University of Asia Pacific
Department of Electrical & Electronic Engineering
Semester Final Examination Fall-2021
Program: B.Sc. in EEE (4th Year/ 1st Semester)

Course Title: VLSI Design I   Course Code: EEE423   Credits: 3.00

Time: 3:00 Hours.   Full Marks: 150

[There are Eight Questions. Answer any Six including question 1 to 4. Figures in the right margin indicate full marks.]

1. Why NMOS is preferred in VLSI design over PMOS. Which design technique [25] (CMOS or NMOS) you will prefer to implement the logic function $F = (\bar{A} + BC)D + \bar{E}$, explain with reasons. Depending on your preference draw the circuit and layout diagram for the logic function of F.

2. A NMOS OR gate with an Depletion type load is biased at $V_{DD} = 4V$, Assume [25] that, $c\mu_n/D = 30\ \mu A/V^2$ for all MOSFET, also assume $(W/L)_{NMOS} = 4$, $(W/L)_{depletion\_load} = 2$, $Vt\_{NMOS} = 0.6V$, $Vt\_{depletion\_load} = -4V$. Findout the Output voltage when inputs A = 4.50 V & B = 4.50 V.

3. Draw the RC model for the following logic circuit and calculate the delay for [25] this circuit, assume that for PMOS and NMOS, k = 3. Where k is the aspect ratio.
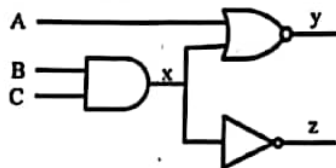
4. Draw the I-V characteristics curve and input-output voltage curve of a CMOS [25] inverter for following input voltages, Vin = 1.5V, 2V, 2.5V, 3V, 3.5V. Determine the output voltage of a CMOS inverter for a input voltage of Vin = 1.5V, given that, $Vtn = Vtp = 0.5V$, $c\mu_n/D = 50\ \mu A/V^2$, $c\mu_p/D = 30\ \mu A/V^2$ and $V_{dd} = 4.3V$, $(W/L)n = 1$, $(W/L)p = 2$.

5. Which PLA technique (AND-OR or NOR-NOR) you will prefer to implement a [25] full adder, explain with reasons. Depending on your preference draw the transistor level diagram of a full adder.

OR

6. Which design technique (NMOS/PMOS/CMOS) will be more efficient to [25] implement arithmetic devices (example, ie. adder, subtractor) and why? As per your evaluation design the circuit or layout diagram of a full adder.

7. Determine the rise time (t_r) and fall time (T_f) for a NMOS inverter with a [25] depletion type load, consider the circuit biased at $V_{dd} = 5V$. Assume that, $c\mu_n/D = 35\ \mu A/V^2$, $V_{t\_NMOS} = 0.5V$ and $V_{t\_load} = -4V$.

OR

8. A NMOS NOR gate with an Enhancement type load is biased at $V_{DD} = 4V$, [25] Findout the output voltage when the inputs A = 0.75 V & B = 3.75 V. Assume that,

For NMOS,	For Enhancement load,
$c\mu_n/D = 35\ \mu A/V^2$	$\epsilon\mu_n/D = 35\ \mu A/V^2$
$(W/L)_{NMOS} = 2$	$(W/L)_{enhancement\_load} = 3$
$V_{t\_NMOS} = 1.2\ V$	$V_{\_enhancement\_load} = 0.5\ V.$
$V_{SB} = 0\ V$	$V_{SB} = 0.4\ V$

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Semester Final Examination, Fall' 2021
Program: B.Sc. in EEE (4th Year/1st Semester)

Course Code: EEE-411   Course Title: Power Station Engineering   Credit Hours: 3 Hours
Time: 3 Hours   Full Marks: 150

[Answer any six questions. Including Question 1, Question 4, Question 7, Question 8]

1. (a). Why is electrical energy preferred over other forms of energy? [05]
   (b). Discuss the different sources of energy available in nature. [10]
   (c). Mechanical energy is supplied to a d.c. generator at the rate of 4200 J/s. The generator [10]
        delivers 32·2 A at 120 V.
        (i) What is the efficiency of generator?
        (ii) How much energy is lost per minute of operation?

