

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), Nov.-Dec. 2015

B. Tech Electrical Engineering, Semester VII

Roll No.....

COURSE CODE: EE723 EHV AC and DC
Transmission

Time: 3 Max. Marks: 100
hours

Instructions to students:

1. Do not write anything other than your roll number on question paper.
 2. Assume suitable data wherever required and mention it clearly.
 3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
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Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

- (i) Series compensation is primarily resorted to
- (a) improve voltage profile (b) improve stability
(c) reduce fault currents (d) none of the above
- (ii) Absence of skin effect, lower line cost, less corona effect are the features of which of the transmission system?
- (a) EHV - AC system (b) HVDC system
(c) Both A and B. (d) UHV - AC system
- (iii) Economic studies have shown that D.C. transmission is cheaper than a.c transmission for lengths:
- (a) below 300 km (b) between 300 Km to 600 Km
(c) beyond 600 km (d) beyond 1200 km
- (iv) Which equipment do not supply reactive power in HVDC converter stations?
- (a) Static VAR compensators
(b) Series capacitors
(c) Synchronous condensers
(d) AC filters
- (v) A back to back HVDC link can be advantageous compared to AC primarily because
- (a) It is cheaper (b) stability considerations
(c) controlled power flow (d) none of these
- (vi) The surge impedance of a 110 kV, 3-phase transmission line is 440 ohms. The surge impedance loading of the line is

- (a) $3 (110)^2 / 440$ MW
 - (b) $(110)^2 / 440$ MW
 - (c) $(110)^2 / (3 \times 440)$ MW
 - (d) none of these
- (vii) During the commutation in the converter
- (a) Voltage is exchanged
 - (b) Current is transformed from one valve to other
 - (c) DC voltage is blocked
 - (d) None of these
- (viii) In 12-pulse connection, transformer are connected
- (a) Delta/Delta(both)
 - (b) Star/Star(both)
 - (c) Star/Delta(both)
 - (d) One Star/Star and other Star/Delta
- Control of DC power in a DC link is done by
- (a) α control
 - (b) β control
 - (c) γ control
 - (d) all of the above

For a long uncompensated line the limit to the line loading is governed by

- (x) (a) Thermal limit
- (b) voltage drop
- (c) stability limit
- (d) corona loss

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- i. Discuss why the insulation design of EHV line is governed by switching surges.
- ii. What is tuned line? Discuss the features of tuned line.
- iii. What are the problems involved in transmission of power using HVDC Transmission?
- iv. Which type of converters are generally used in FACTS devices? Explain it.

Q.3A Explain how series capacitance compensation helps to increase the power handling capacity of the transmission line. 05

Q.3B Bring out the harmful effect of series compensation and explain. 05

Q.4A The configuration of some EHV lines for 400 KV to 1200 KV are given, calculate R_{eq} for each. 05

(i) 400 KV : $N=2$, $d = 2r = 3.18$ cm, $B = 45$ cm

(ii) 750 KV : $N=4$, $d = 3.46$ cm, $B = 45$ cm.

(iii) 1000 KV : $N=6$, $d = 4.6$ cm, $B = 0.6$ m.

Q.4B Explain the parallel operation of an AC link in parallel with DC link. 05

Q.5A Explain the basic operating principle of an UPFC. How an UPFC scheme can be implemented using two back to back voltage source converters? 05

Q.5B Compare STATCOM with SVS. Draw control scheme of STATCOM & explain. 05

Q.6A Derive an expression for reflection coefficient of travelling waves at a junction. 05

Q.6B A step wave of 100 kV travels on the line having a surge impedance of 400 ohms. The line terminated by an inductance of $4000\mu H$. Find the voltage across the inductance and reflected voltage wave. 05

OR

Q.6B Explain what you mean by load ability of overhead line and discuss load ability characteristic of these line. 05

Q.7A Explain briefly about different types of HVDC links used for power transmission. 05

Q.7B What do you understand by current margin between two stations in an HVDC link? How is it assigned to the station? Why is it advantageous to operate the inverter as constant voltage controller under normal condition? 05

OR

Q.7B Write short notes on the following 05

a) Constant Alpha control

b) Inverse cosine control

- Q.8A Draw a schematic diagram of typical HVDC converter station and describe the various components of the station. 10
- Q.9A Discuss the effect of source inductance on the HVDC converter system performance. 10
- Q.9B Draw a schematic of a 6 pulse converter circuit and derive from fundamentals, the expression for voltage and currents for the operation of converter as a rectifier and inverter with relevant waveforms. 10

OR

- Q.9B The DC voltage and current at the sending end of a rectifier are 200 kV and 1000 A respectively. The commutating reactance of rectifier is 10 ohm. Calculate the extinction angle if the DC voltage is 190 kV at the terminal of the inverter. Assume the no load voltage of the inverter as 200 kV at extinction angle $\gamma = 0$. 10