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10EE71

Seventh Semester B.E. Degree Examination, June/July 2019
Computer Techniques in Power System Analysis

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define primitive network. Give the representation of primitive network in impedance and admittance form. Obtain the performance equation in both the forms. **(06 Marks)**

b. For the power system network shown in Fig.Q1(b). Draw the oriented graph and form the following incidence matrices.

i) Element – node incidence matrix $\hat{A}$
ii) Bus incidence matrix A
iii) Branch - path incidence matrix K
iv) Basic cut set incidence matrix B

v) Augmented cut set incidence matrix $\hat{B}$
vi) Basic loop incidence matrix C

vii) Augmented loop incidence matrix $\hat{C}$

Chose bus ① as reference. Take element 4 and 5 as link.

Fig.Q1(b) **(14 Marks)**

2 a. Determine Y_{BUS} by singular transformation of the system with data as below : **(06 Marks)**

Element no.	1	2	3	4	5
Bus code p-q	0 – 1	1 – 2	2 – 3	3 – 0	2 – 0
Self admittance in p.u	1.4	1.6	2.4	2.0	1.8

b. Find the admittance matrix for the system shown in Fig.Q2(b). **(06 Marks)**

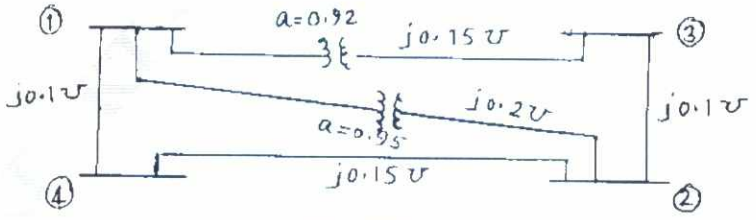

Fig.Q2(b)

c. Derive the generalized algorithm for finding the elements of bus impedance matrix Z_{BUS} when a link is added to the partial network. **(08 Marks)**

3 a. Discuss the importance of load flow analysis in power system. Enumerate the data required for carrying out load flow studies. **(10 Marks)**

b. Obtain the load flow solution at the end of 1st iteration, with data given below. Assume all buses except bus 1 are PQ buses. Use G – S method. **(10 Marks)**

Table – Line data

Line bus to bus	R (pu)	X (pu)
1 – 2	0.05	0.15
1 – 3	0.10	0.30
2 – 3	0.15	0.45
2 – 4	0.10	0.30
3 – 4	0.05	0.15

Table - Input data

Bus no.	P_i(pu)	Q_i(pu)	V_i(pu)
1	–	–	1.04
2	0.5	–0.2	–
3	–1.0	0.5	–
4	0.3	–0.1	–

4 a. Explain the algorithm procedure for load flow analysis using Newton – Raphason's method in polar coordinates. Compare N–R and G–S method for load flow analysis. **(10 Marks)**

b. What are the assumptions made in fast decoupled load flow method? Explain the algorithm through flow chart. **(10 Marks)**

PART – B

5 a. What is penalty factor? Derive an expression for optimal economic despatch including transmission losses. **(10 Marks)**

b. Incremental fuel costs in rupees per Mwhr for a plant consisting of two units are :

$$\frac{dc_1}{dp_1} = 0.20\ P_1 + 40.0$$

$$\frac{dc_2}{dp_2} = 0.25\ P_2 + 30.0$$

Assume that both units are operating at all times and total load varies from 40MW to 250 MW, and the maximum and minimum loads on each unit are to be 125 MW and 20MW respectively. How will the load be shared between the two units as the system load varies over the full range? What are the corresponding values of the plant incremental costs? **(10 Marks)**

