DHANALAKSHMI SRINIVASAN COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

III SEMESTER

EE8301 – ELECTRICAL MACHINES-I

Regulation – 2017

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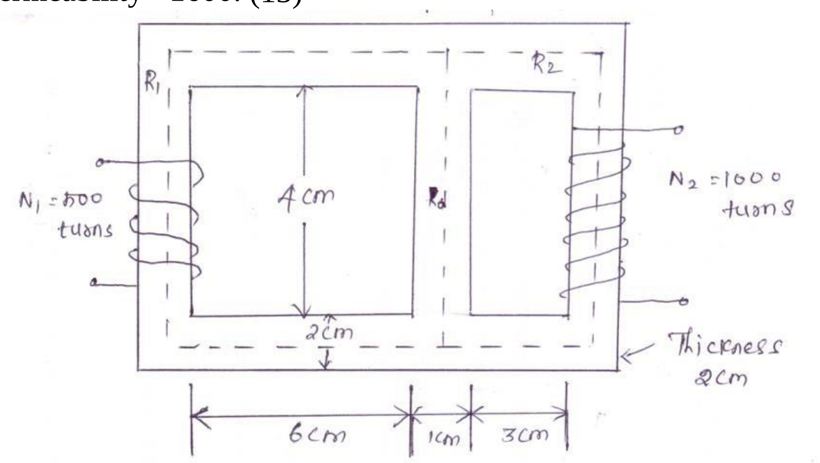
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

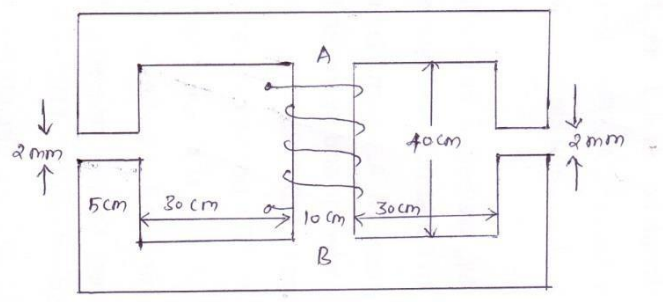
QUESTION BANK

SUBJECT: EE8301 – ELECTRICAL MACHINES-I

SEM / YEAR: IV SEMESTER/II YEAR

UNIT I MAGNETIC CIRCUITS AND MAGNETIC MATERIALS			
Magnetic circuits –Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysterisis and Eddy Current losses - AC excitation, introduction to permanent magnets- Transformer as a magnetically coupled circuit			
PART – A			
Q.No.	**Questions**	**BTL**	**Competence**
1.	Explain Statically induced EMF?	BTL5	Evaluating
2.	Prepare the list of the materials suitable for fabrication of Permanent Magnets.	BTL6	Creating
3.	Classify the basic types of rotating electric machines?	BTL3	Applying
4.	What are the types of magnetic losses.	BTL1	Remembering
5.	Define magnetic flux density.	BTL1	Remembering
6.	A coil of 1500 turns carrying a current of 5 Amps produces a flux of 2.5mWb. Calculate the self inductance of the coil.	BTL3	Applying
7.	Define magnetic reluctance.	BTL1	Remembering
8.	Distinguish statically and dynamically induced EMF.	BTL2	Understanding
9.	Give the expressions for Hysteresis losses and Eddy current losses and illustrate the various ways to minimize them.	BTL3	Applying
10.	Define reluctance and permeance.	BTL1	Remembering
11.	Define Relative Permeability.	BTL2	Understanding
12.	Define (i) Ampere’s Law (ii) Inductance.	BTL1	Remembering
13.	Differentiate leakage flux and mutual flux?	BTL2	Understanding
14.	Define Self Inductance.	BTL2	Understanding
15.	What are the core losses and how can this loss be minimized? Justify.	BTL5	Evaluating
16.	Infer fringing effect in a magnetic circuit?	BTL4	Analysing
17.	Discuss in brief the stacking factor.	BTL3	Applying
18.	Draw and explain the magnetization curve of ferromagnetic material.	BTL4	Analysing
19.	Compare electric and magnetic circuits.	BTL4	Analysing
20.	Formulate the coefficient of coupling?	BTL6	Creating

