

International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Assessment of Autumn-2020	Program: B.Sc. Engg. (EEE)
Course Code: EEE-3519	Course Title: Power System Analysis
Time: 5 hours (Writing - 4 hours 30 minutes + 30 minutes submission time)	Full Marks: 50 (Written 30 + Viva/Viva-Quiz-20)

[Answer **each** of the questions from the followings; Figures in the right margin indicate full marks. **Answer script must be submitted through online method within 5 hours from starting time. Also, write down the Q. Set on the front page of your answer script]**

Question SET Selection Process:

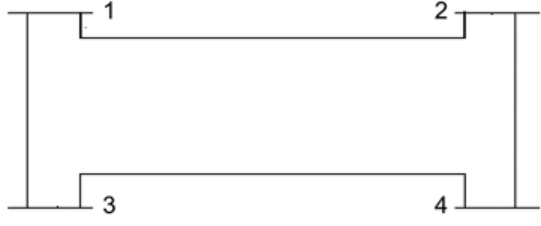
***Please show the **Calculation of Question SET Selection** at the 1st page of answer sheet. ***

LDI=x=Last digit of student ID

[For Question **SET** Selection: (Last digit of Student ID=x)+(the Digit before last digit of Student ID=y)=**Z** . If **Z** is **even** your Question **SET-A** and If **Z** is **odd** your Question **SET-B** If the value of **Z=0**, answer **Question SET-B**.

Example: for St. ID =ET 151015; St. last digit of ID=1=x; and the digit before last digit of ID is =5=y; So, **Z**=(x+y)=(1+5)=6. Here, 6 is an **even** number. So you have to Answer **Question SET-A**.]

SET-A

SL.	Question	Course Outcome	Bloom's Level	Marks																																			
Q.1.	<div style="text-align: center;">  <p>Fig. 1. Typical power system</p> <p>The line admittance of typical bus system given bellow:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Line (bus to bus)</th> <th>Admittance (pu)</th> </tr> </thead> <tbody> <tr> <td>1-2</td> <td>-j3</td> </tr> <tr> <td>1-3</td> <td>-j4</td> </tr> <tr> <td>2-4</td> <td>-j5</td> </tr> <tr> <td>3-4</td> <td>-j6</td> </tr> </tbody> </table> <p>Bus data</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Bus</th> <th>P_p pu</th> <th>Q_p pu</th> <th>V_p pu</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0.3</td> <td>-0.1</td> <td>-</td> <td>PQ bus</td> </tr> <tr> <td>2</td> <td>0.5</td> <td>-0.2</td> <td>-</td> <td>PQ bus</td> </tr> <tr> <td>3</td> <td>-1.0</td> <td>0.5</td> <td>-</td> <td>PQ bus</td> </tr> <tr> <td>4</td> <td>-</td> <td>-</td> <td>1.04 $\angle 0^\circ$</td> <td>Slack bus</td> </tr> </tbody> </table> </div>	Line (bus to bus)	Admittance (pu)	1-2	-j3	1-3	-j4	2-4	-j5	3-4	-j6	Bus	P_p pu	Q_p pu	V_p pu	Remarks	1	0.3	-0.1	-	PQ bus	2	0.5	-0.2	-	PQ bus	3	-1.0	0.5	-	PQ bus	4	-	-	1.04 $\angle 0^\circ$	Slack bus			
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1(a).	A 4-bus power system shown in the Fig. 1. The relevant p.u line admittances on 100 MVA base are indicated on the diagram and bus data are given in the table. Form Y_{bus} and determine V_1 , V_2 and V_3 after second iteration using Gauss-Seidal Method. Use $\alpha = 1.5$.	CO2	Ap	06																																			

2(a).	Why reactor and capacitor banks are used in transmission line? Illustrate with suitable circuit arrangements.	CO3	Ap	03
2(b).	One conductor of a 3-phase line is open. The current flowing to the Δ -connected load through the line “a” is I A. With the current in line “a” as reference and assuming that line “b” is open, find the symmetrical components of the line currents. Draw the circuit arrangement at first. <i>Here, the value of ‘P’ is 10 times of the summation of last two digits of your roll number.</i>	CO3	E	03
3(a).	Why symmetrical fault is considered as most dangerous fault in power system? Describe with suitable example.	CO3	Ap	02
3(b).	A synchronous generator and motor rated 100 MVA, 11 kV and both have subtransient reactances of 0.25. The line connecting them has a reactance of 0.15 on the base of the machine ratings. The motor is drawing ‘P’ MW at 0.75 p.f. leading and a terminal voltage of 9.5 kV when a Symmetrical 3- ϕ fault occurs at motor terminals. Find the subtransient current in the generator, motor and fault by using internal voltage of machines. <i>Here, the value of ‘P’ is 10 times of the summation of last two digits of your roll number.</i>	CO3	E	04
4(a).	Construct the sequence network and deduce the expression of current if Line-to-Line (L-L) fault occurs between two phase of a star connected Synchronous Machine.	CO3	E	02
4(b).	A salient pole generator without dampers is rated 50MVA, 12.6kV and has a direct axis subtransient reactance of $0.X$ p.u. The negative and zero sequence reactance are 0.20 and 0.15 p.u. respectively. The neutral of the generator is solidly grounded. Determine the subtransient current and line-to-line (L-L) voltages when line-to-line fault occurs at the terminals of the generator. Assume that the generator is unloaded and operating at rated terminal voltage when the fault occurs. Neglect the resistance. <i>Here, the value of ‘X’ is 10 times of the summation of last two digits of your roll number.</i>	CO3	Ap	04
5(a).	How power angle curve clarifies the stability of a single synchronous machine. Illustrate with related equations and diagram.	CO1	An	03
5(b).	A generator is delivering 70% of maximum power to an infinite bus through a transmission line at supply frequency is 60Hz. A fault occurs such that the reactance between generator and infinite bus is increased to three times its pre fault value. When the fault is cleared, the maximum power that can be delivered is 85% of its original value. Determine the critical clearing angle (δ_{cr}) and critical clearing time (t_{cr}). <i>Here, the value of ‘H’ is the summation of last two digits of your roll number.</i>	CO1	E	03
6.	Viva/Viva-Quiz: The time of viva/viva-quiz will be declared in google classroom and other online platform.	CO2	R,U,An	20