations. **(10 Marks)**

b. A three phase power transformer having a line voltage ratio of 400 V to 33 KV is connected in star–delta. The CTs on 400 V side have current ratio as 1000/5. What must be the CT ratio on 33 KV side? Show the star–delta arrangement with CT connections. Assume current on 400 V side of transformer to be 1000 A. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE63

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Electrical Machine Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What are the limitations in the design of electrical machines? Explain. **(06 Marks)**

b. Derive the output equation of a D.C machine. **(06 Marks)**

c. Determine the main dimensions and number of poles of a 1000kW, 500 volts, 450 RPM D.C generator. Assume the air gap density as 0.62 Tesla and ampere conductors per meter as 40,000. The ratios of pole arc to pole pitch is 0.65. The ratio of length to pole pitch is 0.75. Assume efficiency as 90% current per brush arm not to exceed 400 amperes and frequency of the reversals in the armature not to exceed 50Hz. **(08 Marks)**

2 a. The field coils of a D.C machine are wound with a single layer winding of bare copper strip 3 cm deep with a separating insulation 0.15mm thick. Determine a suitable winding length, number of turns and thickness of conductor to develop an mmf of 12000 ampere-turns with a potential difference of 5V/coil and with a loss of 1200 Watts /m^2 of total coil surface. The mean length of turn is 1.2m. **(10 Marks)**

b. Estimate the ampere turns per pole required for the air-gap of a 500V, 6 pole, 300 rpm, lap connected D.C machine. The armature core having 90 slots is 30cm long. The pole pitch is 50cm while pole arc is 33cm. The air gap length may be taken as 5mm. There are 16 conductors per slot of width 1.3cm. Assume 5 ventilating ducts, each 1cm wide. The carter's co-efficient is 0.66 and 0.72 for slot width/gap of 2.6 and 2.0 respectively. **(10 Marks)**

3 a. With neat sketch derive the expression for leakage reactance of core type transformer with respect to primary side. State the assumption made. **(12 Marks)**

b. A 100KVA, 200/400V, 50Hz, 1ϕ shell type transformer has the following particular; B_{max} = 1.1wb/m^2, current density = 2.2 A/mm^2, window area constant = 0.33, volt/turn = 11, core is rectangular and stampings are 7cm wide. Height of window = 2 * width of window. Obtain :

i) Net iron area and Area of window

ii) Dimensions and weight of core. Specific gravity of iron = 7.8 gm/cm^2. **(08 Marks)**

4 a. Derive output equation for a 3 phase transformer. **(10 Marks)**

b. A 15000KVA, 33/6.6kV, 3-phase, Y -Δ core type transformer has the following data : Area of cross section of core limb = 0.16m, Area of cross section of yoke = 0.17m. length of flux path in each limb 2.3m in each yoke is 1.6m ; number of turns in h.v winding = 450. AT/m in core leg is 540 AT/m and in yoke is 260 AT/m as obtained from magnetization curves. Loss per kg in iron is 2.6 Watts/kg in limb and 1.5 watts/kg in yoke. Density of iron is 7.8 g/c.c. Estimate the No-Load current/phase. **(10 Marks)**

PART – B

5 a. Explain the factors which influence the length of air gap of 3 – phase induction motor. **(08 Marks)**

b. Calculate : i) Diameter ii) Length iii) Number of turns per phase iv) Full load current and cross – section of conductors and v) Total I^2R loss of stator of 3ϕ, 120kW 2200 volts, 50Hz, 750rpm [synchronous speed], star connected slip ring Induction motor from the following data :
B_{av} = 0.48 Tesla, (ac) = 26000 ampere/mt, efficiency = 92%, power factor = 0.88. Assume $L = 1.25T_p$, winding factor =0.95, current density = 5A/mm^2 mean length of stator conductors = 0.75m, resistivity of copper $\rho = 0.021\Omega$/mt and mm^2. **(12 Marks)**

6 a. Explain crawling an cogging of induction motor. **(10 Marks)**

b. A 120 HP, 500V, 3ϕ, 50Hz, 8 pole induction motor has a star connected stator winding accommodated in 63 slots with 6 conductors per slot. If the slip ring voltage on open circuit is to be about 400V, find a suitable rotor winding stating
i) Number of slots ii) Number of conductors per slot iii) Coil span
iv) Slip ring voltage on open circuit v) Approximate full load current per phase in rotor. Assume efficiency = 0.9 and power factor = 0.86. **(10 Marks)**

