## C.U.SHAH UNIVERSITY **Summer Examination-2017**

## Subject Name: Power System Analysis

Semester: 6       Date: 19/04/2017       Time: 2:30 To 5:30       Marks: 70         Instructions:       (1) Use of Programmable calculator & any other electronic instrument is prohibited.       (2) Instructions written on main answer book are strictly to be obeyed.         (3) Draw neat diagrams and figures (if necessary) at right places.       (4) Assume suitable data if needed.         Attempt the following questions:       (a) One line diagram is representation of       (1) Single Phase system         (2) 3 phase bulanced system       (3) phase bulanced system       (3) phase bulanced system         (3) phase bulanced system       (3) iphase bulanced system         (4) simple components       (b) In the case of transformer It/I <sub>B</sub> is Iz/I <sub>B</sub> .         (1) Greater than       (2) equal to         (3) less than       (4) divided by         (2) The per unit value of transformer impedance is on primary and secondary stop of the open stop on turns ratio         (4) depends upon turns ratio       (4) depends upon turns ratio         (4) depends upon turns ratio       (5) exponent         (3) conjugate       (4) 3 phase         (4) The different       (2) exponent         (3) conjugate       (4) 3 phase         (4) The circuit breaker current rating is decided using	Subjec	t Code: 4	TE06PSA1	Bra	nch: B.Tech (EEF	E <b>,EE</b> )
Instructions:          (1) Use of Programmable calculator & any other electronic instrument is prohibited.         (2) Instructions written on main answer book are strictly to be obeyed.         (3) Draw neat diagrams and figures (if necessary) at right places.         (4) Assume suitable data if needed.         Attempt the following questions:         (a) One line diagram is representation of         (1) Single Phase system         (2) 3 phase unbalanced system         (3) phase balanced system         (4) simple components         (b) In the case of transformer Ir/I <sub>B</sub> is I <sub>2</sub> /I <sub>B</sub> .         (1) Greater than         (2) equal to         (3) less than         (4) divided by         (c) The per unit value of transformer impedance is on primary and secondary stop there are of transformer impedance is on primary and secondary stop there are on the prime are on the primary and secondary stop the prim	Semes	ter: 6	Date: 19/04/2	017 Tin	ne: 2:30 To 5:30	Marks: 70
Attempt the following questions:         a) One line diagram is representation of         (1) Single Phase system         (2) 3 phase unbalanced system         (3) phase balanced system         (4) simple components         b) In the case of transformer In/I <sub>B</sub> is I2/I <sub>B</sub> .         (1) Greater than         (2) equal to         (3) less than         (4) divided by         c) The per unit value of transformer impedance is on primary and secondary s         (1) different         (2) same         (3) depends upon turns ratio         (4) depends upon turns ratio         (4) depends upon voltage ratio         d) S = VI* Where * represents         (1) remark         (2) exponent         (3) conjugate         (4) 3 phase         e) The circuit breaker current rating is decided using         (1) load flow study         (2) fault analysis study         (3) stability analysis study         (4) security study         f) Usually the value of reactance is maximum for a synchronous generator         (1) Transient         (2) Sub transient	(1) (2) (3) (4)	tions: Use of Pr Instructio Draw nea Assume	rogrammable calculations written on main at diagrams and figu	ator & any oth answer book a ires (if necessa ed.	er electronic instrur re strictly to be obe ry) at right places.	nent is prohibited. yed.