PART – B			
1.	For the magnetic circuit as shown below, Calculate the self and mutual inductance between the two coils. Assume core permeability =1600. (13)  	BTL 3	Applying
2.	Draw and explain the typical magnetic circuit with air-gap and its equivalent electric circuit. Hence derive the expression for air gap flux. (13)	BTL 4	Analysing
3.	Examine the property of Magnetic Materials (i) Para Magnetic (ii) Dia Magnetic Materials (iii) Ferro Magnetic Materials. (13)	BTL 3	Applying
4.	Explain the following Magnetic field properties (i) Magnetic Field (ii) Magnetic Flux (iii) Magnetic Flux Density (iv) Magnetic Intensity or Force (v) Absolute and Relative Permeability. (13)	BTL 4	Analysing
5.	An iron rod 1.8 cm diameter is bent to form a ring of mean diameter 25 cm and wound with 250 turns of wire. A gap of 1mm exists in between the end faces. Calculate the current required to produce a flux of 0.6 mWb. Take relative permeability of iron as 1200. (13)	BTL 4	Analysing
6.	(i) Specify the causes for Hysteresis and Eddy current losses in Electrical machines. Also give the methods in construction to minimize the above losses. (6)	BTL 1	Remembering
	(ii) List the properties of magnetic material suitable for fabrication Permanent Magnet and Electromagnet. (7)	BTL 1	Remembering
7.	(i) Describe the AC operation of magnetic circuits. (6)	BTL 1	Remembering
	(ii) Describe the principle of a typical magnetic circuit with airgap and explain. Also show that the core reluctance may be neglected in practice. (7)	BTL 1	Remembering
8.	The magnetic circuit has dimensions: A_c=4*4 cm^2, I_g=0.06 cm, I_c =40 cm and N=600 turns. Assume the value of μ_r=6000 for iron. Measure the exciting current for B_c =1.2 T and the corresponding flux and flux linkages. (13)	BTL 6	Creating
9.	(i) Describe the methods of analyzing the magnetic circuits. (6)	BTL1	Remembering
	(ii) Examine the typical B-H Curve and hysteresis loops and explain its Concept. (7)		

10.	(i) Extend the expression for self and mutual inductance of the coil. (6) (ii) Two coils A and B are wound on same iron core. There are 600 turns on A and 3600 turns on B. The current of 4A flows through coil. A produces a flux of $500*10^{-6}$ Wb in the core. If this current is reversed in 0.02 sec., Identify the average emf induced in coils A and B.(7)	BTL2	Understanding
11.	For the magnetic circuit shown in fig with a core thickness of 5cm, exciting current of 0.5A wound with 1000turns coil, find the flux density and flux in each of the outer limbs and the central limbs. Assume relative permeability for iron of the core 	BTL2	Understanding
12.	(i) Give the expression for energy density in the magnetic field. (3)	BTL2	Understanding
	(ii) Describe in detail "Eddy-current loss". (3)	BTL2	Understanding
	(iii) The total core loss of a specimen of silicon steel is found to be 1500W at 50Hz. Keeping the flux density constant the loss becomes 3000 W when the frequency is raised to75 Hz. Calculate separately the hysteresis and edd y current loss at each of their frequencies. (7)	BTL2	Understanding
13.	Define and Explain the following Laws governing on Magnetic Circuit (i) Magnetic Effect on Current-Right Hand Rule and Cock Screw Rule (ii) Current carrying conductor in Magnetic Field-Fleming's Left Hand and Right Hand Rule (iii) Statically Induced EMF and Dynamically Induced EMF. (13)	BTL1	Remembering
14.	(i) Compare the similarities and dissimilarities between electric and magnetic circuits. (6) (ii) Explain the eddy current and eddy current losses in the magnetic circuit. (7)	BTL5	Evaluating

PART – C			
1.	(i) Compare the difference between electric circuit and magnetic circuit. (7) (ii)What is meant by induced emf? Explain the	BTL4	Analysing

