Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
END TERM EXAMINATION - JUN 2023

Semester : Semester VI - 2020

Course Code : EEE3021

Course Name : Sem VI - EEE3021 - Discipline Elective-IV: Flexible A. C Transmission Systems Facts

Program : EEE

Date : 14-JUN-2023

Time : 9.30AM -12.30PM

Max Marks : 100

Weightage : 50%

Instructions:

(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS **(10 X 3 = 30M)**

1. Provide an explanation of the flow of power in an AC system as well as how FACTS controllers impact and optimise this flow of power.

(CO1) [Knowledge]

2. Recall about the variable impedance type series compensators such as GCSC, TSSC, and TCSC?

(CO2) [Knowledge]

3. What is an NGHSSR damper?

(CO4) [Knowledge]

4. What are the objectives and needs of the Unified Power Flow Controller (UPFC)?

(CO3) [Knowledge]

5. What are the most frequent types of FACTS controllers that are utilised in AC systems, and what are the primary roles that these controllers play?

(CO1) [Knowledge]

6. Explain how shunt compensators of the variable impedance type help to the improved performance and stability of power systems.

(CO1) [Knowledge]

7. What is the schematic representation of a switched converter type shunt compensator (STATCOM) and how does it work?

(CO2) [Knowledge]

8. Summarize about the variable impedance type series compensators such as GCSC, TSSC, and TCSC?

(CO2) [Knowledge]

9. The flow of power in power systems is controlled by voltage and phase angle regulators in what ways?

(CO4) [Knowledge]

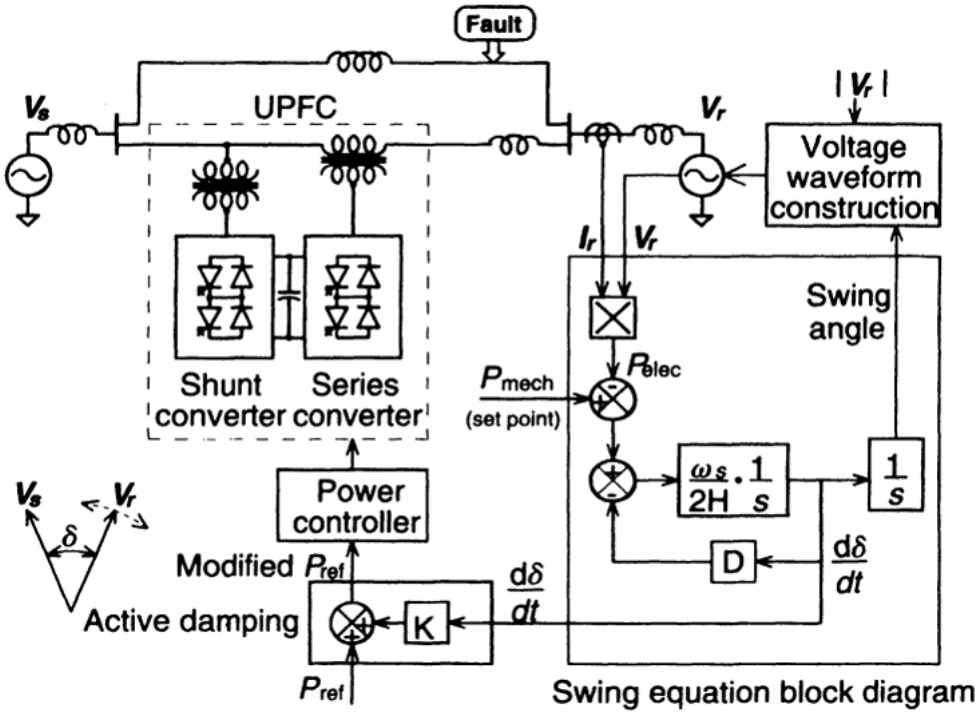
10. What are the objectives of static voltage and phase angle regulators in power systems?

(CO3) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS **(3 X 10 = 30M)**

11. To demonstrate the potential of the UPFC under dynamic (oscillatory) condi□tions, the TNA system model was provided with a receiving-end (V,) bus programmed to have a damped second-order phase angle response characteristic of a generator with a large inertia. The simple algorithm governing this mechanism assumes a defined source of mechanical power to the generator supporting the V, bus and matches this against the electrical power being delivered from the bus to the two transmission lines. Excess mechanical power causes an acceleration with a resultant phase angle advance and, vice versa, insufficient mechanical power causes deceleration with phase angle retardation. By referring to the figure below, discuss about the swing equation in context withUPFC.



