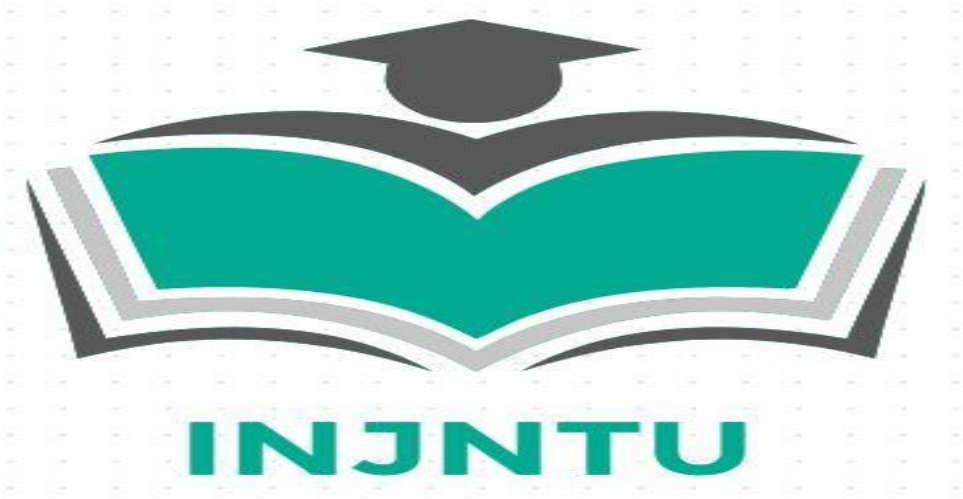

OBJECTIVE:

This subject is an extension of previous machines courses. It deals with the detailed analysis of synchronous generators and motors which are the prime source of electrical power generation and its utilities. Also concerns about the different types of single phase motors which are having significant applications in household appliances and control systems.

Group – I QUESTION BANK ON SHORT ANSWER QUESTION

S.No	QUESTION	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
	UNIT-I **SYNCHRONOUS MACHINES AND CHARACTERISTICS**		
1	State different type of synchronous generators used in hydro electrical power station.	Evaluate	1
2	What are the main parts of synchronous generator	Remember	1
3	Write the EMF equation of an Alternator.	Remember	2
4	What is the speed of a 4 pole 50Hz Synchronous machine?	Remember	2
5	Define Synchronous speed.	Remember	1
6	How can a DC generator be converted into an alternator?	Remember	2
7	Discuss about armature reaction in synchronous generator	Understand	1
8	Define distribution factor.	Understand	1
9	Define pitch factor.	Remember	2
10	Define winding factor.	Remember	2
	UNIT-II **REGULATION OF SYNCHRONOUS GENERATOR**		
1	Write different methods for determining the voltage regulation of synchronous generator.	Remember	3
2	Define regulation of Alternator.	Remember	3
3	What are the components of synchronous impedance?	Remember	4
4	Discuss the importance of synchronous impedance method	Remember	4
5	Discuss two reaction analysis	Remember	3
6	Define Xd and Xq	Remember	3
7	Why voltage regulation calculated by Potier's method is somewhat lower?	Remember	4
8	What are the parameters can be determined from slip test	Understand	4

