Government College of Engineering, Aurangabad

(An Autonomous Institute of Government of Maharashtra)

T. E. (EEP) Examination

End Semester Examination 2016

EE 341: SYNCHRONOUS MACHINES

Time: Three Hours *Date:* 15 NOV 2016 *Max. Marks: 60*

N.B:-

1. ***All questions are compulsary***
2. ***Figures to the right indicate full marks***
3. ***Assume suitable data if necessary and state it clearly***
4. ***Use of non-programmable calculator is allowed***

Q.1 a) Write correct choice with reason (each question carries equal marks) (6M)

1) An under-excited synchronous motor behaves as .....
   a) An inductor b) A capacitor c) A resistor d) None of the above
2) At full-load, the rotor poles of a synchronous motor are displayed by a mechanical angle of 1° from their no-load position. If the machine has 40 poles, then torque angle is .....
   a) 40° electrical b) 20° electrical c)10° electrical d) None of the above
3) The d.c. armature resistance of a delta connected alternator measured across its two terminals is 1 ohm. The per phase d.c. resistance is .....
   a) 3 ohm b) 1.5 ohm c) 0.33 ohm d)None of the above
4) When a number of alternators are operating in parallel, the power factor at which each operates is determined by.....
   a) Power factor of the load b)Driving torque of the prime mover
   c)Its field excitation d)None of the above
5) A two-pole alternator is running at 1500 r.p.m. its angular velocity is .....
   a) 118 rad/s b) 192 rad/s c) 157 rad/s d) 212 rad/s
6) A 3-phase alternator has 3-slots per pole. The distribution factor of the winding is.....
   a) 0.866 b) 0.5 c) 1 d) None of the above

b) Describe any two method used for starting the synchronous motor with neat figure. (06M)

Q.2 Solve any two.(02x06) (12M)

a) Draw and explain the phasor diagram of loaded alternator at lagging and leading power factor.

b) Derive the equation for power generated of a synchronous generator in terms of load and impedance angle.

c) A 550 V, 55 kVA, 1-phase, alternator has an effective resistance of 0.2 ohm. A field current of 10 A produces an armature current of 200 A on short-circuit and an emf of 450 V on open circuit. Calculate the synchronous impedance and the full-load voltage regulation with 0.8 pf lagging.

Q.3 Solve any two.(02x06) (12M)

A) What is the necessity of parallel operations of alternator? State the conditions of synchronism of alternator.

b) Describe with detailed diagram, the one dark and two light method of synchronizing two alternators with the help of two synchronizing lamp.

c) A 2 MVA,3-phase, 8 pole, alternator runs at 750 r.p.m in parallel with other machines on 6000 V busbars. Find the synchronizing power on full load at power factor 0.8 lagging per mechanical degree of displacement and the corresponding synchronizing torque. The synchronous reactance of the machine is 6 ohm per phase.

Q.4 Solve any two.(02x06) (12M)

a) Discuss why synchronous motors are inherently not self starting. Mention all methods and explain any one method of starting in detail.

b) Draw and explain V and inverted V curves of an synchronous motor.

c) A 3-phase, delta connected synchronous motor takes 50 KW at 0.8 pf lagging from 415V busbar. The induced emf is increased by 40%, the real power taken remaining the same. Find the new current and pf. The motor has synchronous impedance of (0.2+j3.0)ohm per phase.

Q.5 a) Deduce an expression for voltage per turn and KVA rating of the transformer. (05M)

OR

a) Derive from the fundamental principles, an expression for output coefficient of 3-phase synchronous alternator in terms of specific electrical loading and specific magnetic loadings. (05M)

b) During the design of stator of 3-phase, 7.5 KVA, 6.6 kV, 50 Hz, 3000 rpm, turbo generator, following informations have been obtained. (07M)

Internal diameter of the stator	= 0.75 m
Gross length of core	= 0.9 m
Number of stator slots per pole per phase	= 7
Sectional area of stator conductor	= 190mm^2
Number of conductors per slot	= 4

Based upon the above data, calculate the following,

(i) flux per pole (ii) specific magnetic loading (iii) specific electric loading (iv) current density for stator winding.

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