6 a. A two bus system shown in Fig.Q6(a). If 100MW of power is imported to bus 2, a loss of 8 MW is incurred, find the required generation for each plant and the power received by the load when plant incremental cost is Rs.100/MWh. The incremental fuel cost of two plants are :

$$\frac{dc_1}{dp_1} = 0.12P_1 + 65 \text{ Rs/MWh}$$

$$\frac{dc_1}{dp_2} = 0.25P_2 + 75 \text{ Rs/MWh}$$

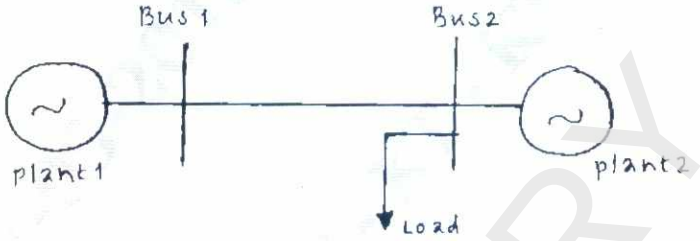

Fig.Q6(a)

(10 Marks)

b. Compute the loss coefficients for the network shown in Fig.Q6(b) using below data.

$I_a = 2 - j0.5$ pu $\quad Z_a = 0.015 + j0.06$ pu

$I_b = 1.6 - j0.4$ pu $\quad Z_b = 0.015 + j0.06$ pu

$I_c = 1 - j0.25$ pu $\quad Z_c = 0.01 + j0.04$ pu

$I_d = 3.6 - j0.9$ pu $\quad Z_d = 0.01 + j0.04$ pu **(10 Marks)**

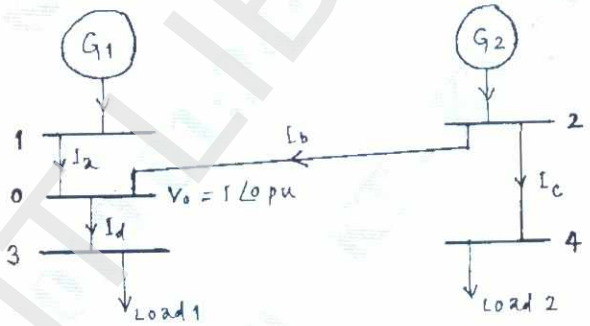

Fig.Q6(b)

7 a. Explain swing equation by point by point method. **(10 Marks)**

b. Explain the modified Euler's method used in solution of swing equation for transient stability studies. **(10 Marks)**

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

b. Explain Milne predictor corrector method for solution of swing equation. **(10 Marks)**

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10EE72

Seventh Semester B.E. Degree Examination, June/July 2019

Electrical Power Utilization

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State and explain Stefan's law of radiation. **(04 Marks)**

b. Six resistance each of 80 Ωs are used in resistance heating furnace, how much power is drawn when they are connected to 1ϕ, 400 V in the following combination:
i) Three groups in parallel, each of 2-resistance
ii) Two groups in parallel, each of 3-resistance **(04 Marks)**

c. In a 3ϕ, arc furnace to melt 10 tons of steel in 2 hrs, estimate the average input to the furnace, if overall efficiency is 50%. If the input current is 9000 A, with the above KW input and resistance and reactance of furnace leads are 0.03 Ω and 0.05 Ωs respectively. Estimate the arc voltage and total KVA taken from supply. Given:
i) Sp. heat of steel = 444 $Kkg^{-1}C^{o-1}$
ii) Latent heat of fusion = 37.25 kJ/kg
iii) Melting point of steel = 1370°C
iv) Initial temperature = 20°C **(12 Marks)**

2 a. Show that in case of Di-electric heating, power required is given by $P = 2\pi f \frac{\epsilon_0 \epsilon_r A}{t} . V^2 . R / Z .$ **(06 Marks)**

b. What is depth of penetration in case of induction heating? Find the depth of penetration in case of hardening of a steel pulley, if the relative permeability is unity and specific resistance is 5×10^{-7} Ω-m and frequency is 56.3 kHz. **(06 Marks)**

c. What are requirements of Good weld? Compare resistance welding versus arc welding. **(08 Marks)**

3 a. Discuss various factors governing better electro deposition. **(10 Marks)**

b. A rectangular plate 20 cm × 10 cm is to be coated with Nickel with a layer of 0.2 mm thick. Determine the quantity of electricity in Amp-hr and time taken for the process, given:
Current density = 190 Amp/m^2
Current efficiency = 90%
Density of Ni = 8900 kg/m^3
ECE of Ni = 0.0003043 **(10 Marks)**