	following types of induced emf (a) Statically Induced emf. (b) Dynamically Induced emf. (8)		
2.	An electromagnetic relay has an exciting coil of 800 turns. The coil has a cross section of 5 cm × 5 cm. Find (a) coil inductance if the air gap length is 0.5 cm. (b) field energy stored for a coil current of 1.25 A (c) Permeance at the air gap. (15)	BTL 5	Evaluating
3.	Explain the following Magnetic field properties (i) Magnetic Field (ii) Magnetic Flux (iii) Magnetic Flux Density (iv) Magnetic Intensity or Force (v) Absolute and Relative Permeability (vi) Reluctance (vii) Permeance (viii) Magneto Motive Force. (15)	BTL4	Analysing
4.	A toroidal core made of mild steel has a mean diameter of 16cm and a cross-sectional area of $3cm^2$. Calculate a) the m.m.f to produce a flux of 4×10^{-4} Wb and b) the corresponding values of the reluctance of the core and the relative permeability. (15)	BTL4	Analysing
UNIT II TRANSFORMERS			
Construction – principle of operation – equivalent circuit parameters – phasor diagrams, losses – testing – efficiency and voltage regulation - all day efficiency - Sumpner's test, per unit representation – inrush current - three phase transformers-connections – Scott Connection – Phasing of transformer – parallel operation of three phase transformers - auto transformer – tap changing transformers - tertiary winding.			
PART - A			
1.	List out the merits and demerits of core and shell type transformer.	BTL5	Evaluating
2.	How do you reduce leakage flux in a transformer?	BTL2	Understanding
3.	Show the no load phasor diagram of a transformer.	BTL4	Analysing
4.	What happens if DC supply is applied to the transformer?	BTL3	Applying
5.	Give the principle of transformer.	BTL2	Understanding
6.	List the losses in a transformer?	BTL1	Remembering
7.	The emf per turn for a single-phase 2200/220 V, 50 Hz transformer is 11 V. Calculate the number of primary and secondary turns.	BTL3	Applying
8.	Describe turns ratio of transformer.	BTL4	Analysing
9.	Whyis transformer rated in KVA?Justify	BTL1	Remembering
10.	Explain ideal transformer and draw its phasor diagram?	BTL1	Remembering
11.	Compose the advantages and applications of auto transformer.	BTL1	Remembering
12.	Differentiate two winding transformer and auto transformer.	BTL1	Remembering
13.	Full load copper loss in a transformer is 1600 W, What will be the loss at half load?	BTL1	Remembering
14.	Deduce the regulation of a transformer.	BTL5	Evaluating
15.	Predict the causes of stray losses?	BTL2	Understanding
16.	Show the condition for parallel operation of a transformer?	BTL2	Understanding
17.	Compose the purpose of conducting open circuit test?	BTL6	Creating
18.	Describe the role of tertiary winding in Transformer.	BTL4	Analysing
19.	Define all day efficiency. Explain whyall day	BTL2	Understanding

	efficiency is lower than commercial efficiency?		
20.	Interpret the Inrush current in a transformer	BTL6	Creating
PART - B			
1.	Explain the construction, working principle and operation of a transformer. Derive its emf equation. (13)	BTL4	Analysing
2.	The voltage per turn of a single phase transformer is 1.1 volt, when the primary winding is connected to a 220 volt, 50 Hz AC supply the secondary voltage is found to be 550 volt. Identify the primary and secondary turns and core area if maximum flux density is 1.1 Tesla. (13)	BTL5	Evaluating
3.	Calculate the efficiency for half, full load of a 100KVA transformer for the P.F of unity and 0.8, the copper loss at full load is 1000W and iron loss is 1000W. (13)	BTL3	Applying
4.	Develop the equivalent circuit of a single phase transformer referred to primary and secondary. (13)	BTL6	Creating
5.	Draw and explain the phasor diagram of transformer when it is operating under load. (13)	BTL3	Applying
6.	(i) The emf per turn of a single phase, 6.6 kV/440 V, 50 Hz transformer is approximately 10V. Calculate the number of turns in the HV and LV windings and the net cross sectional area of the core for a maximum flux density of 1.6 T. (7)	BTL1	Remembering
	(ii) A 500 KVA Transformer has a core loss of 2200 watts and a full load copper loss of 7500 watts. If the power factor of the load is 0.90 lagging, Evaluate the full load efficiency and the KVA load at which maximum efficiency occurs. (6)	BTL 5	Evaluating
7.	(i) A 11000/230 V, 150 kVA, 1-phase, 50 Hz transformer has loss of 1.4 kW and Full Load copper loss of 1.6 kW. Determine (i) the kVA load for maximum efficiency and the value of maximum efficiency at unity p.f. (ii) The efficiency at 0.8 pf leading. (6)	BTL2	Understanding
	(ii) A 500KVA transformer has 95% efficiency at full load and also at 60% of full load both at UPF. a) Separate out the transformer losses. b) Measure the transformer efficiency 75% full load, UPF. (7)	BTL2	Understanding
8.	(i) Obtain the generalised conditions for parallel operation of Transformer. Also explain the effect of load sharing due to impedance variation between transformers during parallel operation. (7)	BTL6	Creating
	(ii) A 100 KVA, 3300 V/240 V, 50 HZ single phase transformer has 990 turns on the primary. Identify the number of turns on secondary and the approximate value of primary and secondary full load currents. (6)	BTL1	Remembering
9.	A single phase transformer has 180 turns respectively in its secondary and primary windings.	BTL1	Remembering