S.No	QUESTION	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
9	What are the differences between MMF and EMF methods	Understand	3
10	Distinguish between salient pole and cylindrical rotor synchronous generators?	Remember	4
	UNIT-III **PARALLEL OPERATION OF SYNCHRONOUS GENERATOR**		
1	Write synchronous power equation for cylindrical pole rotor and salient pole rotor machine.	Understand	4
2	What are the conditions for parallel operation of alternators?	Understand	5
3	What is Power angle of an alternator?	Remember	4
4	What is an infinite bus? Mention three conditions to be satisfied prior to synchronizing an alternator to an infinite bus.	Remember	5
5	A machine with large air-gap has a higher synchronizing power, why?	Remember	4
6	Define sub-transient, transient and steady-state reactance's of AC generators.	Remember	5
7	What is the effect of varying excitation of an alternator running in parallel with other alternator	Understand	4
8	How will the power angle and power factor of a 3-phase alternator supplying power to an infinite bus at constant excitation change if the steam input is reduces?	Remember	5
9	At what power angle a synchronous generator will develop maximum power?	Remember	5
10	What are synchronizing current and synchronizing power?	Remember	5
	UNIT-1V **SYNCHRONOUS MOTORS AND POWER CIRCLES**		
1	What are the main parts of synchronous motor?	Remember	6
2	Discuss why synchronous motor has no starting torque.	Understand	5
3	What is synchronous capacitor?	Remember	7
4	Synchronous motor always runs at synchronous speed why?	Remember	5
5	What is hunting?	Remember	6
6	What are V-Curves and inverted V curves?	Remember	5
7	What are the uses of damper windings in a synchronous motor?	Remember	7
8	How do you operate the synchronous motor at any desired pf?	Understand	5
9	What will be the pf when the synchronous motor is operated at under excited conditions?	Remember	6
10	What are the different methods of starting synchronous motor?	Remember	7
	UNIT-V **SINGLE PHASE MOTORS & SPECIAL MACHINES**		
1	What are the applications of AC series motor?	Remember	8
2	What is stepper motor?	Remember	9
3	What is the function of capacitor in a single phase induction motor?	Remember	10
4	In which direction does a shaded pole induction motor run?	Remember	9
5	Write the classification of stepper motor?	Remember	6
6	Why singe phase induction motor has low power factor?	Remember	10
7	What is meant by split phase motor?	Remember	9
8	What are the advantages of universal motor?	Remember	8
9	What are the applications of universal motor?	Remember	10
10	What are the applications of stepper motor	Remember	9

Group – II LONG ASNWERS QUASTIONS

S.No	QUESTION	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
	UNIT-I **SYNCHRONOUS MACHINES AND CHARACTERISTICS**		
1	Deduce the relation between the number of poles, the frequency and the speed of the synchronous generator	Apply	1
2	What are the causes of harmonics in the voltage waveform of an alternator?	Understand	1
3	What is an armature reaction? Explain its effect on the terminal voltage of an alternator at unity power factor load.	Understand	1
4	In brief, derive an expression for the winding factor of an alternator	Apply	2
5	Derive EMF equation and describe how the induced 'emf' in armature winding is affected by (a) form factor (b) pitch factor and (iii) distribution factor	Apply	2
6	Discuss about the determination of synchronous reactance of an alternator	Understand	2
7	Draw the load characteristics of synchronous generator and describe the same	Apply	2
8	What is the difference between integral slot and fractional slot windings	Understand	1
9	With phasor diagram, discuss about the leakage reactance of synchronous generator	Apply	1
10	Compute the distribution factor for a 36-slot, 4-pole, single-layer 3-Phase winding.	Apply	2
	UNIT-II **REGULATION OF SYNCHRONOUS GENERATOR**		
1	Discuss in brief, how voltage regulation can be computed by synchronous impedance method	Understand	2
2	Discuss in brief about the two-reaction analysis of a salient-pole synchronous machine	Understand	2
3	With relevant waveforms and connection diagram, describe the slip test of synchronous machine	Apply	3
4	What is the significance of zero power-factor characteristics of an alternator? Discuss in brief to obtain the same	Apply	2
5	Describe why, synchronous impedance method of computing the voltage regulation, leads to a pessimistic value at lagging power factor loads	Understand	3
6	Describe how, open-circuit and short-circuit tests are conducted on a synchronous machine	Understand	3
7	Discuss in brief, how voltage regulation can be computed by MMF method.	Understand	3
8	Discuss in brief, how voltage regulation can be computed by ASA method.	Understand	3
9	Discuss in brief, how voltage regulation can be computed for salient pole alternators.	Understand	3
10	A synchronous generator has X_d=0.75 pu and X_q=0.5 pu. It is supplying full-load at rated voltage at 0.8 lagging power factor. Draw the phasor diagram and compute the excitation emf	Apply	2
	UNIT-III **PARALLEL OPERATION OF SYNCHRONOUS GENERATOR**		
1	Derive expression for synchronizing power and synchronizing torque when two alternators are connected in parallel.	Apply	4
2	Describe the factors which affect the sharing of load between two alternators operating in parallel. .	Understand	4
3	Why bright lamp method is preferred over dark lamp method for synchronizing of alternators.	Understand	5