7 a. From first principles derive the output ecuation of a 3 phase alternator. **(06 Marks)**

b. Define short circuit ratio in connection with 3 phase alternator. Explain the factors affecting the SCR. **(06 Marks)**

c. A 1250 KVA, 3phase, 50Hz, 3300V, start connected 300rpm salient pole alternator has the following data : Diameter = 1.9 mt ; length = 0.335 mt ; pole arc/pole pitch = 0.66, turns/phase = 150. Single layer winding with full pitched coils having 5 conductors per slot is used SCR = 1.2. Assume the distribution of gap flux is rectangular under the pole arc with zero value at inter-poler region. Determine :
i) Specific magretic loading ii) Armature mmf per pole iii) Gap flux density over pole arc iv) current per phase v) length of air gap.
Assume gap contraction factor = 1.15 and Air gap mmf = 88% of no load field mmf.
(08 Marks)

8 a. Explain the design procedure for designing the field winding of a salient pole alternator. **(10 Marks)**

b. A 2500KVA, 225 rpm, 3 phase, 60Hz, 2400V, Star connected salient pole alternator has the following data :

Stator bore diameter = 250cm, Core length = 44cm, Slots/pole/phase = $3\frac{1}{2}$, Conductors per slot = 4, Circuits per phase = 2, Leakage factor = 1.2, Winding factor = 0.95. The flux density in pole core is 1.5 wb/m^2, the winding depth is 3cm. the ratio of full load field mmf to armature mmf is 2, field winding space factor is 0.84 and the field winding dissipates 1800 Watts/m^2 of inner and outer surface without the temperature rise exceeding the limits. Leave 3cm for insulation, flanges and height of pole shoe along the height of pole.
Find :
i) The flux per pole
ii) Length and width of pole
iii) Winding height and
iv) Pole height **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE64

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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. If X(k) is N – point DFT of N-length sequence x(n), and if $x_1(n)$ is DFT of X(k), then determine $x_1(n)$ interms of x(n). **(05 Marks)**

b. Compute 8 – point DFT of the sequence x(n) = {1, 2, 2, 1, 2, 2} and verify conjugate symmetry about k = N/2. **(10 Marks)**

c. If X(k) represent 6-point DFT of sequence. X(n) = {2, –1, 3, 4, 0, 5}, then find y(n) of same length as x(n) such that its DFT $Y(k) = W_3^{2k} X(k)$. **(05 Marks)**

2 a. Using Stockham's method find circular convolution of the sequences :
$g(n) = \delta(n) + 2\delta(n-1) + 3\delta(n-2) + 4\delta(n-3)$ and $h(n) = n$ for $0 \le n \le 3$. **(07 Marks)**

b. Obtain output of the system having impulse response $h(n) = \cos\left(\frac{2\pi n}{N}\right)$ and input $x(n) = \sin\left(\frac{2\pi n}{N}\right)$, through N – point circular convolution. **(06 Marks)**

c. Use sectional convolution approach to find the response of filter having impulse response h(n) = { , 2} and input x(n) = {1, 2, –1, 2, 3, –2, –3, –1, 1, 1, 2, –1}. Use 5-point circular convolution use overlap and add method. **(07 Marks)**

3 a. Develop DIF FFT algorithm for N = 8 from basic principles of decomposition of radix–2. **(10 Marks)**

b. Using time decomposition approach find the DFT of sequence for N point such that $N = 2^M$ and M = 3, the given sequence is y(n) = {1, 1, 1, 1 1}. **(10 Marks)**

4 a. The first five points of DFT of a sequence are given as {7, –0.707–j0.707, –j, 0.707–j0.707, 1}. Obtain the corresponding time domain sequence of length–8 using DIF FFT algorithm. **(10 Marks)**

b. Develop a N–composite DIT FFT algorithm for evaluating 9 point DFT. **(10 Marks)**

PART – B

5 a. A lowpass Butterworth filter has to meet the following specifications :
Passband gain, $K_p = -1$dB at $\Omega_p = 4$ rad/sec
Stopband attenuation greater than or equal to 20 dB at $\Omega_S = 8$ rad/sec.
Determine the transfer function $H_a(s)$ of the lowest order Butterworth filter to meet the above specifications. **(10 Marks)**

b. Design a Chebyshev – I filter to meet the following specifications :

Passband ripple	: ≤ 2dB
Passband edge	: 1 rad/sec
Stopband attenuation	: ≥ 20 dB
Stopband edge	: 1.3 rad/sec.

