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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOVEMBER 2017

SUBJECT: POWER SYSTEM OPERATION & CONTROL [ELE 4008]

REVISED CREDIT SYSTEM

Time: 2:00 PM - 5:00 PM **Date: 25 November 2017** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** questions.
- Use of non-programmable scientific calculator is permitted.

1A. A salient pole machine with 4 poles as shown in Fig.1A is being rotated at a constant speed of 'ω' rad/sec from a fixed reference. If the rotor field is excited with 'I_f' current and the stator coil a-a' being excited with 'i_a' current, determine the inductance of coil a-a'.

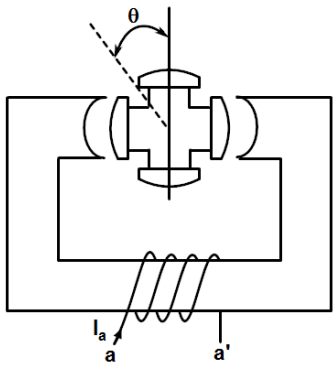

Fig. 1A

(06)

1B. With neat diagram, explain the different components of a brushless excitation system.

(04)

2A. Discuss the various factors that influence the power handling capability of transmission lines.

(04)

2B. A radial transmission line of 400 km long has β=0.0013 rad/km. The line is connected to two generating units on either ends, both supplying voltage at 1.2 p.u. If one of the generating units is removed out of service, determine the percentage change in voltage at its end. Also draw the voltage and current profile for this case. Consider the characteristic impedance of the transmission line equal to 250 Ω.

(06)

3A. What is the need for providing compensation in transmission lines?. Do FACTS controllers provide better compensation? Explain. ***(05)***

3B. With neat diagram, explain how a SSSC provides reactive power compensation. ***(05)***

4A. Why should the frequency of the supply be kept constant? Explain.
Also list the different ways by which it is maintained. ***(04)***

4B. A small system consists of 2 identical 500 MVA generators feeding a total load of 800 MW. The inertia constant 'H' for each unit is 5 on a 500 MVA base. The load varies by 2% for 1% change in frequency when there is a sudden drop in load by 20 MW.

a. Determine the system block diagram constants 'H' and 'D' expressed to 1000MVA base.
b. Find the frequency deviation, assuming that is no speed governing action. ***(06)***

5A. Formulate the economic dispatch problem for 'N' no. of thermal power plants supplying a total load of 'P_L' through a transmission network with a total line loss amounting to 'P_{LOSS}'. Also, bring out the importance of scheduling the generators for economic operation. ***(03)***

5B. The heat input in MBtu/hr for two thermal generating units is as given below:

$$H_1 = 225 + 8.4\,P_1 + 0.0025\,P_1^2$$

$$H_2 = 729 + 6.3\,P_2 + 0.0081\,P_2^2$$

Where, P_n is the unit output in MW with a minimum loading of 45 MW and maximum loading of 350 MW.

The daily load cycle is as follows:

Time Band	Load (MW)
0.00 – 06.00 Hrs	80
06.00 – 18.00 Hrs	600
18.00 – 00.00 Hrs	200

Using Newton's method, determine the economic schedule. Also, consider a fuel cost of 1000 Rs/MBtu. ***(07)***