	The respective resistances are 0.233 and 0.067. Calculate the equivalent resistance of a) the primary in terms of the secondary winding b) the secondary in terms of the primary winding c) the total resistance of the transformer in terms of the primary.(13)		
10.	Explain the back to back method of testing for two identical single phase transformers. (13)	BTL2	Understanding
11.	Obtain the equivalent circuit of a 200/400V 50 Hz single phase transformer from the following test data. O.C.test: 200V, 0.7A, 70W – on L .V Side S.C. test: 15V, 10A, 85W – on H.V side Calculate the secondary voltage when delivering 5 kW at 0.8 p.f. lagging. The primary voltage being 200V. (13)	BTL4	Analysing
12.	Describe the various three phase transformer connection and parallel operation of three phase transformer. (13)	BTL1	Remembering
13.	Describe the method of calculating the regulation and efficiency of a single phase transformer by OC and SC tests? (13)	BTL1	Remembering
14.	i) Interpret in detail about the autotransformer, their principle. Arrive at the expression for saving of copper.(10) ii) Evaluate in brief the voltage regulation with necessary expressions. (5)	BTL4	Analysing
PART - C			
1.	Obtain the equivalent circuit of a 200/400V 50 Hz single phase transformer from the following test data. O.C.test: 1100V, 0.5A, 55W – on primary Side, secondary being open circuited S.C. test: 10V, 80A, 400 W – on LV side, high voltage side being short circuited. Calculate the voltage regulation and efficiency for the above transformer when supplying 100A at 0.8 p.f. lagging. (15)	BTL 4	Analysing
2.	A 20 kVA, 2000/200V, 50 Hz, single phase transformer has the following parameters: $r_1 = 2.8\ \Omega$, $r_2=0.02\Omega$, $x_{11}=4.2\Omega$ and $x_{12}=0.6\Omega$. Calculate (i) Equivalent resistance, leakage reactance and impedance referred to HV side. (ii) Equivalent resistance, leakage reactance and impedance referred to LV side. (iii) Full load copper loss. (15)	BTL 4	Analysing
3.	The primary of the transformer is rated at 10A and 1000V. The open circuit reading are V_1=1000V, V_2=500V, I=.42A, P_{ac}=100W. The short circuit readings are I_1=10A,V_1=125V and P_{ac}=400W. Draw the equivalent circuit for the transformer. Predict the ouput voltage for the load impedance Z_L=19+j12ohms and draw the phasor diagram. (15)	BTL 5	Creating
4.	A 75KVA transformer has 500 turns' primary and 100	BTL 5	Creating

	turns secondary. The primary and secondary resistances are 0.4 ohm and 0.02ohm respectively and the corresponding leakage reactances are 1.5ohm and 0.045ohm respectively. The supply voltage is 2200V, evaluate (a) equivalent impedance referred to primary circuit and (b) voltage regulation and secondary terminal voltage for full load load at power factor of (i) 0.8 lagging and (ii) 0.8 leading. (15)		
UNIT III ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES			
Energy in magnetic system – Field energy and coenergy - force and torque equations – singly and multiply excited magnetic field systems - mmf of distributed windings – Winding Inductances - magnetic fields in rotating machines – rotating mmf waves – magnetic saturation and leakage fluxes.			
PART - A			
1.	Describe co energy?	BTL2	Understanding
2.	Why do all practical energy conversion devices make use of the magnetic field as a coupling medium rather than an electric field? Explain.	BTL4	Analysing
3.	Compose the advantages of analyzing energy conversion devices byfield energy concept?	BTL4	Analysing
4.	Give the general block diagram of electromechanical energy conversion device.	BTL2	Understanding
5.	Formulate synchronous speed. Write the expression also.	BTL6	Creating
6.	Differentiate the pitch factor and distribution factor?	BTL2	Understanding
7.	Generalize example for singly and multiply excitation systems.	BTL6	Creating
8.	Explain reactance voltage?	BTL4	Analysing
9.	List the basic requirements of the excitation systems?	BTL1	Remembering
10.	Tell why fractional pitched winding is preferred over full.	BTL1	Remembering
11.	Why the relationship between current and coil flux linkages of electromechanical energy conversion devices are linear?	BTL1	Remembering
12.	Show the equation, which relates rotor speed in electrical and mechanical radian/second.	BTL1	Remembering
13.	Draw the diagram showing the flow of energy in electromechanical energy conversion via coupling medium.	BTL3	Applying
14.	Define winding factor?	BTL1	Remembering
15.	In a linear system Show that field energy and co energy are equal.	BTL3	Applying
16.	Whar are the cusses for irrecoverable energy loss when the flux in the magnetic circuits undergoes a cycle?	BTL2	Understanding
17.	Deduce the assumptions made to determine the distribution of coil mmf?	BTL5	Evaluating
18.	Define the term pole pitch and coil pitch.	BTL1	Remembering
19.	Why synchronous machine does not produce torque at any other speed? Justify.	BTL5	Evaluating
20.	Describe SPP? What is its significance?	BTL2	Understanding