2. (a). Draw a neat schematic diagram of a hydro-electric plant and explain the functions of various [15]
        components.
   (b) It has been estimated that a minimum run off of approximately 94 m^3/sec will be available at [10]
       a hydraulic project with a head of 39 m. Determine (i) firm capacity (ii) yearly gross output.
       Assume the efficiency of the plant to be 80%.

Or

3. (a) Draw the schematic diagram of a nuclear power station and discuss its operation. [15]
   (b) What is the power output of a $_{92}U^{235}$ reactor if it takes 30 days to use up 2 kg of fuel? Given [10]
       that energy released per fission is 200 MeV and Avogadro's number = $6·023 \times 10^{26}$ per
       kilomole.

4. (a) What do you understand by the load curve? What informations are conveyed by a load [4+4]
       curve?
   (b) A 100 MW power station delivers 100 MW for 2 hours, 50 MW for 6 hours and is shut down [10]
       for the rest of each day. It is also shut down for maintenance for 45 days each year.
       Calculate its annual load factor.
   (c) Explain the term diversity factor. How do these factor influence the cost of generation? [07]

5. (a) Discuss the various methods of determining the depreciation of the equipment. [25]

Or

6. (a) Explain how the load factor plays a vital role in determining the cost of energy. [10]
   (b) The equipment in a power station costs Tk 15,60,000 and has a salvage value of Tk 60,000 at [15]
       the end of 25 years. Determine the depreciated value of the equipment at the end of 20 years
       on the following methods :
       (i) Straight line method
       (ii) Diminishing value method
       (iii) Sinking fund method at 5% compound interest annually.

7. (a) What do you understand by tariff ? Discuss the objectives of tariff. [07]
   (b) Describe the desirable characteristics of a tariff. [08]
   (c) The maximum demand of a consumer is 20 A at 220 V and his total energy consumption is [10]

8760 kWh. If the energy is charged at the rate of 20 paise per unit for 500 hours use of the maximum demand per annum plus 10 paise per unit for additional units, calculate : (i) annual bill (ii) equivalent flat rate.

8. (a) What do you mean by renewable energy? Explain how wind energy is converted into electrical power. [20]

(b) What is biomass? [05]

Course Title: Energy Conversion and Special Machines   Course No. EEE 401   Credits: 3.00
Time: 3.00 Hour   Full Marks: 150

[There are **Eight** Questions. Answer **Six Questions** including Questions **1, 2, 5 and 6**. Figures in
the right margin indicate marks.]

1. (a) Consider, you have a 2-phase stator with 2-pole permanent magnet (PM)   [5+8]
    rotor Stepper Motor. Which control sequence method will you suggest for
    higher torque operation? Also draw the stepping sequence with brief
    explanation and calculate the full step angle.

    (b) A Variable Reluctance stepping motor has 4 main poles which have been   [12]
    castellated to have 6 teeth each. If rotor has 40 teeth, then determine the
    following-
        i. Step angle
        ii. Resolution
        iii. Number of steps required for the shaft to make 6 revolutions and
        iv. Shaft speed, if the stepping frequency is 280 pps.

2. (a) A universal motor has armature circuit resistance of 15 Ω and inductance   [12]
    of 0.3 H. On being connected to a 220 V dc supply, it draws 1.5 A from the
    mains and runs at 2000 rpm. Find the speed and power factor of the motor,
    when connected to a 230 V, 25 Hz supply and drawing the same armature
    current.

    (b) What are the types of variable reluctance stepper motor? Explain how they   [3+10]
    develop the torque and how resolution of step angle of variable reluctance
    motor can be increased.

3. (a) An overhead crane in a factory is driven horizontally by means of two   [10]
    similar linear induction motors whose rotors are the two steel I beam on
    which the crane rolls. The three phase two pole linear stators which are
    mounted on opposite sides of the crane have a pole pitch of 4.7 cm and are
    energized by variable frequency source. The tests on one of the motors
    gave the following results- Stator frequency = 50 Hz, Stator copper and iron
    loss = 1.5 kW, Power to stator = 6 kW and Crane Speed = 3.5 m/sec.
        Calculate- i. Synchronous speed and slip
               ii. Power input to rotor

iii. Copper loss in the rotor
iv. Gross mechanical power developed
v. Thrust.