4 a. State and explain the laws of Illumination. **(06 Marks)**

b. A 250 V, lamp has a total flux of 3000 lumens and takes a current of 0.8A. Calculate (i) Lumens/watt (ii) MSCP/watt **(06 Marks)**

c. A small light source with intensity uniform in all directions is mounted at a height of 10 mtrs above a horizontal surface. Two points A and B both lie on the surface with point 'A' directly beneath the source. How far is point 'B' from 'A', if the illumination at point 'B' is only $\frac{1}{10}^{th}$ as great as at point A? **(08 Marks)**

PART – B

5 a. What are basic requirements of an ideal traction systems? **(06 Marks)**

b. What are simplified speed time curves? For a simplified trapezoidal speed time curve, develop an expression for crest-speed. **(06 Marks)**

c. The speed-time curve of a train consists of
- Uniform acceleration of 6 kmphps for 25 secs
- Uniform retardation of 6 kmphps to stop the train
- Free running for 10 mins
- A stop of 5 mins

Find: i) Distance between the station
ii) Average speed
iii) Schedule speed **(08 Marks)**

6 a. Derive an expression for Tractive effort required by train for propulsion along a gradient. **(08 Marks)**

b. A train weighing 120 tons is to be driven up an incline of 2% at a speed of 36 kmph. If the train resistance at this speed is 2 kg/ton, find the current required at 1500 V d.c., if the efficiency of motors and gears is 88%. If the current were cut off, how long would the train take to come to rest? **(12 Marks)**

7 a. Develop an expression for specific energy output of a locomotive, using a simplified speed time curve. State the factors affecting the same. **(08 Marks)**

b. An electric train weighing 100 tons has a rotational inertia of 10%. This train while running between two stations, which are 2.5 km apart has an average speed of 50 km/hr. The acceleration of retardation during braking are 1 kmphps and 2 kmphps respectively. The percentage gradient between these stations is 1% and the train is to move up the incline. The track resistance is 40 N/ton. If the combined efficiency of electric train is 60%, determine:
i) Maximum power at driving Axle
ii) Total energy consumption
iii) Specific energy consumption
Assume that journey estimation is being made on simplified trapezoidal speed time curve. **(12 Marks)**

8 Write short notes on (any FOUR):
a. A.C. series motor
b. Performance of electrical vehicles
c. Traction motor characteristics
d. Train lighting system
e. Linear induction motor **(20 Marks)**

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10EE73

Seventh Semester B.E. Degree Examination, June/July 2019

High Voltage Engineering

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What are the advantages of transmitting a certain amount of electrical power at a high voltage? Assume the power factor, current density and reactance of the line to remain unchanged. **(09 Marks)**

b. Explain the need for generating high voltages in laboratory. **(04 Marks)**

c. What is the use of an electrostatic precipitator? With a neat schematic diagram describe in short principle of its operation. **(07 Marks)**

2 a. Define Townsend's first and second ionization coefficients. **(04 Marks)**

b. Derive Paschen's law and draw Paschen's curve in respect of a gas subjected to a uniform static electric field. **(08 Marks)**

c. In a Townsend experiment conducted on a certain gas it was found that the steady state current (the secondary ionization can be ignored) is 6×10^{-8} A at 10 kV at a gap spacing of 0.4 cm between electrodes. Keeping the field constant and reducing the distance to 0.2 cm a current of 10×10^{-9} A was obtained. Calculate Townsend's first ionization coefficient, α. However, the gas broke down when the gap distance was increased to 1.0 cm. What is the second ionizing coefficient, γ? **(08 Marks)**

3 a. Describe the mechanism of breakdown of a commercial liquid dielectric due to gaseous bubbles. **(06 Marks)**

b. Explain the mechanism of thermal breakdown in solid insulating materials. **(06 Marks)**

c. Discuss in brief the streamer mechanism of breakdown of a gaseous insulation. **(08 Marks)**

4 a. Explain with a neat diagram the cascade connection to obtain 750 kV, 50 Hz using three winding testing transformers, each rated at 230V/250kV/230V. **(10 Marks)**

b. An eight stage Cockroft-Walton type cascade circuit with capacitances all equal to 0.05 μF is fed from 150 kV, 150 Hz. If 3.5 mA current is to be supplied to the load, determine:

i) The ripple

ii) Voltage drop and regulation

iii) Optimum number of stages for maximum output voltage. **(10 Marks)**

PART – B

5 a. With a neat diagram, explain what is meant by a 1500 kV, 1.2/50 voltage. **(04 Marks)**

b. Derive an expression for the output voltage of the single stage impulse generator shown in Fig.Q5(b). The spark gap G breaks down the moment C_1 is charges to V_0.