PART - B			
1.	Two coupled coils have self and mutual inductance of L_{11} = 3+0.5x ; L_{22} = 2+0.5x ; L_{12} = L_{21} = 0.3x over a certain range of linear displacement x. the first coil is excited by a constant current of 15 A and the second by a constant current of -8 A. Determine, (i) Mechanical work done if x changes from 0.6m to 1m. (ii) Energy supplied by each electrical source. (13)	BTL1	Remembering
2.	Formulate the torque equation of a round rotor machine. Also clearly state the assumptions made. (13)	BTL6	Creating
3.	Consider an attracted armature relay is excited by an electric source. Explain about the mechanical force developed and the mechanical energy output with necessary equation for linear and nonlinear cases. (13)	BTL2	Understanding
4.	Explain briefly the production of rotating magnetic field. What are the speed and direction of rotation of the field? Is the speed uniform? (13)	BTL4	Analysing
5.	(i) Describe the concept of rotating MMF waves in AC Machine. (6)	BTL1	Remembering
	(ii) Obtain an expression for the mechanical force of field origin in a typical Attracted armature relay. (7)	BTL2	Understanding
6.	Derive an expression for the magnetic force developed in a multiply excited magnetic systems. (13)	BTL2	Understanding
7.	Illustrate the necessary expression for co-energy density of an Electromechanical energy conversion device. (13)	BTL3	Applying
8.	(i) Describe the torque in doubly excited magnetic system and show that is equal to the rate of increase of field energy with respect to displacement at constant current. (6)	BTL2	Understanding
	(ii) The λ-I characteristics of singly excited electromagnet is given by $\mathbf{i = 121\,\lambda^2 x^2}$ for $\mathbf{0<i<4}$ **A** and $\mathbf{0<x<10}$**Cm**. If the air gap is 5cm and a current of 3A is flowing in the coil, Identify (a) Field Energy (b) Co- energy (c) Mechanical Force on the moving part. (7)	BTL1	Remembering
9.	Describe the m.m.f space wave of one phase of distributed a.c. winding. (13)	BTL1	Remembering
10.	(i) Describe the flow of energy in electromechanical devices. (4)	BTL1	Remembering
	(ii) Describe about the ‘field energy’ and ‘co energy’in		Remembering

	magnetic system.(4)	BTL1	
	(iii) The magnetic flux density on the surface of an iron face is 1.6 T which is a typical saturation level value for ferromagnetic material. Identify the force density on the iron face. (5)	BTL1	Remembering
11.	Derive an expression for the magnetic energy stored in a singly excited electromagnetic relay. (13)	BTL4	Analysing
12.	Evaluate an expression for co-energy density of an electromechanical energy conversion device. (13)	BTL5	Evaluating
13.	Two windings, one mounted in stator and other at rotor have self and mutual inductance of L_{11} =4.5 and L_{22} =2.5, L_{12} =2.8cosθ where θ is the angle between axes of winding. Winding2 is short circuited and current in winding as a function of time is i_1 = 10 sinωt A. Infer the expression for numerical value in Newton-meter for the instantaneous value of torque in terms of θ. (13)	BTL4	Analysing
14.	In an electromagnetic relay, functional relation between the current i in the excitation coil, the position of armature is x and the flux linkage Ψ is given by $i= 2\Psi^3 + 3(1-x+x^2)$, x>0.5. Examine the force on the armature as a function of Ψ. (13)	BTL3	Applying
PART - C			
1.	The doubly-excited magnetic field has coil self and mutual inductances of $L_{11}=L_{22}=2$ $L_{12}=L_{21}=\cos\theta$ Where θ is the angle between the axes of the coils. The coils are connected in parallel to a voltage source $V=V_m\sin\omega t$. Derive an expression for the instantaneous torque as a function of the angular position θ. Find the time-average torque. Evaluate for θ=30deg, γ=100sin314t. (15)	BTL6	Creating
2.	(i) Explain the concepts of rotating MMF waves in AC Machines. (7)	BTL5	Evaluating
	(ii) The magnetic flux density on the surface of an iron faces is 1.8T which is a typical saturation level value for ferromagnetic material. Identify the force density on the iron face.(8)	BTL5	
3.	With neat sketch explain multiple excited magnetic field system in electromechanical energy conversion systems. Also obtain the expression for field energy in the system. (15)	BTL4	Analysing
4.	Explain in detailed MMF distribution in AC synchronous machine and derive the expression for fundamental MMF. (15)	BTL5	Evaluating
UNIT IV DC GENERATORS			
Construction and components of DC Machine – Principle of operation - Lap and wave windings - EMF equations – circuit model – armature reaction – methods of excitation - commutation and interpoles - compensating winding – characteristics of DC generators.			
1.	List the factors involved in the voltage buildup of a	BTL1	Remembering