S.No	QUESTION	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
4	Discuss in brief about the short-circuit transient in synchronous machine	Understand	6
5	Describe the factors which affect the sharing of load between two alternators operating in parallel.	Understand	5
6	Derive expressions for synchronizing power and synchronizing torque when two AC generators are connected in parallel	Apply	5
7	Describe with relevant diagram, dark lamp method of synchronizing two 3-phase alternators	Understand	4
8	Describe with relevant diagram, bright lamp method of synchronizing two 3-phase alternators	Understand	5
9	Discuss the use of synchro scope in the parallel operation of alternators.	Understand	5
10	Two single-phase generators operate in parallel on a load impedance of Z ohms. Their emfs are E1 and E2 and their synchronous impedances Z1 and Z2. Deduce the terminal voltage in terms of these and admittances Y,Y1 and Y2	Understand	5
	UNIT-IV **SYNCHRONOUS MOTORS AND POWER CIRCLES**		
1	Describe in brief the principle of operation of synchronous motor	Understand	6
2	Draw and discuss the phasor diagrams of a 3-phase synchronous motor for lagging, leading and unity power factor conditions. Name all the phasors.	understand	6
3	What do you mean by constant power circle for synchronous motor? How it is derived?	Apply	7
4	Name different methods of starting a synchronous motor, explain any one in detailed.	Remember	7
5	Derive an expression of mechanical power developed for a synchronous motor in terms of E & V	Understand	7
6	Mention the various applications of synchronous motor and describe the functions of a damper winding in a synchronous motor	Apply	8
7	What could be the reasons if a 3-phase synchronous motor fails to start?	Understand	8
8	Write a short note on synchronous induction motor	Remember	6
9	Derive the expression for power developed in a synchronous motor, various conditions for maximum power developed	Apply	7
10	Describe how a synchronous motor can be operated as a synchronous condenser.	Understand	8
	UNIT-V **SINGLE PHASE MOTORS & SPECIAL MACHINES**		
1	Discuss in detail about the split-phase motors	Understand	6
2	Discuss about the principle and performance of AC series motor	Understand	6
3	Describe the phase control of 1-phase induction motor	Remember	6
4	Write a short notes on double revolving field theory	Remember	6
5	Discuss about Torque-Speed curve of single-phase induction motor	Apply	6
6	Show that the starting torque of a single phase-phase induction motor is zero	Apply	6
7	With a neat sketch, discuss about the operation of shaded pole motor with squirrel cage rotor	Understand	6
8	What type of operating characteristics does an ac series motor give?	Understand	6
9	What is the principle of operation of universal motor?	Understand	7
10	What is the principle of operation of stepper motor?	Understand	7