(10 Marks)

6 a. Using impulse invariant transformation, design a digital Chebyshev I filter that satisfies the following constraints. $0.8 \le |H(\omega)| \le 1, \quad 0 \le \omega \le 0.2\pi$

$|H(\omega)| \le 0.2, \quad 0.6\pi \le \omega \le \pi.$ **(12 Marks)**

b. Define the following windows along with their impulse response :

i) Rectangular window

ii) Hamming window

iii) Hanning window. **(08 Marks)**

7 a. The desired frequency response of a lowpass FIR filter is given by :

$$H_d(\omega) = \begin{cases} e^{-j3\omega}, & |\omega| < \frac{3\pi}{4} \\ 0, & \frac{3\pi}{4} < |\omega| < \pi \end{cases}$$

Determine the frequency response of the filter using Hamming window for N =7. **(10 Marks)**

b. Determine the filter coefficients h(n) obtained by sampling $H_d(\omega)$ given by :

$$H_d(\omega) = \begin{cases} e^{-j3\omega}, & 0 < \omega \le \frac{\pi}{2} \\ 0, & \frac{\pi}{2} < \omega < \pi \end{cases}$$

Also obtain frequency response taking N = 7. **(10 Marks)**

8 a. For a LTI system described by following input-output relation :

$2y(n) - y(n-2) - 4y(n-3) = 3x(n-2)$

Realize the system in following forms :

i) Direct form – I

ii) Direct form – II transposed realization **(10 Marks)**

b. Obtain cascade realization for the system function given below :

$$H(z) = \frac{(1+z^{-1})^3}{\left(1-\frac{1}{4}z^{-1}\right)\left(1-z^{-1}+\frac{1}{2}z^{-2}\right)}.$$ **(06 Marks)**

c. Compare direct from – I and II realizations. **(04 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE662

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Advanced Power Electronics

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Derive the input-output relationship for a buck converter operations in DCM mode. **(10 Marks)**

b. For the buck converter shown in Fig. Q1 (b) input voltage $V_s = 12V$, the required output voltage is $V_0 = 5$ V at R = 500 Ω and the peak-peak output ripple voltage is 20 mV. The switching frequency is 25 kHz. If the peak to peak ripple current of inductor is limited to 0.8 A calculate (i) Duty cycle K (ii) Filter inductance L (iii) Filter capacitor C and (iv) Critical values of L & C. **(10 Marks)**

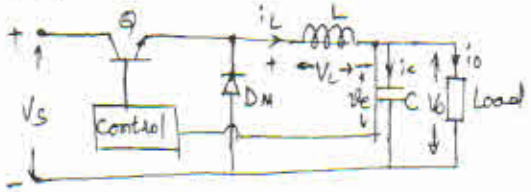


Fig. Q1 (b)

2 a. With a neat circuit and wave forms explain the working of full bridge converter. **(10 Marks)**

b. In a cuk converter operating at 50 kHz $L_1 = L_2 = 1$ mH and $C_1 = 5$ μF. The output capacitor is sufficiently large to give constant output voltage. Here $V_d = 10$ V and the output voltage is regulated to be constant at 5 V. It is supplying 5 W to load. Assume ideal components. Calculate the percentage errors in assuming a constant voltage across C_1. **(10 Marks)**

3 a. With a neat circuit and waveform, explain the working of push-pull inverter. **(08 Marks)**

b. Briefly explain the pulse width modulated switching scheme. **(04 Marks)**

c. In a 1-ϕ full bridge PWM inverter, V_d varies in the range of 295 – 325 V The output voltage is required to be constant at 200 V (rms) and the maximum load current is 10 A(rms). Calculate the combined switch utilization ratio. **(08 Marks)**

4 a. With a neat circuit and waveforms explain the square wave operation of 3-ϕ inverter. **(10 Marks)**

b. The 1-ϕ full bridge inverter has a resistive load of R = 2.4 Ω and input dc voltage $V_d = 48V$. Calculate

(i) The rms output voltage V_{01} at fundamental frequency.
(ii) rms output power
(iii) peak current at each switch
(iv) average currents of each switch and
(v) T.H.D. **(10 Marks)**

PART – B

5 a. With the help of circuit and waveform explain the working of L type ZCS resonant converter. **(08 Marks)**

b. Give a comparision between ZCS and ZVS resonant converters. **(06 Marks)**

c. The ZCS resonant converter of Fig. Q5 (c) delivers maximum power of PL = 400 mW at V_0 = 4 V. The supply voltage is V_S = 12 V. The maximum operating frequency is f_{max} = 50 kHz. Find the values of L & C. Assume that intervals t_1 and t_3 are very small and x = 1.5 **(06 Marks)**

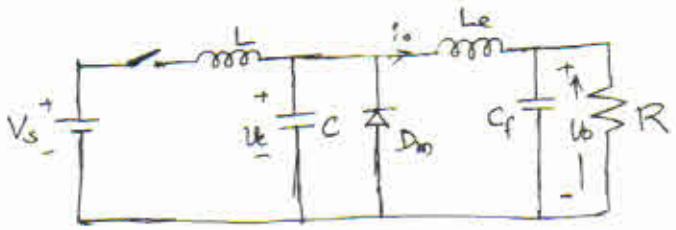


Fig. Q5 (c)