	Shunt Generator.		
2.	Why the armature core in a DC machine is constructed with laminated steel sheets instead of solid steel sheets?	BTL1	Remembering
3.	Define residual EMF in DC Generator?	BTL1	Remembering
4.	Define back pitch and front pitch.	BTL1	Remembering
5.	Define winding pitch and commutator pitch.	BTL1	Remembering
6.	Define Commutation and Commutation period.	BTL1	Remembering
7.	Differentiate Lap winding and Wave Winding of a DC machine armature.	BTL2	Understanding
8.	Discuss why the external characteristics of a DC Shunt Generator is more drooping than that of a separately excited.	BTL2	Understanding
9.	Discuss the detail under which conditions a dc shunt generator fails to excite.	BTL2	Understanding
10.	Discuss the purpose of yoke in dc machine.	BTL2	Understanding
11.	Classify the different types of DC Generators based on method of excitation?	BTL3	Applying
12.	Demonstrate the armature reaction in DC Generators? What are its effects?	BTL3	Applying
13.	Illustrate a schematic diagram indicating flow of energy in the conversion of Mechanical Energy into Electrical Energy.	BTL3	Applying
14.	Explain in short the role of inter poles in DC Machines.	BTL4	Analysing
15.	Pointout why the air gap between the pole pieces and the armature is kept very small?	BTL4	Analysing
16.	Explain in short the Commutation and Commutation period.	BTL4	Analysing
17.	Integrate the Characteristics of all DC Generators in single graph.	BTL5	Evaluating
18.	Summarize the application of various types of Generators.	BTL5	Evaluating
19.	Generalize the requirements of the excitation systems?	BTL6	Creating
20.	Develop critical resistance of a dc shunt generator.	BTL6	Creating
	PART - B		
1.	(i) Draw and Explain the Internal and External Characteristics of different types of DC Generators. (6) (ii) A 4 pole DC Shunt Generator with lap connected armature supplies 5 kilowatt at 230 Volts. The armature and field copper losses are 360 Watts and 200 Watts respectively. Calculate the armature current and generated EMF? (7)	BTL1	Remembering
2.	A separately excited generator when running at 1000rpm supplied 200A at 125V. What will be the load current when the speed drops to 800rpm if I_f is unchanged? Given that armature resistance=0.04Ω and brush drop=2V. Derive the necessary equations.(13)	BTL6	Creating

3.	In a 400 volts, DC Compound Generator, the resistance of the armature, series and shunt windings are 10 ohm, 0.05 ohm and 100 ohms respectively. The machine supplies power to 20 Nos. resistive heaters, each rated 500 watts, 400 volts. Identify the induced emf and armature currents when the generator is connected in (1) Short Shunt (2) Long Shunt. Allow brush contact drop of 2 volts per brush. (13)	BTL2	Understanding
4.	(i) Explain the armature reaction and commutation in detail for a DC Machine. (6)	BTL4	Analysing
	(ii) A 4 pole 50 kW 250 V wave wound shunt generator has 400 armature conductors. Brushes are given a lead of 4 commutator segments. Calculate the demagnetization ampere-turns per pole if shunt field resistance is 50Ω. Also calculate extra shunt field turns per pole to neutralize the demagnetization. (7)		
5.	With neat sketch explain the construction and principle of operation of DC Generator. (13)	BTL2	Understanding
6.	A 6-pole DC Generator has 150 slots. Each slot has 8 conductors and each conductor has resistance of 0.01Ω. The armature terminal current is 15 A. Calculate the current per conductor and the drop in armature for Lap and Wave winding connections. (13)	BTL3	Applying
7.	(i) Show the condition for maximum efficiency of the DC Generator. (7)	BTL2	Understanding
	(ii) Explain the following: (a) Self and separately excited DC generators(3) (b) Commutation.(3)	BTL1	Remembering
8.	(i) Calculate the emf induced in the armature of a two pole generator whose armature has 280 conductors and is revolving at 1000 rpm. The flux per pole is 0.03 Weber. (6)	BTL1	Remembering
	(ii) Calculate the generated emf of a DC Generator which has 4 poles total number of conductors equal to 256 Lap wound running at 2000 rpm. The useful flux per pole is 0.2 Weber. (7)		
9.	Explain in detail about commutation and list out the various methods of improving commutation in detail with a neat sketch. (13)	BTL1	Remembering
10.	(i) Derive an expression for the EMF Equation of DC Generator. (7)	BTL4	Analysing
	(ii) The lap wound armature has a 4-pole generator has 51 slots. Each slot contains 20 conductors. What will be the emf generated in machine when driven at 1500 rpm. If useful flux per pole is 0.01 Wb? (6)		
11.	A 12 pole DC Generator has a simple wave wound armature containing 144 coils of 10 turns each. The resistance of each turn is 0.01 ohm. Its flux per pole is 0.05 Weber and it is running at a speed of 200 rpm. Obtain the induced armature voltage and the effective resistance. (13)	BTL5	Evaluating