GROUP – III ANALYTICAL QUESTIONS

S.No	QUESTIONS	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
	UNIT-I **SYNCHRONOUS MACHINES AND CHARACTERISTICS**		
1	Calculate the speed and open-circuit line and phase voltages of a 4-pole,3-phase,50hz star-connected alternator with 36 slots and 30 slots 30 conductors per slot. The flux per pole is 0.05wb.	Evaluate	2
2	A 4-ploe, 50hz star-connected alternator has a flux per pole of 0.12wb. it has 4 slots per pole per phase, conductors per slot being 4.if the winding coil span is 150^0,find the emf.	Apply	2
3	A 3-phase,8-pole,750rpm star-connected alternator has 72 slots on the armature. Each slot has 12 conductors and winding is short-pitched by 2 slots. Find the induced emf between lines, given the flux per pole is 0.06wb	Apply	2
4	An 8-pole,3-phase,60^0 spread, double layer winding has 72 coils in 72 slots. The coils are short-pitched by two slots. Calculate the winding factor for the fundamental and third harmonic.	Evaluate	2
5	The stator of a 3-phase,20-pole alternator has 120 slots and there are 4 conductors per slot accommodated in two layers. If the speed of the alternator is 300rpm, calculate the emf induced per phase. Resultant flux in the air-gap is 0.05 wb per pole. Assume the coil span as 160^0 electrical.	Evaluate	2
6	A star-connected,3-phase,6-pole alternator has a stator with 90 slots and 8 conductors per slot.the rotor revolves at 1000rpm. The flux per pole is $4x10^{-2}$ wb. calculate the emf generated if all the conductors in each phase are in series. Assume sinusoidal flux distribution and full-pitched coils.	Evaluate	2
7	A 16 pole,3-phase alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03wb distributed sinusoidally and the speed is 375 rpm. Find the line voltage, if the coil span is 150^0 elec.	Apply	3
8	A 3-phase,16-pole alternator has the following data: number of slots=192,conductors per slot=8,coil span 10 slots; speed of alternator=375rpm;flux per pole =55mwb.calculate the phase and line voltage.	Evaluate	3
9	For a 3-Φ winding with 4 slots per pole phase and with the coin span of 10 slot pitch, calculate the values of the distribution factor and coil span factor.	Evaluate	3
10	An 8-pole ac generator is running at 750rpm. What is the frequency? At what speed must the generator be run so that frequency shall be 25hz?	Apply	3
	UNIT-II **REGULATION OF SYNCHRONOUS GENERATOR**		
1	A 3-phase star-connected synchronous generator is rated at 1.4MVA, 11KV. the armature effective resistance and synchronous reactance are 1.2 Ω and 25Ω respectively per phase. Calculate the percentage voltage regulation for a load of 1.4375MVA at (i) 0.8pf lagging and (ii) 0.8pf leading. also find out the pf at which the regulation becomes zero.	Evaluate	4
2	A 3-phase, star-connected alternator is rated at 1600kva, 13500v. The armature resistance and synchronous reactance are 1.5 Ω and 30Ω respectively per phase. Calculate the percentage regulation for a load of 1280kw at 0.8leading power factor.	Evaluate	4
3	From the following test results, determine the regulation of a 2 KV single phase alternator, delivering a current of 100 A at 0.8 p.f. leading test results; full load current of 100 A is produced on short circuit by a field excitation of 2.5 A. An emf of 500 V is produced on open circuit by the same field current. The armature resistance is 0.8 ohms.	Apply	4

