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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)**

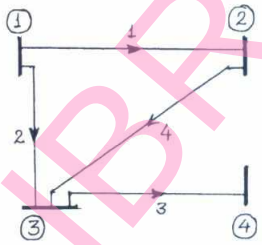
b. What is primitive network? The data relating to passive elements is given in table Q.1(b). Obtain: i) Primitive impedance matrix, z; ii) Primitive admittance matrix, y. **(05 Marks)**

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)**

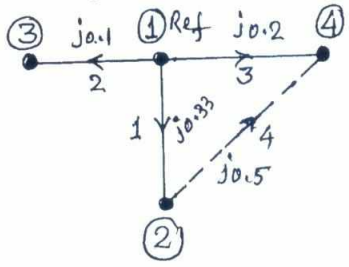
Fig.Q.1(c)



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

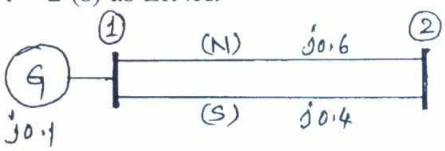
b. With the help of singular transformation method, determine the bus admittance matrix Y_{bus} for the power system whose oriented graph is shown in Fig.Q.2(b). Element no. and self-impedance of the elements in pu are marked on the diagram. Neglect mutual coupling. Verify the same using ROI method (Inspection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

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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 = 2.78×10^{-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 (ii) 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)**

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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)**

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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)**

PART – B

5 a. A 440V, 50Hz, 6 pole, 950 rpm, Y – connected induction motor has following parameters referred to the stator: Rs = 0.5Ω, R'_r = 0.4Ω, X_s = X'_r = 1.2Ω, X_m = 50Ω. 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)**

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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)**

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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)**

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10EE762

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
Computer Control of Electrical Drives

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With a schematic diagram, explain any 16 bit microcomputer. **(10 Marks)**
b. Explain with block diagram AC voltage sensor and DC current sensor. **(10 Marks)**

2 a. Mention features of IGBT and IGCT along with relevant symbols. **(10 Marks)**
b. With help of neat sketch explain variable voltage, constant frequency operation of induction motor drives. **(10 Marks)**

3 a. Explain drive operating regions of variable frequency and variable voltage of induction motor. **(10 Marks)**
b. Explain torque pulsation that occurs in induction motor drives. **(10 Marks)**

4 a. With neat sketch discuss the features of sinusoidal surface magnet machine. **(10 Marks)**
b. Discuss the features of variable reluctance machine (VRM), with neat diagram. **(10 Marks)**

PART – B

5 a. With suitable circuit diagram, waveforms and equations explain cosine wave crossing control of phase controlled converters. **(10 Marks)**
b. Discuss EMI and line power quality problems of converters. **(10 Marks)**

6 a. Explain static Kramer drive and its phasor diagram. **(10 Marks)**
b. Explain modes of operation of Scherbius drive. **(10 Marks)**

7 a. Discuss the voltage model of flux vector estimation. **(10 Marks)**
b. With help of block diagram explain open loop flux control. **(10 Marks)**

8 a. Mention the design procedure involved in design methodology of expert system. **(10 Marks)**
b. With help of suitable diagram, explain fuzzy logic control for induction motor speed control. **(10 Marks)**

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10EE764

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
VLSI Circuits & Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Discuss Moore's law with graph. **(04 Marks)**

b. Outline the procedure of masking E-beam masks. Mention its advantages and different types of E-beam masks. **(08 Marks)**

c. With the help of necessary structures, explain the twin tub process of CMOS fabrication process. **(08 Marks)**

2 a. Discuss the Latch up condition in pwell CMOS process. **(10 Marks)**

b. Discuss the drain to source current I_{ds} versus voltage V_{ds} relationship for non saturated and saturated regions. **(10 Marks)**

3 a. List the colour, stick encoding, layers, mask layout encoding for single metal nMOS process. **(06 Marks)**

b. Draw the circuit symbols and stick diagram of nMOS inverters and CMOS Inverters. **(08 Marks)**

c. Draw the stick diagram and layout plan for nMOS shift register cell. **(06 Marks)**

4 a. What is sheet resistance? Calculate sheet resistance of a transistor channel if $L = 8\lambda$, $w = 2\lambda$ if n transistor channel $R_s = 10^4\Omega$/square. **(06 Marks)**

b. Derive the expression for rise time and fall time estimation of CMOS inverter delay. **(06 Marks)**

c. Write a note on BiCMOS drivers. **(08 Marks)**

PART – B

5 a. Draw scaled nMOS transistor diagram. **(04 Marks)**

b. Indicate the scaling factors for any 10 transistor parameters. **(10 Marks)**

c. What are the limitations of sub threshold current and current density? **(06 Marks)**

6 a. Explain nMOS 4 bit dynamic shift register logic. **(05 Marks)**

b. What are the guidelines of a subsystem design process? **(05 Marks)**

c. Explain the structured design of bus arbitration logic for n lines. Also write the circuit diagram and stick diagram for a single cell. **(10 Marks)**

7 a. Explain with the neat diagram 4×4barrel shifter. **(10 Marks)**

b. Explain the general arrangement of 4 bit arithmetic processor. **(10 Marks)**

8 a. Explain the design of 4 bit adder with adder element requirements. **(10 Marks)**

b. Draw the structure of multiplexer based adder logic with stored and buffered sum output. **(10 Marks)**

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