12.	Explain the different methods of excitation and characteristics of DC Generators with suitable diagram. (13)	BTL4	Analysing
13.	Explain the following constructional components of DC Machine (i) Magnetic Frame or Yoke (ii) Pole Core (iii) Field Coils (iv) Armature (v) Armature Winding (vi) Commutator (vii) Brushes and Bearings. (13)	BTL3	Applying
14.	Explain the effect of armature reaction in a dc generator. How are its demagnetizing and cross magnetizing calculated. (13)	BTL4	Analysing

PART - C			
1.	A four pole lap wounded shunt generator supplies 60 lamps of 100W, 240V each; the field and armature resistances are 55ohm and 0.18ohm respectively. If the brush drop is 1volt for each brush formulate (i) armature current (ii) current per path (iii) generated emf (iv) power output of dc machine. (15)	BTL6	Creating
2.	(a) In Armature Reaction Explain the following terms (i) Main field of DC Machine (ii) Armature Field of DC Machine (iii) Interaction between a main field and armature mmf (iv) Armature conductor and Ampere Turns. (8)	BTL5	Evaluating
	(b) In commutation Explain the following terms (i) Mechanical Cause of Commutation (ii) Electrical cause of commutation (iii) Process of commutation (iv) Methods to improve commutation. (7)		
3.	(i) With suitable neat diagram explain the construction of a DC Machine and also explain each elements. (8)	BTL4	Applying
	(ii) With neat diagram explain principle of operation of a DC Machine. (7)		
4.	(i) Obtain the expression for the EMF Equation of a DC Generator. (8)	BTL4	Applying
	(ii) Explain the following terms in DC Generator (a) Lap and Wave Winding (b) Compensation Winding. (7)		
UNIT V DC MOTORS			
Principle and operations - types of DC Motors – Speed Torque Characteristics of DC Motors starting and speed control of DC motors –Plugging, dynamic and regenerative braking testing and efficiency – Retardation test- Swinburne’s test and Hopkinson’s test – Permanent Magnet DC (PMDC) motors-applications of DC Motor			
1.	Define Back emf in a D.C. Motor?	BTL1	Remembering
2.	List the application of various types of DC Motor.	BTL1	Remembering
3.	List the merits and demerits of Swinburne’s test.	BTL1	Remembering
4.	Define Speed regulation of DC Motor.	BTL1	Remembering
5.	Why commutator is employed in d.c.machines?	BTL1	Remembering
6.	When you will say the motor is running at base speed?	BTL1	Remembering