S.No	QUESTIONS	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
4	A three phase star connected 1000 KVA, 11000 V alternator has rated current of 52.5 A the ac resistance of the winding per phase is 0.45 Ohms. The test results are given below; OC test : field current = 12.5 A, voltage between lines = 422 V. SC test: field current = 12.5 A , line current = 52.5 A determine the full load voltage regulation of the alternator a) 0.8 p.f. lagging b) 0.8 p.f. leading	Evaluate	4
5	A)A three phase star connected, 5KVA, 400 V, 50 Hz, 4-pole alternator has the following test data at rated speed i) exciting current 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 6 8 Per phase OC Volts 75 140 173 202 224 270 250 257 260 263 266 271 ii) exciting current 1 2 3 SC line current 3.6 7.2 10.8 iii) Armature resistance per phase is 2 ohms Draw OC and SC characteristics on a graph paper and then determine unsaturated value of synchronous reactance per phase and in per unit. B) For the same synchronous machine, a) determine percentage voltage regulation at rated load at 0.8 p.f. lag and lead by synchronous impedance method under unsaturated condition. Draw relevant phasor diagrams.	Apply	4
6	A 3-phase star-connected, 1000kva, 2000v, 50hz alternator gave the following open-circuit and short circuit test readings: Field current(amp): 10 20 25 30 40 50 Open-circuit voltage(v): 800 1500 1760 2000 2350 2600 Short-circuit current(amp):- 200 250 300 - - Draw the characteristic curves and estimate the full-load percentage regulation at i)0.8 p.f. lagging and (ii) 0.8 p.f. leading. the armature resistance per phase may be taken as 0.2Ω.use mmf method	Apply	4
7	A 3-phase synchronous generator has per phase a direct axis synchronous reactance of 1.0p.u. And a quadrature axis synchronous reactance of 0.65 pu. Draw a phasor diagram of the machine when operating at full-load at a pf 0.8 lagging and estimate from there (i) the load angle and (ii)pu no-load emf. Neglect armature resistance.	Apply	4
8	A 3.5 MVA, slow speed,3-phase synchronous generator rated at 6.6kv has 62 poles. It's direct and quadrature axis synchronous reactance as measured by the slip test is 9.6 and 6 Ω respectively. Neglect armature resistance; determine the regulation and excitation emf needed to maintain 6.6kv at the terminals when supplying a load of 2.5MW at 0.8pf lagging. What maximum power can generator supply at the rated terminal voltage, if the field becomes open-circuited?	Evaluate	4
9	A 10kva, 380v, 50hz,3-phase,star-connected salient pole alternator has direct axis and quadrature axis reactance of 12Ω and 8Ω respectively. The armature has a resistance of 1Ω per phase. The generator delivers rated load at 0.8pf lagging with the terminal voltage being maintained at rated value. If the load angle is 16.15^0, determine (i)the direct axis and quadrature axis components of armature current (ii)exciting voltage of the generator.	Apply	4
10	The following data pertains to a 15000 kva,11kv,3-phase,50hz,star-connected turbo-alternator: OC line kv :4.9 8.4 10.1 11.5 12.8 13.3 13.65 Field AT in 10^3 :10 18 24 30 40 45 50 Zero p.f. full-load line kv : - 0 - - - 10.2 - Determine: (i) armature reaction (ii) armature reactance (iii) synchronous reactance (iv) percentage regulation for full-load at 0.8 p.f. lagging.	Apply	4

S.No	QUESTIONS	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
	UNIT-III **PARALLEL OPERATION OF SYNCHRONOUS GENERATOR**		
1	Two identical 2MVA alternators operate in parallel. The governor of first machine is such that the frequency droops uniformly from 50hz on no-load to 47.5 hz on full-load.the corresponding uniform speed droop of the second machine is 50hz to 48hz. How will they share a load of 3MW?	Evaluate	5
2	Two identical 3-phase alternators work in parallel and supply a total load of 1600kw at 11000v at a power factor of 0.92. each machine supplies half the total power. The synchronous reactance of each is 50 ohm per phase and resistance is 2.5 ohm per phase. The field excitation of the first machine is adjusted so that armature current is 50A lagging. Determine the armature current of the second alternator, the power factor at which each is working and generated voltage of the first alternator?	Evaluate	5
3	A 2000KVA,3-phase,8-pole alternator runs at 750rpm in parallel with other machines on 6000v bus-bars. Find synchronizing power on full load 0.8 pf lagging per mechanical degree of displacement and the corresponding synchronizing torque. The synchronous reactance is 6 ohms per phase.	Evaluate	5
4	Two identical 2 MVA alternators operate in parallel. The governor of first machine is such that the frequency drops uniformly from 50 Hz on no-load to 47.5 Hz on full-load. The corresponding uniform speed drop of the second machine is 50 Hz to 48 Hz. How will they share a load of 3 MW?	Evaluate	6
5	A 3 MVA,6-pole alternator runs at 1000rpm on 3.3kv bus-bars.the synchronous reactance is 25%.calculate the synchronous power and torque per mechanical degree of displacement when the alternator is supplying full-load at 0.8 pf lag.	Apply	6
6	A 2000kva,3-phase,8-pole alternator runs at 750rpm in parallel with other machines on 6000v bus-bars. Find synchronous power on full-load 0.8 pf lagging per mechanical degree of displacement and the corresponding synchronizing torque. The synchronous reactance is 6 ohms per phase.	Apply	5
7	A 2-pole, 50hz,3-phase,turbo-alternator is excited to generate the bus-bar voltage of 11kv on no-load. Calculate the synchronizing power per degree of mechanical displacement of the rotor and the corresponding synchronizing torque. The machine is star-connected and the short- circuit current for this excitation is 1200 amperes.	Apply	7
8	Two identical 3-phase alternators work in parallel and supply a total load of 1600kw at 11000V at a power factor of 0.92. each machine supplies half the total power. the synchronous reactance of each is 50 ohms/phase and resistance is 2.5 ohms/phase. The field excitation of the first machine is adjusted so that armature current is 50A lagging. Determine the armature current of the second alternator, the power factor at which each machine is working and generated voltage of the first alternator.	Evaluate	7
9	A 10mva, 10 kv,3-phase,50hz,1500 rpm alternator is paralled with others of much greater capacity. the moment of inertia of the rotor is $2x10^5$ kg-m^2 and the synchronous reactance of the machines is 40%. Calculate the frequency of oscillation of the rotor.	Apply	7
10	A 100 MVA, 22 Kv, 50 Hz synchronous generator is operating open circuited and is excited to give rated terminal voltage. A 3-phase short circuit develops at its terminals. Neglecting DC and double frequency components of current	Apply	7
	UNIT-IV **SYNCHRONOUS MOTORS AND POWER CIRCLES**		
1	A 2.3 kV, 3-phase, star-connected synchronous motor has Z_s=(0.2+j2.2) Ω/phase. The motor is operating at 0.5 power factor leading with a line current of 200 A. Determine the generated emf per phase	Apply	5