6 a. Explain the design parameters involved in designing the high frequency transformers. **(10 Marks)**

b. Explain the design of high frequency inductor. **(10 Marks)**

7 a. With a neat circuit diagram and waveforms analyse the working of flyback converter. **(10 Marks)**

b. The dc output voltage of the push pull circuit is V_0 = 24V at a resistive load of R = 0.8 Ω. The on state voltage drops across transistors and diodes are V_t = 1.2 V and V_d = 0.7 V respectively. The turns ratio of the transformer is $a = \frac{N_S}{N_P} = 0.25$. Calculate (i) Average input current I_S (ii) Efficiency η (iii) Average transistor current I_A (iv) Peak transistor current I_p and (v) rms transistor current I_R. **(10 Marks)**

8 a. Explain resonant AC power supply with the help of neat circuit diagram. **(07 Marks)**

b. Explain bidirectional ac power supply with neat circuit diagram. **(07 Marks)**

c. Explain the operation of uninterrupted power supply (UPS). **(06 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE71

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
Computer Techniques in Power System Analysis

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain with an example: i) Oriented graph; ii) Tree; iii) Basic cutset. **(05 Marks)**

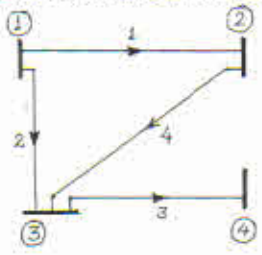
b. What is primitive network? The data relating to passive elements is given in table Q.1(b). Obtain: i) Primitive impedance matrix, z; ii) Primitive admittance matrix, y. **(05 Marks)**

Table Q.1(b)

Element No.	Self Impedance, $Z_{pq,pq}$		Mutual Impedance, $Z_{pq,rs}$	
	Bus code (p-q)	Impedance in pu	Bus code (r-s)	Impedance in pu
1	1 – 2	j0.45	-	-
2	2 – 3	j0.30	1 – 2	j0.15
3	1 – 3	j0.60	1 – 3	j0.25

c. For the power system shown in Fig.Q.1(c), obtain incidence matrixes A, B and K and verify the identity $B_f = A_f K^t$. Choose bus-1 as reference and element 4 as link. **(10 Marks)**

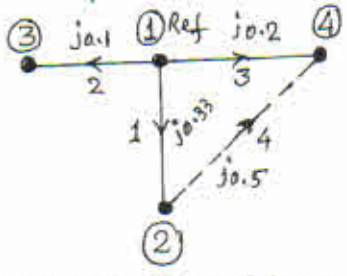
Fig.Q.1(c)



2 a. With usual notations, prove that $Y_{bus} = A^t[y]A$ using singular transformation. **(06 Marks)**

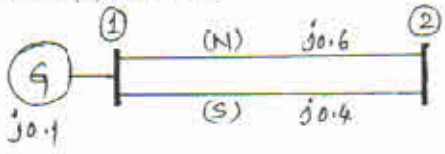
b. With the help of singular transformation method, determine the bus admittance matrix Y_{bus} for the power system whose oriented graph is shown in Fig.Q.2(b). Element no. and self-impedance of the elements in pu are marked on the diagram. Neglect mutual coupling. Verify the same using ROI method (Inspection method). **(08 Marks)**

Fig.Q.2(b)



c. Form Z_{bus} using step by step building algorithm of the system shown in Fig.Q.2(c). Take element connected between 1 – 2 (s) as LINK. **(06 Marks)**

Fig.Q.2(c)



3 a. Explain the classification of different types of buses considered during power system load flow analysis. Discuss the need of slack bus in such an analysis. **(08 Marks)**

b. For a typical four buses and five lines power system, determine the bus voltages at the end of first iteration using GS method. The system data is given in Table Q3(b). Assume acceleration factor of 1.6.

Table Q3(b)

LINE DATA		BUS DATA				
Bus code	Admittance in pu	Bus No.	P	Q	V	Remarks
1 – 2	2 – J8	1	-	-	1.06∠0	SLACK
1 – 3	1 – J4	2	0.5	0.2	1 + J0	PQ
2 – 3	0.66 – J2.664	3	0.4	0.3	1+ J0	PQ
2 – 4	1 – J4	4	0.3	0.1	1 + J0	PQ
3 – 4	2 – J8					

(12 Marks)

4 a. Discuss clearly the significance and properties of Jacobian matrix as applied to load flow analysis. **(06 Marks)**

b. Write the generalized flow chart for GS method. **(08 Marks)**

c. Explain the step by step procedure of fast decoupled load flow analysis. **(06 Marks)**