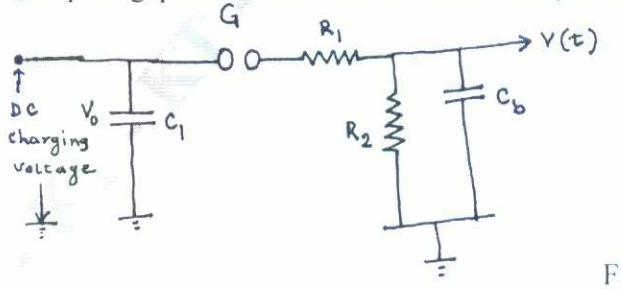

Fig.Q5(b) **(10 Marks)**

c. An 8 stage impulse voltage generator has 0.12 μF capacitors rated at 167 kV. What is the maximum discharge energy? It has to produce s 1/50 wave form across a load capacitor of 15000 pf. Find a rough estimate of WFR and WTR. **(06 Marks)**

6 a. Describe Chubb-Fortescue method for measurement of peak value of ac voltage. **(08 Marks)**

b. Explain the principle of an electrostatic voltmeter. Show that it measures d.c. voltage and rms value of ac voltage. **(08 Marks)**

c. An absolute electrostatic voltmeter has a movable circulate plate of 8 cm diameter. If the spacing between the plates is 4 mm and the applied voltage is 1 kV d.c. Calculate the force on the plate. $\epsilon_0 = 8.854 \times 10^{-12}$ F/m, $\epsilon_r = 1$. **(04 Marks)**

7 a. Show the two circuit models to represent a lossy capacitor. What is tans? Explain its significance? **(04 Marks)**

b. With a neat diagram describe a high voltage Schering bridge to measure the capacitance and dissipation factor of a sample of a dielectric. **(10 Marks)**

c. A 33 kV, 50 Hz, H.V. Schering bridge is used to test a sample of insulation. The various arms have the following parameters at balance. The standard air capacitor is 500 pF and the resistive branch is 8000 Ω. The branch with parallel combination of resistance and capacitance have the values of 180 Ω and 0.15 μF. Determine the parameters of the sample, the loss angle and power factor under these conditions. **(06 Marks)**

8 a. Describe the high voltage tests conducted on a suspension insulator string touching on the following points:

i) Experimental arrangement

ii) High voltage tests of different types

iii) Salt fog test **(10 Marks)**

b. Describe the lightning impulse tests conducted on a power transformer in the laboratory. **(10 Marks)**

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10EE74

Seventh Semester B.E. Degree Examination, June/July 2019

Industrial Drives and Applications

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the different parts of electrical drives system. **(10 Marks)**

b. What is quadrantal diagram? Explain the multi quadrant operation of a motor driving a hoist load. **(10 Marks)**

2 a. What is load equalization? Explain the components of load torque. **(10 Marks)**

b. What are the classes of motor duty? Explain them in brief. **(10 Marks)**

3 a. Explain the operation of 1ϕ fully controlled rectifier control of D.C. motor separately excited. **(10 Marks)**

b. A 200 V, 875 rpm separately executed d.c. motor has an armature resistance of 0.06 Ω. It is fed from a 1ϕ fully controlled rectifier with an ac voltage of 220 V, 50 Hz. Assuming continuous conduction, calculate:
i) Firing angle for rated motor torque and 750 rpm
ii) Firing angle for rated torque with (–500 rpm)
iii) Motor speed for $\alpha = 160°$ and rated torque. **(10 Marks)**

