

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/  
COMMERCIAL PRACTICE, APRIL - 2025**

**SYNCHRONOUS MACHINES & FHP MOTORS**

[Maximum marks: 75]

[Time: 3 Hours]

**PART A**

**I. Answer all the following questions in one word or one sentence. Each question carries 1 mark.**

**(9 x 1 = 9 Marks)**

		Module outcome	Cognitive level
1	List the types of alternator based on rotor type.	M1.01	R
2	Write the equation for pitch factor.	M1.02	R
3	Match the following based on their effect of armature reaction: (i) ZPF Lag (a) Purely Magnetization (ii) ZPF Lead (b) Purely Cross Magnetization (iii) UPF (c) Purely Demagnetization	M1.03	U
4	Enumerate any two methods for pre-determining voltage regulation.	M2.01	R
5	Name the equipment used for synchronization.	M2.04	R
6	The inverted V curve is the plot between ..... in X axis and ..... in Y axis.	M3.02	U
7	Name the type of excitation of a synchronous condenser.	M3.04	R
8	List any two modes of operation of Variable Reluctance Motor.	M4.03	R
9	Write the equation for step angle of a stepper motor.	M4.03	R

**PART B**

**II. Answer any eight questions from the following. Each question carries 3 marks.**

**(8 x 3 = 24 Marks)**

		Module outcome	Cognitive level
1	Enlist any three advantages of stationary armature construction.	M1.01	R
2	Enumerate the conditions for smooth parallel operation of alternators.	M2.03	R
3	Illustrate the V curve and inverted V curve of a synchronous motor.	M3.02	U
4	Illustrate the different power stages of a synchronous motor.	M3.02	R
5	Explain Pull-in torque and Pull-out torque of a synchronous motor.	M3.03	R

6	Compare synchronous motor and induction motor based on any six parameters.	M3.03	A
7	Draw and explain capacitor start induction run motor.	M4.01	U
8	List any 6 applications of universal motors.	M4.02	R
9	List any three advantages and disadvantages of a PMDC motor.	M4.03	R
10	Explain the three basic categories of stepper motors.	M4.03	U

### PART C

**Answer all questions. Each question carries seven marks.**

**(6 x 7 = 42 Marks)**

		Module outcome	Cognitive level
III	A 3-phase, 16-pole alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb, sinusoidally distributed and the speed is 375 r.p.m. Find the frequency rpm and the phase and line e.m.f. Assume full-pitched coil.	M1.02	A
	<b>OR</b>		
IV	A 3-phase, star-connected alternator supplies a load of 10 MW at p.f. 0.85 lagging and at 11 kV (terminal voltage). Its resistance is 0.1 ohm per phase and synchronous reactance 0.66 ohm per phase. Calculate the line value of e.m.f. generated.	M1.04	A
V	Explain the constructional features of an alternator.	M1.01	U
	<b>OR</b>		
VI	With neat phasor diagrams explain the effect of power factor variation in armature reaction.	M1.03	U
VII	A 3-phase, star-connected alternator is rated at 1600 kVA, 13,500 V. The armature resistance and synchronous reactance are 1.5 $\Omega$ and 30 $\Omega$ respectively per phase. Calculate the percentage regulation for a load of 1280 kW at 0.8 leading power factor.	M2.01	A
	<b>OR</b>		
VIII	Derive the expression for power developed in an alternator.	M2.02	A
IX	Enumerate the steps of ZPF method of voltage regulation.	M2.01	U

X	<b>OR</b> Illustrate and explain the dark lamp and bright lamp method of synchronization of alternators.	M2.04	U
XI	Justify the statement with proper diagrams: “Synchronous motors are not self-starting”.	M3.01	U
XII	<b>OR</b> Describe hunting phenomenon in a synchronous motor and the steps to eliminate it.	M3.03	U
XIII	Explain the construction and working of shaded pole motor.	M4.01	U
XIV	<b>OR</b> With suitable figures explain the working of stepper motors.	M4.03	U

\*\*\*\*\*