PART – B

5 a. Derive an expression for economical load schedule for an n-plant system neglecting the transmission losses and hence show that plant incremental cost is given by:

$$\lambda = \frac{P_D + \sum_{i=1}^{n} \frac{b_i}{2c_i}}{\sum_{i=1}^{n} \frac{1}{2c_i}}$$

where, P_D is load demand in MW b_i and c_i are coefficients of cost function. **(10 Marks)**

b. The incremental fuel costs in Rs. per MWh for a plant consisting of two units are

$$\frac{dF_1}{dP_{G1}} = 0.1\ P_{G1} + 20, \quad \frac{dF_2}{dP_{G2}} = 0.12\,P_{G2} + 15.$$

Assume that both units are operating at all times. Determine:

i) The most economical division of load between the generators for a constant load of 300MW.

ii) The saving in Rs. per day obtained compared to equal load sharing between the two units. **(10 Marks)**

6 a. What are transmission line loss coefficients? Derive an expression for transmission loss as a function of plant generation for a two plant system. **(10 Marks)**

b. Discuss the problem formulation and solution procedure of optimal scheduling for hydro-thermal plants. **(10 Marks)**

7 A 50 Hz, 500 MVA, 400 kV generator (with transformer) is connected to a 400kV infinite bus bar through an interconnector. The generator has H = 2.5 MJ/MVA, voltage behind transient reactance is 450 kV and is loaded 460 MW. The transfer reactance's between generator and bus bar under various conditions are:

Pre fault: 0.5 pu

During fault: 1.0 pu

Post fault : 0.75 pu

Calculate the swing curve using intervals of 0.05 sec and assuming that the fault is cleared at 7.5 cycles. **(20 Marks)**

8 a. Illustrate clearly the method of solving swing equation using Runge-Kutta approach for transient analysis of a power system. **(10 Marks)**

b. Explain the representation of loads in a power system during transient stability period. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE72

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
Electrical Power Utilization

Time: 3 hrs. Max. Marks:100

Note:1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Any missing data may be suitably assumed.***

PART – A

1 a. Discuss the main advantages of electric heating over other systems of heating (namely, coal, oil or gas heating). **(04 Marks)**

b. Discuss the advantages and disadvantages of resistance electric welding. **(04 Marks)**

c. A 15 kW, 220 V, single phase resistance oven employ nickel-chrome wire for its heating elements. If the wire temperature is not to exceed 1000°C and the temperature of the charge is to be 600°C. Calculate the length and diameter of the wire. Assume radiating efficiency to be 0.6 and emissivity as 0.9. Resistivity for nickel-chrome wire is 1.016×10^{-6} ohm-meter. **(12 Marks)**

2 a. Discuss the major drawback of a direct core type induction furnace. **(04 Marks)**

b. Discuss the advantages of high frequency eddy current heating. **(04 Marks)**

c. Estimate the efficiency of a high frequency induction furnace which takes 10 minutes to melt 1.8 kg of aluminium. The input to the furnace being 5 KW and initial temperature 15°C.
Given : Specific heat of aluminium = 880 J/kg/°C ;
Melting point of aluminium = 660°C.
Latent heat of fusion of aluminium = 32 KJ/kg
$1J = 2.78\times10^{-7}$ KWh **(12 Marks)**

3 a. Discuss the principle of dielectric heating. **(04 Marks)**

b. A slab of insulting material 130 cm^2 in area and 1 cm thick is to be heated by dielectric heating. The power required is 380 W of 30 MHz. Material has a relative permittivity of 5 and power factor of 0.05. Absolute permittivity = 8.854×10^{-12} F/m. Determine the necessary voltage. **(06 Marks)**

c. The power required for dielectric heating of a slab resin 150 cm^2 in area and 2 cm thick is 200 watts, frequency 30 MHz. The material has a relative permittivity of 5 and power factor of 0.05. Determine the voltage necessary and current flowing through the material. If the voltage is limited to 600 V, what will be the value of the frequency to obtain the same heating? Assume absolute permittivity = 8.854×10^{-12} F/m. **(10 Marks)**

4 a. Explain the basic principle of electrolysis. **(02 Marks)**

b. Calculate the thickness of copper deposited on a plate area of 2.2 cm^2 during electrolysis if a current of 1A is passed for 90 minutes.
Electro chemical equivalent of copper = 32.95×10^{-8} kg/columb and
Density of copper = 8900 kg/m^3. **(06 Marks)**

c. A copper refining plant using 500 electrolytic cells carries a current of 6000 A; Voltage per cell being 0.25 volt. If the plant were to work 40 hours/week, calculate the energy consumption per tonne assuming electro chemical equivalent of copper as 0.3281 mg/columb of electricity. **(12 Marks)**

PART – B

5 a. Define the following terms and their units:
(i) Luminous flux (ii) Luminous intensity (iii) Illumination
(iv) Mean horizontal candle power (v) Mean spherical candle power **(05 Marks)**

b. Discuss the laws of illumination. **(05 Marks)**

c. A filament lamp of 500 watts is suspended of a height of 5 meters above working plane and gives uniform illumination over an area of 8 meter diameter. Assume efficiency of reflector as 60%, determine the illumination on the working plane. Efficiency of lamp is 0.9 watt per candle power. **(10 Marks)**