4 a. With a relevant circuit diagram and waveforms, explain the operation of chopper control of separately excited d.c. motor. **(08 Marks)**

b. A 230 V, 960 rpm and 200 A, separately excited d.c. motor has an armature resistance of 0.02 Ω. The motor is fed from a chopper which provide both motoring and braking operations. The source has a voltage of 230 V. Assuming continuous conduction.
i) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm
ii) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm
iii) If max. duty ratio of chopper is limited to 0.95 and Max. permissibility motor current is twice the rated. Calculate max permissible field weakening and power feed to the source
iv) If motor field is also controlled. Calculate field current as a fraction of its rated filed current as a function of its rated value for a speed of 1200 rpm. **(08 Marks)**

c. Explain regeneration braking of a separately excited D.C. generator using chopper circuit. **(04 Marks)**

PART – B

5 a. What are the methods employed for braking of an Induction motor? Explain in brief Regenerative braking. **(10 Marks)**

b. A 400 V, Y connected, 3 phase, 6 pole, 50 Hz induction motor has following parameters referred to the stator $R_S = R'_r = 1\Omega$, $X_S = X'_r = 2\Omega$ for regenerative braking operation of this motor determine:
i) Maximum overhauling torque it can hold and range of speed for safe operation.
ii) Speed at which it will hold an overhauling load with a torque of 10 N-m. **(10 Marks)**

6 a. Explain the operation of synchronous machine from a fixed frequency supply. **(05 Marks)**
b. Explain the operation of braking in synchronous machines. **(05 Marks)**
c. Explain the steady-state stability limit, and dynamic stability in synchronous motors. **(10 Marks)**

7 a. Explain the operation of rotor resistance control of induction motor. **(08 Marks)**
b. A 3 phase 400 V, 6-pole, 50 Hz, Δ-connected, slip-ring induction motor has rotor resistance of 0.2 Ω and leakage reactance of 1 Ω/phase referred to stator when driving a fan load it runs at full load at 4% slip. What resistance must be inserted in the rotor circuit to obtain a speed of 850 rpm? Neglect stator impedance and magnetizing branch. Stator to rotor ratio is 2.2. **(12 Marks)**

8 a. Explain the different drives used in textile mills. **(05 Marks)**
b. Explain the different drives used in rolling mill drives. **(05 Marks)**
c. Explain the operation of self controlled synchronous motor drive employing load commutated thyristor inverter. **(10 Marks)**

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10EE756

Seventh Semester B.E. Degree Examination, June/July 2019
Testing and Commissioning of Electrical Equipment

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the procedure of drying out of a power transformer. **(06 Marks)**
b. What are the qualities of good insulating oil? **(06 Marks)**
c. Describe the test setup for impulse testing of power transformers. **(08 Marks)**

2 a. What are the standard specifications of a power transformer? **(06 Marks)**
b. With a neat sketch, explain the method of measurement of insulation resistance. **(08 Marks)**
c. List the various commissioning tests on a power transformer. Explain any one of them. **(06 Marks)**

3 a. Name the various accessories and fitments on a transformer. **(10 Marks)**
b. What are the typical ratings of synchronous Generator? **(10 Marks)**

4 a. Describe features of steam – turbine generators. **(06 Marks)**
b. What is unit commissioning? What are the essential steps in unit commission protocol with reference to steam turbine generator unit? **(06 Marks)**
c. Define short – circuit ratio SCR of synchronous machine. What is its significance? **(08 Marks)**

PART – B

5 a. State the various steps in the installation and commission of Induction motors. **(10 Marks)**
b. What are permissible tolerances of shaft alignment? Explain the procedure of alignment of shaft of electrical machines. **(10 Marks)**

6 a. Give example of a Rating plate of an Induction motor. **(06 Marks)**
b. Explain the drying out of a motor by radiating lamps (or) infrared lamps. **(06 Marks)**
c. Sate the checks to be carried out at site prior to commissioning of an Induction motor. **(08 Marks)**

7 a. List the various factors to be considered while selecting a circuit breaker. **(06 Marks)**
b. Explain different tests to be conducted on circuit breaker. **(06 Marks)**
c. Explain the various commissioning tests on high voltage A.C circuit breakers. **(08 Marks)**

8 Write a short not on :
i) Maintenance of SF_6 circuit breaker.
ii) Various steps in installation and commissioning of outdoor circuit breaker.
iii) Polarization Index
iv) Short circuit test setup for circuit breaker. **(20 Marks)**