<ul> <li>a) One line diagram is representation of</li> <li>(1) Single Phase system</li> <li>(2) 3 phase unbalanced system</li> <li>(3) phase balanced system</li> <li>(4) simple components</li> <li>(5) In the case of transformer II/I<sub>B</sub> is I<sub>2</sub>/I<sub>B</sub>.</li> <li>(1) Greater than</li> <li>(2) equal to</li> <li>(3) less than</li> <li>(4) divided by</li> <li>(c) The per unit value of transformer impedance is on primary and secondary s</li> <li>(1) different</li> <li>(2) same</li> <li>(3) depends upon turns ratio</li> <li>(4) depends upon turns ratio</li> <li>(5) Sev I* Where * represents</li> <li>(1) remark</li> <li>(2) exponent</li> <li>(3) conjugate</li> <li>(4) 3 phase</li> <li>(4) 3 phase</li> <li>(5) The circuit breaker current rating is decided using</li> <li>(1) load flow study</li> <li>(2) fault analysis study</li> <li>(3) stability analysis study</li> <li>(4) security study</li> <li>(5) Sub transient</li> <li>(2) Sub transient</li> </ul>		Attempt	the following ques	tions:		
<ul> <li>b) In the case of transformer It/I<sub>B</sub> is I<sub>2</sub>/I<sub>B</sub>.</li> <li>(1) Greater than</li> <li>(2) equal to</li> <li>(3) less than</li> <li>(4) divided by</li> <li>(c) The per unit value of transformer impedance is on primary and secondary s</li> <li>(1) different</li> <li>(2) same</li> <li>(3) depends upon turns ratio</li> <li>(4) depends upon voltage ratio</li> <li>(4) depends upon voltage ratio</li> <li>(5) S = VI* Where * represents</li> <li>(1) remark</li> <li>(2) exponent</li> <li>(3) conjugate</li> <li>(4) 3 phase</li> <li>(4) 10 phase</li> <li>(5) The circuit breaker current rating is decided using</li> <li>(1) load flow study</li> <li>(2) fault analysis study</li> <li>(3) stability analysis study</li> <li>(4) security study</li> <li>(5) Sub transient</li> <li>(2) Sub transient</li> </ul>	a)	One line (1) Single (2) 3 pha (3) phase (4) simpl	diagram is represent e Phase system se unbalanced system e balanced system le components	tation of m		
<ul> <li>c) The per unit value of transformer impedance is on primary and secondary s <ol> <li>d) different</li> <li>asme</li> <li>d) depends upon turns ratio</li> <li>d) depends upon voltage ratio</li> </ol> </li> <li>d) S = VI* Where * represents <ol> <li>remark</li> <li>exponent</li> <li>conjugate</li> <li>f) conjugate</li> <li>security study</li> <li>stability analysis study</li> <li>security study</li> </ol> </li> <li>f) Usually the value of reactance is maximum for a synchronous generator <ol> <li>Transient</li> <li>Sub transient</li> </ol> </li> </ul>	b)	In the cas (1) Great (2) equal (3) less th (4) divide	se of transformer I1/2 ter than to han ed by	I <sub>B</sub> is	I <sub>2</sub> /I <sub>B</sub> .	
<ul> <li>d) S = VI* Where * represents</li> <li>(1) remark</li> <li>(2) exponent</li> <li>(3) conjugate</li> <li>(4) 3 phase</li> <li>e) The circuit breaker current rating is decided using</li> <li>(1) load flow study</li> <li>(2) fault analysis study</li> <li>(3) stability analysis study</li> <li>(4) security study</li> <li>f) Usually the value of reactance is maximum for a synchronous generator</li> <li>(1) Transient</li> <li>(2) Sub transient</li> </ul>	c)	The per u (1) differ (2) same (3) deper (4) deper	unit value of transfor rent nds upon turns ratio nds upon voltage ratio	rmer impedanc io	e is on pr	imary and secondary side.
<ul> <li>e) The circuit breaker current rating is decided using</li> <li>(1) load flow study</li> <li>(2) fault analysis study</li> <li>(3) stability analysis study</li> <li>(4) security study</li> <li>f) Usually the value of reactance is maximum for a synchronous generator</li> <li>(1) Transient</li> <li>(2) Sub transient</li> <li>(2) Sub transient</li> </ul>	d)	S = VI*V (1) reman (2) expon (3) conju (4) 3 pha	Where * represents _ rk nent gate se			
<ul> <li>f) Usually the value of reactance is maximum for a synchronous generator (1) Transient</li> <li>(2) Sub transient</li> </ul>	e)	The circu (1) load f (2) fault a (3) stabil (4) secur	uit breaker current ra flow study analysis study ity analysis study ity study	ating is decided	l using	
(3) Steady state	f)	Usually t (1) Trans (2) Sub t (3) Stead	the value of sient ransient ly state	reactance	is maximum for a	synchronous generator.