6 a. Explain the following terms related to train movement:
(i) Crest speed (i) Average speed (iii) Schedule speed. **(03 Marks)**

b. Discuss the factors that affect the schedule speed of a train. **(05 Marks)**

c. The speed time curve of a train consists of,
(i) Uniform acceleration of 6 km per hour per second for 25 seconds.
(ii) Free running for 10 minutes.
(iii) Uniform deceleration of 6 km per hour per second to stop the train.
(iv) A stop of 5 minutes.
Find the distance between the stations, the average and schedule speed. **(12 Marks)**

7 a. Derive the tractive efforts required for propulsion of a train considering gradient and resistance to train movement. **(08 Marks)**

b. An electric train weighing 200 tonnes has eight motors geared to driving wheels, each wheel is 90 cm diameter. Determine the torque developed by each motor, to accelerate the train to a speed of 48 km per hour. The tractive resistance is of 50 newtons per tonne, the effect of rotational inertia is 10% of the train weight, the gear ratio is 4 to 1 and gearing efficiency is 80 percent. **(12 Marks)**

8 a. Define energy consumption and specific energy consumption related to electric fraction. **(04 Marks)**

b. Discuss the factors that influence the specific energy consumption of a train operating on a given schedule speed. **(04 Marks)**

c. An electric train has an average speed of 42 km/hour on a level track between stops 1.4 km apart. It is accelerated at 1.7 km per hour per second and is braked at 3.3 km/hour/second. Assuming Fractive resistance as 50 newtons/tonne, allowing 10 percent rotational inertia and efficiency of motors 85 percent. Estimate the specific energy consumption. Assume maximum speed, V_m = 52 kmph, Duration of braking = 15.8 seconds (t_3). **(12 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE73

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
High Voltage Engineering

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What are the advantages and limitations of transmitting power at high voltages? Explain briefly. **(10 Marks)**

b. With a neat sketch explain the principle and working of electrostatic painting and coating. **(10 Marks)**

2 a. Derive the criterion for breakdown in electronegative gases and discuss the importance of electro-negative gases. **(10 Marks)**

b. Explain the streamer theory of breakdown in air at atmospheric pressure. **(10 Marks)**

3 a. Explain the various theories that explain the breakdown in commercial liquid dielectrics. **(10 Marks)**

b. Briefly explain electromechanical break down and thermal breakdown in solid insulating materials. **(10 Marks)**

4 a. Explain the schemes for cascade connection of transformers for producing very high a.c voltages. **(06 Marks)**

b. What is tesla coil? How are the damped high frequency oscillations obtained from of tesla coil? **(06 Marks)**

c. A Cockraft-Waltons type voltage multiplier has eight stages with capacitance all are equal to 0.05μF. The supply transformer secondary voltge is 125kV at a frequency of 150Hz, if the load current to be supplied is 5mA, find: i) the percentage ripple ii) Regulation. **(08 Marks)**

PART – B

5 a. With neat sketch explain the Marx circuit arrangement for multistage impulse generator. **(10 Marks)**

b. What is trigatron gap? Explain its function and operation. **(06 Marks)**

c. A 12 stage impulse generator has capacitor each rated at 0.3μF, 150kV. The capacitance of test specimen is 400pF. Determine the wave front and wave tail resistances to produces a 1.2/50μF. **(04 Marks)**

6 a. With neat sketch explain principle, working and construction of electrostatic voltmeter. **(10 Marks)**

b. Briefly explain the factors affecting measurement of voltages using sphere gap. **(06 Marks)**

c. A resistance divider of 1400kV (impulse) has a high voltage arm of 16kΩ and L.V arm consisting of 16 members of 250Ω, 2 watt resistors in parallel. The divider is connected to a CRO through a cable of surge impedances 75Ω and is terminated at the other end though 75Ω resistor. Calculate the exact divider ratio. **(04 Marks)**

7 a. Explain method of measurement of capacitance and tan δ using H.V Schering bridge. **(08 Marks)**

b. Explain the transformer ratio arm bridge for audio frequency range measurements. **(06 Marks)**

c. Discuss the method of discharge detection using straight detectors for locating partial discharges in electrical equipment. **(06 Marks)**

8 a. What are the different power frequencies and impulse tests done on insulators? Mention the procedure for testing. **(10 Marks)**

b. Explain the method of impulse testing of high voltage, Transformers. What is the procedure adopted for locating the failure? **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE74

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
Industrial Drives and Applications

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What are the advantages of an electric drive system? **(05 Marks)**

b. With a neat block diagram, state the essential parts of an electric drive system. Briefly explain. **(08 Marks)**

c. Determine the expression of over-loading factor 'K' while selecting the main rating, for short time duty class. **(07 Marks)**

2 a. Obtain the thermal model of motor for heating and cooling. Also briefly explain heating and cooling curves. **(10 Marks)**

b. A thyristor fed dc motor has following specifications: Rated armature current is 700A, armature resistance is 0.01 ohms. The drive operates on following duty cycle.

i) Acceleration at twice the rated armature current for 15sec.
ii) Running at full load for 20 sec.
iii) De acceleration at twice the rated armature current for 15sec.
iv) Idling internal.