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10EE761

Seventh Semester B.E. Degree Examination, June/July 2019

Power System Planning

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What do you understand by planning process? Mention the step by step procedure for strategic planning. **(10 Marks)**

b. Explain the concept of least-cost utility planning with the aid the flow chart. **(10 Marks)**

2 a. What is cogeneration? What are its benefits? List the important factors in deciding on cogeneration? **(10 Marks)**

b. List out national action plan goals associated with generation planning in brief terms. **(10 Marks)**

3 a. Discuss in brief the basic tariff making philosophy. **(10 Marks)**

b. Explain private participation with respect to ownership options and modes of participation. **(10 Marks)**

4 a. Discuss the impact of power generation on environment. What are the measures to be taken for minimizing environmental effects? **(10 Marks)**

b. Explain with the help of V-T curve the need of insulation coordination in power system. **(10 Marks)**

PART – B

5 a. With the help of a schematic diagram, explain the various means of load management. **(08 Marks)**

b. Explain in brief the following real time operations:
i) State Estimation ii) AGC
iii) Economic Load Dispatch iv) Stability **(12 Marks)**

6 a. What is power system simulator? Explain its functions using a block diagram. **(10 Marks)**

b. With a figure, explain a centralized computing system for monitoring and controlling a power system. **(10 Marks)**

7 a. Develop mathematical objective function of power system expansion planning. **(10 Marks)**

b. Explain the methodology to be adopted for optimal expansion planning of power system. **(10 Marks)**

8 a. Explain least cost optimization problem. **(10 Marks)**

b. Explain in brief any two optimization techniques. **(10 Marks)**

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10EE764

Seventh Semester B.E. Degree Examination, June/July 2019

VLSI Circuits and Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With a neat diagram, explain the working of basic nMOS enhancement mode transistor. **(08 Marks)**

b. Explain with neat diagrams the process of fabrication of p-well CMOS inverter. **(08 Marks)**

c. Explain the procedure used for production of e-beam mask. **(04 Marks)**

2 a. Derive an expression for pull-up to pull down ratio for an nMOS inverter driven through one or more transistors and hence find the typical value for it. **(08 Marks)**

b. Explain latch-up in CMOS circuits with relevant diagrams and waveforms. **(07 Marks)**

c. An nMOS transistor has L = 2 μm, W = 20 μm and $\mu_n C_o$ = 90 μA/V^2, V_{tn} = 0.5 V. Determine drain to source current for V_{gs} = 3.3 V, V_{ds} = 2V. **(05 Marks)**

3 a. Explain Lambda (λ) based design rules as applicable to wires and transistors with appropriate diagrams. **(08 Marks)**

b. Draw the circuit symbol and stick diagrams for CMOS inverter. **(06 Marks)**

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

4 a. What is sheet resistance? Calculate sheet resistance of transistor channel if L = 8λ, W = 2λ, if n-transistor channel $R_s = 10^4$ Ω/square. **(04 Marks)**

b. With schematic diagrams, explain inverting and non-inverting super buffers. **(06 Marks)**

c. Explain three different kinds of wiring capacitances. **(05 Marks)**

d. Briefly explain BiCMOS drivers. **(05 Marks)**

PART – B

5 a. Derive scaling factor for any 10 device parameters. **(10 Marks)**

b. Discuss the limitations of scaling on interconnect and contact resistance. **(10 Marks)**

6 a. Draw the symbolic diagram for BiCMOS 2 input NAND gate. **(06 Marks)**

b. Explain in detail pseudo nMOS logic taking inverter as an example. **(06 Marks)**

c. With block diagram and stick diagram explain the design approach of a parity generator. **(08 Marks)**

7 a. Draw and explain combinational circuit to generate 2-phase clocking. **(06 Marks)**

b. Explain pre-charged bus concept with circuit diagrams. **(06 Marks)**

c. Explain the operation of 4 × 4 cross bar switch with a neat diagram. **(08 Marks)**

8 a. Explain with diagrams and expressions how to implement ALU functions with an adder? **(10 Marks)**

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

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