	g)	<ul> <li>The distortion of the supply signal in symmetrical short circuit current is due to</li> <li>(1) Fault impedance</li> <li>(2) Prefault voltage</li> <li>(3) Rotor D.C. component</li> </ul>	(1)
	h)	<ul> <li>(4) Unsymmetrical generator reactance</li> <li>The theorem is solution for unbalanced set of phasors in mathematical form.</li> <li>(1) Constant Flux</li> <li>(2) Constant Power</li> <li>(3) Fortesque</li> </ul>	(1)
	i)	<ul> <li>(4) Berlesque</li> <li>Three phase power is of symmetrical component powers.</li> <li>(1) Product</li> <li>(2) sum</li> <li>(3) image</li> </ul>	(1)
	j)	<ul> <li>(4) division</li> <li>Transformers are to phase shift in case of symmetrical components.</li> <li>(1) Variant</li> <li>(2) Invariant</li> <li>(3) deviant</li> </ul>	(1)
	k)	<ul> <li>(4) constant</li> <li>The limit of transient stability is the steady state limit.</li> <li>(1) Greater than</li> <li>(2) less than</li> <li>(3) equal to</li> </ul>	(1)
	l)	<ul> <li>(4) none</li> <li>The solution of point by point method is adopted to solve the swing equation for</li> <li>(1) Power Angle</li> <li>(2) Critical clearing angle</li> <li>(3) both</li> <li>(4) none</li> </ul>	(1)
	m)	<ul> <li>(4) none</li> <li>In method the convergence is not affected by the choice of slack bus.</li> <li>(1) N-R</li> <li>(2) G-S</li> <li>(3) Both</li> <li>(4) None</li> </ul>	(1)
Attempt	n) any f	If the torque angle increases without limit the system is (1) Stable (2) Marginally stable (3) Critically stable (4) Unstable Four questions from Q-2 to Q-8	(1)
Q-2	a)	<b>Attempt all questions</b> For the function containing n variables derive the Taylor series form in vector	(14) (7)

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	representation for Newton Raphson Method.			
<b>b</b> )	State the comparison of various load flow methods.			(4)

Briefly explain the classification of bus for load flow study. (3) c)

Q-3 Attempt all questions

a) Define per unit system. Derive the formulae of per unit impedance for the single phase (7)



(14)

case.

b) Derive the formulae of peak to peak value of short circuit current when a synchronous (7) generator terminal is subjected to 3 phase symmetrical short circuit fault.

## Attempt all questions Q-4

- a) Derive the per unit model of a transformer.
- (7) **b**) Draw the zero sequence components for the following configuration of 3 phase (7) transformers. (i) Star ungrounded- star grounded (ii) Star grounded- Star grounded (iii) Star grounded – Delta (iv) Delta – Delta

## Q-5 **Attempt all questions**

(14)

(14)

a) For the graph structure shown in the figure 1 derive the suitable bus incidence matrix and (14) evaluate the Ybus matrix if the diagonal matrix Y contains the following elements :

Dia [  $y_{10} y_{20} y_{30} y_{40} y_{34} y_{23} y_{12} y_{24} y_{13}$ ]... The notations have their usual meanings.



Figure 1, Question 5 (a)

Q-6	a) b)	Attempt all questions Derive the value of Current Ia <sub>1</sub> when a three phase transmission line is subjected to single line to ground fault. With usual notations prove that $\mathbf{VP} = \mathbf{AVs}$	(14) (7) (7)
Q-7	a) b)	Attempt all questions Derive the r+1 iteration of Voltage of ith bus using a Gauss Siedel Method when system contains n buses in the power system and all the buses are of type PQ bus. Discuss the positive sequence network and negative sequence network of a synchronous generator.	(14) (7) (7)
Q-8	a) b)	Attempt all questions Draw and explain equal area criterion system. In the system shown in Figure 2,a three-phase static capacitor of reactance 1 pu per phase is connected through a switch at motor bus bar.(i) Calculate the limit of steady state power with and without reactor switch closed.(ii)Recalculate the power limit with capacitive reactor replaced by an inductive reactor of the same value. Let p.u. power for generator is 1.2 p.u. and motor is 1.0 p.u.	(14) (7) (7)





Figure 2, Question 8 (b)