The core loss is constant at 1kW. If B has value of 0.5, Determine the maximum frequency of drive operation. **(10 Marks)**

3 a. With a neat circuit and graph, explain dynamic and plugging type of braking system for separately excited DC motor. **(10 Marks)**

b. Controlled rectifier with an a.c. source voltage of 230V, 50Hz, Ra = 2Ω. Conduction can be assumed to be continuous. Calculate the firing angles for

i) Half the rated motor torque and 500rpm.
ii) Rated motor torque and -1000 rpm. **(10 Marks)**

4 a. With neat circuit diagrams and waveforms explain three phase fully controlled rectifier control of DC separately excited motor. **(10 Marks)**

b. Give the comparison of conventional and static Ward Leonard schemes. **(05 Marks)**

c. A 230V, 960rpm, 200A separately excited motor has an armature resistance of 0.02Ω. The motor is fed from a chopper which provides dynamic braking with a braking resistance of 2Ω.

i) Calculate duty ratio of chopper for a motor speed of 600rpm and braking torque of twice the rated value.
ii) What will be the motor speed for duty ratio of 0.6 and motor torque equal to twice its rated value? **(05 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – B

5 a. A 440V, 50Hz, 6 pole, 950 rpm, Y – connected induction motor has following parameters referred to the stator: $R_s = 0.5\Omega$, $R_r' = 0.4\Omega$, $X_s = X_r' = 1.2\Omega$, $X_m = 50\Omega$. Motor is driving a fan load, the torque of which is given by $T_L = 0.0123\ W_m^2$. Now one phase of the motor fails. Calculate motor speed and current. Will it be safe to allow the motor to run for a long period? **(12 Marks)**

b. Show that time required for stopping by plugging is

$$t_b = \tau_m \left[0.345 s_m + \frac{0.75}{s_m} \right]$$

where τ_m is the mechanical time constant of motor and s_m is the slip at maximum torque. Also find the corresponding value of rotor resistance. **(08 Marks)**

6 a. With neat diagram explain the operation of voltage source inverter fed induction motor drives. What are the different schemes of VSI fed induction motor drive? **(10 Marks)**

b. With a neat circuit diagram, explain the static Scherbius drive. **(10 Marks)**

7 a. With neat circuit diagram, explain the self controlled synchronous motor drive, employing the load commutated thyristor inverter. **(12 Marks)**

b. With neat block diagram, explain the operation of variable frequency control of multiple synchronous motor drive. **(08 Marks)**

8 a. Classify and explain the drives used in cement industry. **(10 Marks)**

b. Explain the various stages in paper mill and motors used in various stages. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE752

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
Programmable Logic Controllers

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain internal architecture of PLC, with a neat block diagram. **(08 Marks)**

b. Explain various terms used for defining the performance of sensor. **(06 Marks)**

c. What are proximity switches? Explain the different types of proximity switches. **(06 Marks)**

2 a. Write the ladder diagram for the following logic function : i) AND ii) NAND iii) NOT. **(06 Marks)**

b. Explain the latch circuit with the help of an example. **(06 Marks)**

c. Explain the location of stop and emergency stop switches in a safe PLC system. **(08 Marks)**

3 a. Explain the elements of sequential functional charts. **(06 Marks)**

b. Draw the ladder diagram and instruction list (IL) programming for the following logic functions : i) NAND ii) OR iii) XOR iv) NOR. **(08 Marks)**

c. Draw the ladder diagram and instruction list (IL) programming for a signal lamp is required to be switched on if a pump is running and the pressure is satisfactory or if the lamp test switch is closed. **(06 Marks)**