S.No	QUESTIONS	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
2	A 3-phase,415v,6-pole,50hz,star-connected synchronous motor has emf of 520v(L-L). the stator winding has a synchronous reactance of 2ohms per phase and the motor developes a torque of 220N-m.the motor is operating at 415v,50hz bus (a) calculate the current drawn from the supply and it's power factor (b) draw the phasor diagram showing all the relevant quantities.	Apply	8
3	A 500v,6-pole,3-phase,50hz,star-connected synchronous motor has a resistance and synchronous reactance of 0.3Ω and 3Ω per phase respectively. The open-circuit voltage is 600v. If the friction and core losses total 1kw,calculate the line current and power factor when the motor output is 100hp.	Evaluate	8
4	A 50hz,4-pole,3-Φ,star-connected synchronous motor has a synchronous reactance of 12.0Ω/phase and negligible armature resistance. The excitation is such as to give an open-circuit voltage of 13.2kv.the motor is connected to 11.5kv, 50hz supply. What maximum load can the motor supply before losing synchronism? What is the corresponding motor torque, line current and power factor?	Evaluate	8
5	The excitation of a 415v,3-phase,mesh connected synchronous motor is such that the induced emf is520v.the impedance per phase is (0.5+j4.0)Ω. if the friction and iron losses are constant at 1000watts,calculate the power output, line current, power factor and efficiency for maximum power output?	Apply	8
6	A 75 kw 3phase Y connected, 50Hz,440V cylindrical rotor synchronous motor operates at rated condition with 0.8pf leading. The motor efficiency excluding field and stator losses, is 95% and Xs=2.5Ωcalculate (i) mechanical power developed (ii) armature current (iii) back emf (iv) power angle and (v)max or pull out toque of the motor.	Evaluate	8
7	A 3 phase 150kw 2300v 50Hz 1000rpm salient pole synchronous motor has Xd=32ohms/ph and Xq=20ohm/ph. Neglecting losses ,calculate the torque developed by the motor if field excitation is so adjusted as to make the back emf twice the applied voltage and α=60°.	Evaluate	8
8	A 3300v, 1.5 Mw, 3 phase, Y connected synchronous motor has Xd=4ohm/ph and Xq=3ohm/ph. Neglecting losses, calculate the excitation emf when motor supplies rated load at upf. Calculate the maximum mechanical power which the motor would develop for this field excitation.	Evaluate	9
9	The input to an 11000V, 3 phase star connected synchronous motor is 60A. The effective resistance and synchronous reactance per phase are respectively 1 ohm and 30ohms. Find (i) the power supplied to the motor (ii) mechanical power developed and (iii) induced emf for a power factor of 0.8 leading	Apply	9
10	A synchronous motor having 40% reactance and a negligible resistance is to be operated at rated load at (i) upf (ii) 0.8 pf lag (iii) 0.8pf lead. What are the values of induced emf? Indicate assumptions made if any.	Apply	8
	UNIT-V **SINGLE PHASE MOTORS & SPECIAL MACHINES**		
1	A 2-winding single-phase motor has the main auxiliary winding currents I_m=15 A and I_a=7.5 A at stand-still. The auxiliary winding current leads the main winding current by α=45^0 electrical. The two winding are in space quadrature and the effective number of turns are N_m=80 and N_a=100. Compute the amplitudes of the forward and backward stator *mmf* waves. Also determine the magnitude of the auxiliary current and its phase angle difference α with the main winding current if only the backward field is to be present.	Evaluate	8