(b) Although all motors give rotational motion except one type of motor which gives linear translational motion. With figure show how the motor can be constructed to produce that motion. [10]

(c) To avoid unnecessary wear and tear friction losses how repulsion motor can be operated as repulsion-start induction-run motor? Justify your answer. [5]

Or,

4. (a) A 10 kW 4-pole, 220 V, 50 Hz reluctance motor has a torque angle of 25 degrees when operating under rated load condition. Calculate load torque. Find the torque angle if the voltage drops to 205 volts. [10]

(b) Is there any dc motor available who does not involve in mechanical commutation to the windings, no electromagnet and brush then again it converts electrical energy into mechanical energy? How the motor develop such mechanical torque? [10]

(c) In selection of rotor material for hysteresis motor why do we need to know the B-H curve of that magnetic material? Justify your answer. [5]

5. (a) As an Assistant Engineer you have asked to design a Solar Home System for a semi-urban area. How do you represent the design in a flow chart? [10]

(b) To run 3 lamps of 15 W and 2 fans of 24 W at a distance of 30 m how do you select the required wire size for a solar home system? You may assume the load voltage as 24 V. [5]

(c) At Standard Test Conditions, a SOVA Solar polycrstalline module exhibits the following characteristics: Maximum power 300 Wp, open-circuit voltage 44.46 V, Short Circuit current 8.74 A. The module is composed of 72 cells dimensions of 15 cm/15 cm and its outer dimensions are 195.5 cm/ 98.2 cm. Determine the (i) solar cell efficiency (ii) packing factor (iii) solar module efficiency (iv) fill factor. [10]

6. (a) An NGO named GIZ wants to install an offshore wind turbine in Kutubdia Island where the wind speed at 15 m height is 4 m/s. You have asked submit a project proposal to install a wind turbine at 80 m height. If the rotor blade length is 22 m and power coefficient is 0.45 then what will be the maximum electrical power output? [10]

(b) Do you agree that wind turbine will operate and generate electrical power at any wind speed? Justify your answer. [5]

(c) What are the decisions you may take from the following I-V curve?
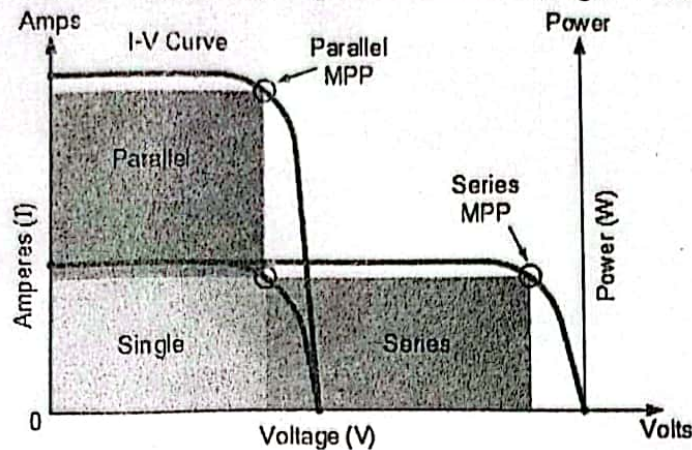
7. (a) A four star hotel in Cox's Bazar wants to setup a renewable energy based water heating system to meet it daily hot water requirements. What type of water heating system you may suggest to the hotel authority and how the system will works? [10]

(b) To generate biogas the required biomass resources must be on wet form, else biogas will not produce. How do you disagree or agree with this statement? Justify your answer. [10]

(b) Consider you are working in a consultancy firm and as a design engineer you have asked to design a wiring system for an off-grid SHSs in a residential building. Remember the electrical loads should run by AC. [05]

Or,

8. (a) Government of Bangladesh has impose a policy that every residential building should use 5% electricity that generate from renewable resources. The area has good solar energy potential and 1 kW/m^2 or more radiation will be available from 10.30 am to 3.30 pm. The building authority has decided to install SHS as an obligation to the govt. policy and you have asked to design and make a list of the SHS components require for a 5-storied residential building. [10]

(b) To produce charcoal the required biomass resources must be on solid form and go through a process where absence of oxygen is mandatory or else charcoal will not produce. Justify your answer? [10]

(c) Design a sketch through single line diagram of a Grid-Tied solar PV system with battery storage. [05]

sol To generate biogas the required biomass resources must be definately in wet form.

Biogas is generated from Biomass and the medium of generating biogas is microorganism, and their number is directly proportional to the yield of biogas.

microorganism can easily be regrowth and increase their number in the presence and for their activity to be performed moisture is necessary and hence wet biomass is responsible for biogas