4 a. Explain structured text implementation of conditional statements, iterative statements. **(08 Marks)**

b. Explain the jump within jump operations with the help of suitable example. **(06 Marks)**

c. For the instruction shown, draw the equivalent ladder diagram : **(06 Marks)**

i)
```
LD   X400
OR   X402
LD   X401
OR   X403
AND
OUT  X430
END
```

ii)
```
LDI  X400
ANI  X401
ANI  X402
ANI  X403
OUT  X430
END
```

iii)
```
LD   X400
OR   X402
AND  X401
OUT  X430
END
```

PART – B

5 a. With a neat ladder diagram and instruction list show how more than one master control relay can be used in a program. **(08 Marks)**

b. Explain the working of battery – backed relay. **(06 Marks)**

c. Explain SET and RESET function with respect to internal relay. **(06 Marks)**

6 a. Explain different types of timers with timing diagram. **(06 Marks)**

b. Explain with the ladder diagram usage of timer for flashing the lights on and off as long as there is an output occurring. **(06 Marks)**

c. Write an instruction list program for a counter to control a machine is required to direct 6 tins along one path for packaging a box and then 12 tins for packaging another box. A deflector might be controlled by a photocell sensor that gives an output every times a tin passes and also draw the ladder diagram. **(08 Marks)**

7 a. Explain the operation of pulse on timer after the input ceases. **(06 Marks)**

b. Explain with the help of ladder diagram and timing diagram, how a ON delay timer can be used to produce an OFF – delay timer. **(06 Marks)**

c. Draw ladder diagram for sequencing of traffic lights to five the sequence of red only, red plus amber, green, amber then repeat it self, with some delays. **(08 Marks)**

8 a. Explain with ladder diagram and the sequence signals of a 4 – bit shift register. **(08 Marks)**

b. Explain the implementation of closed loop control system using PLC's. **(06 Marks)**

c. Explain data comparison operations in PLC. **(06 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE756

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
Testing and Commissioning of Electrical Equipment

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With neat sketch name the various accessories and fitments on transformer and briefly explain the function of each accessories. **(10 Marks)**

b. Which are the four phasor groups adopted for standard connection of transformers? Explain any one with phasor diagram and winding connection. **(10 Marks)**

2 a. Explain the step by step procedure for drying out of a power transformer. **(10 Marks)**

b. What is impulse testing? Explain the test set up used for impulse testing of transformers. **(10 Marks)**

3 a. Explain the function and principle of brush less excitation system. **(10 Marks)**

b. State the various types of enclosures for rotating electrical machines and the types of cooling adopted in them. **(10 Marks)**

4 a. State and explain the procedure of various tests on synchronous machine and their significance. **(10 Marks)**

b. Explain the procedure of low slip test and method of calculation of X_q from the same. **(10 Marks)**

PART – B

5 a. Give an example of rating plate of an induction motor. **(05 Marks)**

b. Explain the procedure of foundation of electric machines. **(10 Marks)**

c. Explain the procedure of shaft alignment of electrical machines. **(05 Marks)**

6 a. Explain the procedure of assembly of bearing on a shaft and state the various troubles with bearings and their remedies. **(12 Marks)**

b. State the various categories of tests on 3–phase induction motor. **(08 Marks)**

7 a. Explain noload test and locked rotor test on a 3 – phase induction motor. What data does such a test provide? **(10 Marks)**

b. Explain the different methods of measurement of slip of a induction motor. **(10 Marks)**

8 a. What are the important rated quantities of low voltage AC circuit breakers? **(10 Marks)**

b. Explain the procedure of installation of circuit breakers and metal clad switch gears. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE761

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
Power System Planning

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What is planning process? Explain the planning with a block diagram. **(06 Marks)**
b. With a block diagram, explain the least cost utility planning. **(08 Marks)**
c. Discuss the different planning tools. **(06 Marks)**

2 a. Explain goals of national action plan. **(07 Marks)**
b. Explain power pooling and power trading. **(06 Marks)**
c. Explain dispatchability in transmission planning criteria. **(07 Marks)**

3 a. With block diagrams, explain the private participation with respect to ownership options and modes of participation. **(10 Marks)**
b. Explain the main objectives of a sound pricing structure with respect to rational tariffs. **(10 Marks)**

4 a. What is wheeling in power systems? Mention the objectives of wheeling. **(06 Marks)**
b. Explain greenhouse effect and technological impacts on power system planning. **(08 Marks)**
c. What is reactive power compensation? List the compensating equipments. **(06 Marks)**

PART – B

5 a. Explain reliability planning with optimal reliability characteristics. **(07 Marks)**
b. Explain the real time operations: (i) State estimation and (ii) Automatic generation control. **(06 Marks)**
c. Explain the regression analysis with respect to load prediction. **(07 Marks)**

6 a. With the help of block diagram, explain the computerized management of power systems. **(10 Marks)**
b. With a schematic diagram, explain the power system simulator. **(10 Marks)**

7 a. Develop a mathematical objective function of power system expansion planning. **(10 Marks)**
b. Discuss least-cost optimization problem for non-conventional power plants. **(10 Marks)**

8 a. Explain the linear programming method and the integer programming method. **(12 Marks)**
b. Define objective function and the costs associated with generation expansion planning. **(08 Marks)**

* * * * *