B.E.(with Credits)-Regular-Semester 2012-Electrical Engineering (E. & P.) Sem V EP501 - Electrical Machines-II

P. Pages: 2

Time : Three Hours

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GUG/W/16/3719

Max. Marks: 80

Notes a) I t b) I c) I	: 1. 2. 3. 4. 5. 6. Explain this meth Explain	All questions carry equal marks. Solve the questions as per the choice given. Illustrate your answers wherever necessary with the help of neat sketches. Due credit will be given to neatness and adequate dimensions. Assume suitable data wherever necessary. Use of slide rule, Drawing instruments, non programmable calculator is permitted. speed control of 3-phase induction motor by changing supply frequency. Why in nod voltage / frequency ratio kept constant.	4
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b) 1 c) 1	Explain	auto-transformer starting	
c) l		auto-transformer starting.	
	Explain	capacitor start single phase induction motor.	
		OR	
a) l	Explain	double field revolving theory, hence explain torque-slip characteristic.	
b) l	Explain	plugging.	
a) V	What do pitch fac	you mean by short pitch winding ? Hence define and derive the equation for tor. How will you reduce 7 th order harmonic using short pitch winding.	
b) I I t i	A 50 Hz pitch coi to line if i) two ii) star	, 6 pole synchronous generator has 36 slots. It has a two layer winding with full l of 8 turns / coil. The flux per pole is 0.015 Wb. Determine the induced emf line coils are connected to form : phase winding connected 3-phase winding.	
		OR	
a) l f	Explain frequenc	the principle of operation of 3-phase alternator. Hence derive the equation for by of emf generated by alternator. Also prove that	
1	a) b) a) b)	a) Explain b) Explain a) What do pitch fac b) A 50 Hz pitch coi to line if i) two ii) star a) Explain frequenc $\theta_e = \frac{p}{2}\theta$	ORa) Explain double field revolving theory, hence explain torque-slip characteristic.b) Explain plugging.a) What do you mean by short pitch winding ? Hence define and derive the equation for pitch factor. How will you reduce 7 th order harmonic using short pitch winding.b) A 50 Hz, 6 pole synchronous generator has 36 slots. It has a two layer winding with full pitch coil of 8 turns / coil. The flux per pole is 0.015 Wb. Determine the induced emf line to line if coils are connected to form : i) two phase winding ii) star connected 3-phase winding.ORAExplain the principle of operation of 3-phase alternator. Hence derive the equation for frequency of emf generated by alternator. Also prove that $\theta_e = \frac{p}{a} \theta_m$

where θ_e - is electrical angle

 θ_m - is mechanical angle &

p - no. of poles.

 b) A 3-phase, 50 Hz, 750 rpm, star connected alternator has flux per pole = 45 mwb sinusoidally distributed. If slots / phase = 32 and coil span = 10 slots for single layer winding; calculate the line value of the induced emf. Turns / coil = 8 Also calculate pitch factor and distribution factor for third harmonic. 8

b)	A salient pole synchronous generator has a following per unit parameters. $X_d = 0.2$ $X_q = 0.8$ Neglect armature resistance. Compute the excitation voltage in per unit system where the generator is delivering rated kVA at rated voltage for -	8
	 i) 0.8 p.f. lagging ii) 0.8 p.f. leading Draw the phasor diagram for both. 	
a)	Explain two reaction theory applied to salient pole synchronous machines. Hence draw the equivalent circuit and phasor diagram of alternator.	8
b)	A 3300V, 3-phase star connected alternator has a full load current of 100 Amp. On short circuit a field current of 5 Amp was necessary to produce full load current. The emf on open circuit for the same excitation was 800 volts. The armature resistance was 0.8Ω /phase. Determine full load voltage regulation for - i) 0.8 p.f. lagging ii) 0.8 p.f. leading	8
a)	For an alternator first derive the equation for electrical output power $p_{e(out)}$ and	8
	mechanical input $p_{m(in)}$. Then prove that if armature resistance is neglected, $p_{e(out)} = p_{m(in)}$.	
b)	Explain the phenomenon of hunting in synchronous motor.	8
a)	A 400V, 3-phase, delta connected synchronous motor has an effective resistance and synchronous reactance of 0.1 and 1 Ω respectively. The induced line emf is 500 V. Calculate the line current and power factor when output is 150 kW. Assume friction, windage and core losses are total 10 kW.	8
b)	Which are the various conditions for parallel operation of three phase alternator ? Why it is necessary. Explain dark lamp method of parallel operation of alternator.	8
a)	Define subtransient direct and quadrature axis reactance of salient pole synchronous machine. Hence justify why $X_d^{"} < X_q^{"}$.	5
b)	Explain the working principle and construction of universal motor.	7
c)	How will you measure negative sequence reactance in laboratory.	4
a)	Explain the phenomenon of sudden short circuit in 3-phase alternator with the help of constant flux linkage theorem. Draw the oscillogram of short circuit current clearly indicating sub transient, transient and steady state period.	8
b)	Write short note on universal motor.	8
	 a) b) a) b) a) b) c) a) b) 	 kVA at rated voltage for - 0.8 p.f. lagging 0.8 p.f. leading Draw the phasor diagram for both. OR a) Explain two reaction theory applied to salient pole synchronous machines. Hence draw the equivalent circuit and phasor diagram of alternator. b) A 3300V, 3-phase star connected alternator has a full load current of 100 Amp. On short circuit a field current of 5 Amp was necessary to produce full load current. The emf on open circuit for the same excitation was 800 volts. The armature resistance was 0.8 Ω/phase. Determine full load voltage regulation for - 0.8 p.f. lagging 0.8 p.f. lagging 0.8 p.f. leading a) For an alternator first derive the equation for electrical output power p_{e(out)} and mechanical input p_{m(in)}. Then prove that if armature resistance is neglected, p_{e(out)} = p_{m(in)}. b) Explain the phenomenon of hunting in synchronous motor. OR a) A 400V, 3-phase, delta connected synchronous motor has an effective resistance and synchronous reactance of 0.1 and 1 Ω respectively. The induced line emf is 500 V. Calculate the line current and power factor when output is 150 kW. Assume friction, windage and core losses are total 10 kW. b) Which are the various conditions for parallel operation of alternator. a) Define subtransient direct and quadrature axis reactance of salient pole synchronous machine. Hence justify why X_d["] < X_q["]. b) Explain the working principle and construction of universal motor. c) How will you measure negative sequence reactance in laboratory. OR a) Explain the phenomenon of sudden short circuit in 3-phase alternator with the help of constant flux linkage theorem. Draw the oscillogram of short circuit current clearly indicating sub transient, transient and steady state period.
