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| Serial No: |
| **Sessional I** |
| **Total Time: 1 Hour** |
| **Total Marks: 65** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Signature of Invigilator |

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| **EE-227 Digital**  **Logic Design** |
| Monday 26th February, 2018 |
| **Course Instructor** |
| Dr. Mewhish Hassan, Mehreen Alam,  Rabia Bannu |

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## DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.

**Instructions:**

1. Attempt on question paper. Attempt all of them. Read the question carefully, understand the question, and then attempt it.
2. No additional sheet will be provided for rough work. Use and mark the back of the last page for rough work.
3. If you need more space write on the back side of the paper and clearly mark question and part number etc.
4. After asked to commence the exam, please verify that you have **Seven (7)** different printed pages including this **Title page** and **Rough work page** at the end. There are total of **5 questions**.
5. **Calculator is NOT allowed**.
6. Use permanent ink pens only. Any part done using soft pencil will not be marked and cannot be claimed for rechecking.
7. **For each question show your complete method in solution to get full credit**.

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| --- | --- | --- | --- | --- | --- | --- |
|  | Q-1 | Q-2 | Q-3 | Q-4 | Q-5 | **Total** |
| **Total**  **Marks** | **20** | **10** | **15** | **10** | **10** | **65** |
| **Marks Obtained** |  |  |  |  |  |  |

**Vetted By: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Vetter Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Question No.1 [ 5+5+5+5 = 20pts ]

1. Perform 8 bit Signed Binary addition of (-29) + (-49) using Signed-2’s-Complement representation.
2. Perform addition of 4946 and 6054 using BCD, you must show all the steps.
3. Complete the table below using 5 bits only.

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| --- | --- | --- | --- |
| **Decimal** | **Signed 2’s complement** | **signed 1’s complement** | **signed magnitude** |
| **+0** |  |  |  |
| **-0** |  |  |  |
| **-1** |  |  |  |
| **-2** |  |  |  |
| **-3** |  |  |  |
| **-4** |  |  |  |
| **-5** |  |  |  |
| **-6** |  |  |  |
| **-7** |  |  |  |
| **-8** |  |  |  |
| **-9** |  |  |  |
| **-10** |  |  |  |
| **-11** |  |  |  |
| **-12** |  |  |  |
| **-13** |  |  |  |
| **-14** |  |  |  |
| **-15** |  |  |  |
| **-16** |  |  |  |

1. Subtract using 2’s complement. Your answer should not be in 2’s complement form. 1001-110101

Question No.2 [ 5 + 5 = 10pts ]

1. Using duality principle, find the complement of the expression **z + z’ ( v’w + xy ).**
2. Using Boolean Algebra, reduce the expression to two literals: **ABC’D + A’BD + ABCD**

**Question No.3 [ 5+5+5 = 15 pts ]**

Without using k-maps or truth table, for F = (X' + Y + Z) (W + X) (Y + Z') find:

1. SOP canonical form
2. POS canonical form
3. SOP standard form

**Question No.4 [ 10pts ]**

For the Boolean function: **F(A, B, C, D) = A’B’C’D’ + BC’D + A’C’D + A’BCD + ACD’**

1. Express this function as sum of minterms
2. Find the minimal sum-of-product expression.

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F = …………………………………………………………………

**Question No.5 [ 10pts ]**

Find all the prime implicants and determine which are essential.

F(w, x, y, z) = ∑ ( 0, 1, 2, 5, 7, 8, 10, 15)

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Prime implicant :…………………………………………….

…………………………………………….

Essential Prime implicants: …………………………………….

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**Rough Work**