(CO4) [Comprehension]

12. Modern power systems are designed to operate efficiently to supply power on demand to various load centres with high reliability. A grid of transmission lines operating at high or extra high voltages is required to transmit power from the generating stations to the load centres. In addition to transmission lines that carry power from the sources to loads, modern power systems are also highly interconnected for economic reasons. AC lines have inherent power flow control as the power flow is determined by the power at the sending end or receiving end Assuming the line to be lossless and ignoring the line charging, Discuss about the power flow between the sending end and receiving end with the help of supporting equations and how FACTS controllers can be used to improve the power flow

(CO1) [Comprehension]

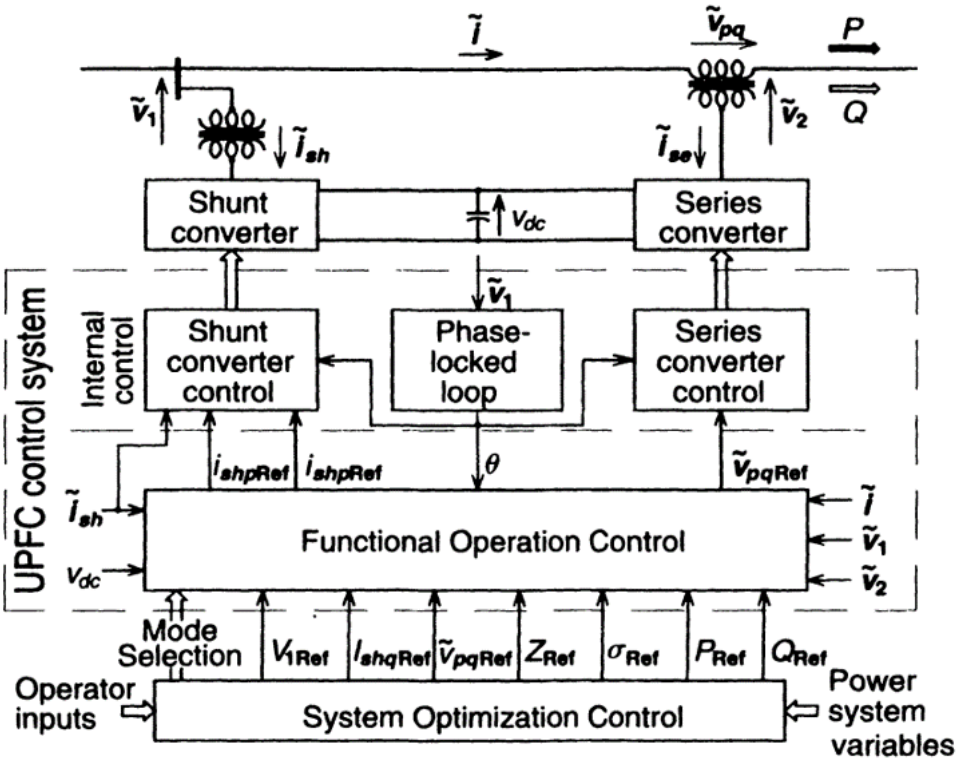
13. Power transmission efficiency along EHV transmission lines over great distances has been enhanced through the use of capacitors connected in series.Improving power distribution at the lowest possible cost can be achieved by increasing the number of capacitors linked in series. System planners have been hesitant to fully commit to series compensation, however, due to the SSR issue.Although shunt capacitors' efficacy is significantly location-dependent, there is no need to worry about SSR when employing them. Using series capacitors in long lines is appealing because thyristor control can provide variable series compensation. The SSR issue, also known as the torsional interaction, has been much mitigated, which is a big plus. Use the given information to explain how you would go about modelling a series compensator using continuous control.

(CO2) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS **(2 X 20 = 40M)**

14. The VpqRef and iqReh internal references for series and shunt compensation are generated by the external or functional operation control to fulfil the requirements of the gearbox system. An operator can either manually (through a computer keyboard) or automatically (by a system optimisation control) configure the functional operating modes and compensation demands, represented by external (or system) reference inputs, to fulfil specified operating and contingency requirements. Give an explanation for the parts shown in the diagram and what they do.



(CO3) [Application]

15. After being picked up by potential and current transformers, voltage (VSVC) and current (ISVC) signals are rectified. When looking at the system from the SVC bus, the AC filter functions as a notch filter, cutting off the frequency component of the signal that corresponds to the parallel resonance. Resonance between the line inductance and line capacitance (in parallel with SVC capacitance) is possible. The notch filter is designed to counteract the SVC voltage regulator's instability of this resonant phase of oscillation. The signal is corrected and then filtered. The fundamental and second harmonic components are tuned into separate notch filters, while the ripple content is removed by a low pass filter on the DC side. Notch filters are included to protect the SVC from damage brought on by voltages on the SVC bus that are a second harmonic positive sequence and a fundamental frequency negative sequence, respectively. Explain briefly how SVC works and what it can do for you.

(CO1) [Application]