S.No	QUESTIONS	BLOOMS TAXONOMY LEVEL	COURSE OUTCOME
2	A stepper motor driven by a bipolar drive circuit has the following parameters: winding inductance = 30 mH, rated current = 3A, DC supply = 45V, total resistance in each phase = 15Ω. When the transistors are turned off, determine (i) the time taken by the phase current to decay to zero and (ii) the proportion of the stored inductive energy returned to the supply.	Evaluate	10
3	A stepper motor has a step angle of 3 . Determine (a) resolution (b) number of steps required for the shaft to make 25 revolutions and (c) shaft speed, if the stepping frequency is 3600 pps.	Apply	10
4	A stepper motor has a step angle of 1.8 . What number should be loaded into the encoder of its drive system if it is desired to turn on the shaft ten complete revolutions?	Evaluate	10
5	What is the motor torque T_m required to accelerate an initial load of $3*10^{-4}$ kg m^2 from f_1 = 1000 Hz to f_2 = 2000 Hz during 100 ms. The frictional torque T_f is 0.05 N-m and the step angle is 1.8°.	Apply	10
6	A 250W single phase 50hz 220v universal motor runs at 2000rpm and takes 1 A when supplied from a 220V dc supply. If the motor is connected to 220V ac supply and takes 1A(r m s), calculate the speed, torque and power factor, assume Ra=20Ω and La=0.4H	Evaluate	8
7	A universal series motor has a resistance of 30Ω and an inductance of 0.5H. when connected to a 250V DC supply and loaded to take 0.8A,it runs at 2000rpm. Estimate its speed and power factor when connected to a 250V, 50hz ac supply and loaded to take the same current.	Evaluate	8
8	Find the mechanical power output of 185kw, 4 pole, 110V, 50Hz single phase induction motor, whose constants are given below at a slip of 0.05. R1=1.86Ω, X1=2.56 Ω, Xϕ=53.5 Ω, R2=3.56 Ω X2=2.56 Ω core loss 3.5w, friction and wind age loss 13.5w	Evaluate	10
9	A 250w, 230V, 50Hz capacitor start motor has the following constants for the main and auxiliary windings: main winding, Zm=(4.5+3.7i)Ω. Auxiliary winding Za=(9.5+3.5i)Ω. Determine the value of the starting capacitor that will place the main and auxiliary winding currents in quadrature at starting.	Apply	8
10	A single phase induction motor has stator windings in space quadrature and is supplied with a single phase voltage of 200V at 50Hz. The standstill impedance of the main winding is (5.2+10.1i) and the auxiliary winding is (19.7+14.2i). find the value of capacitance to be inserted in the auxiliary winding for maximum starting torque.	Apply	8