7.	Summarize the different techniques used to control the speed of DC Shunt motor.	BTL2	Understanding
8.	Describe the torque equation of a DC Motor.	BTL2	Understanding
9.	Give the advantages and disadvantages of Flux control method?	BTL2	Understanding
10.	Express the voltage equation of DC Motor.	BTL2	Understanding
11.	Demonstrate How to reverse the direction of rotation of DC Motor?	BTL3	Applying
12.	Show at what load does the efficiency is maximum in DC Shunt Machines.	BTL3	Applying
13.	Demonstrate How you will change the direction of rotation of a DC Motor.	BTL3	Applying
14.	Point out why the Starters necessary for starting DC Motors?	BTL4	Analysing
15.	What will happen to the speed of a dc motor when its flux approaches to zero?	BTL4	Analysing
16.	Explain why Swinburne's test cannot be performed on DC Series Motor.	BTL4	Analysing
17.	Criticize "belt drive not suitable for DC Series Motor why?"	BTL5	Evaluating
18.	Explain the significance of back emf in a DC Motor?	BTL5	Evaluating
19.	Explain the function of no-volt release in a Three-point starter?	BTL6	Creating
20.	Mention the effects of differential compounding and cumulatively compound on the performance of DC Compound motor.	BTL6	Creating
PART - B			
1.	With neat diagram explain the principle, construction and working of DC Motor and its characteristics. (13)	BTL1	Remembering
2.	Describe briefly the various methods of controlling the speed of a DC Shunt Motor and bring out their merits and demerits. Also, state the situations where each method is suitable. (13)	BTL1	Remembering
3.	Describe Plugging, dynamic and regenerative braking in DC Motor. (13)	BTL1	Remembering
4.	A 230 volts DC Shunt motor on no-load runs at a speed of 1200RPM and draw a current of 4.5 Amperes. The armature and shunt field resistances are 0.3 ohm and 230 ohms respectively. Calculate the back EMF induced and speed, when loaded and drawing a current of 36 Amperes. (13)	BTL3	Applying
5.	Discuss why starting current is high at the moment of starting a DC Motor? Explain the method of limiting the starting current in DC Motors and also various methods of speed control. (13)	BTL2	Understanding
6.	With neat sketch explain three point starter to start the DC Shunt Motor. (13)	BTL4	Analysing
7.	A DC Series Motor runs at 500 rpm on 220 V supply drawing a current of50 A. The total resistance of the machine is 0.15Ω, calculate the value of the extra resistance to be connected in series with the motor	BTL3	Applying

	circuit that will reduce the speed to 300 rpm. The load torque being then half of the previous to the current. (13)		
8.	(i) A 500V DC Shunt Motor running at 700 rpm takes an armature current of50A.Its effective armature resistance is 0.4Ω. What resistance must be placed in series with the armature to reduce the speed to 600 rpm, the torque remaining constant? (7)	BTL4	Analysing
	(ii) Explain briefly the merits and demerits of Hopkinson's test? (6)	BTL4	Analysing
9.	Explain the different methods of excitation and characteristics of a DC Motors with suitable diagrams.(13)	BTL4	Analysing
10.	A 400 Volts DC Shunt Motor has a no load speed of 1450 RPM, the line current being 9 Amperes. At full loaded condition, the line current is 75 Amperes. If the shunt field resistance is 200 Ohms and armature resistance is 0.5Ohm. Evaluate the full load speed. (13)	BTL5	Evaluating
11.	With the help of neat circuit diagram, explain Swinburne's test and Hopkinson's Test. derive the relations for efficiency (Both for generator and Motor). (13)	BTL1	Remembering
12.	A 4pole DC series motor has 944 wave connected armature conductors. At a particular load, the flux per pole is 0.04wb and the total torque developed is 260 N-m. Calculate the line current taken by the motor and the speed at which it will run with an applied voltage of 500V. The total motor resistance is 3Ω. (13)	BTL6	Creating
13.	Explain the construction, principle, working and equivalent circuit of PMDC Motor. (13)	BTL2	Understanding
14.	A 440 V D.C. shunt motor takes 4A at no load. Its armature and field resistances are 0.4 ohms and 220 ohms respectively. Estimate the kW output and efficiency when the motor takes 60A on full load.	BTL4	Analysing
PART - C			
1.	Determine developed torque and shaft torque of 220V, 4 pole series motor with 800 conductors wave connected supplying a load of 8.2kW by taking 45A from the mains. The flux per pole is 25mWb and its armature circuit resistance is 0.6 ohm. (8)	BTL6	Creating
	(b) In DC Motor explain the speed versus torque characteristics of DC Motor (i) DC Series Motor (ii) DC Shunt Motor. (7)		
2.	(a) What is meant by Braking of Electric Motor? Explain the following types of Electrical Braking (i) Regenerative Braking (ii) Dynamic or Rheostatic Braking (iii) Plugging or Reverse Braking. (8)	BTL5	Evaluating
	(b) Explain the different methods for speed control of DC Motor (i) Armature Control (ii) Field Control. (7)		
3.	In a Hopkinson's test on a pair of 500V, 100kW shunt	BTL6	Creating

	generators, the following data was obtained: Auxiliary supply: 30A at 500V Generator output current: 200A Field Currents: 3.5A (Generator) and 1.8A (Motor). Armature circuit resistances: 0.075Ω each machine. Voltage drop at the brushes: 2V (each machine). Calculate the efficiency of the machine acting as a generator. (15)		
4.	A 220 V, 22 A, 1000 rpm dc shunt motor has armature circuit resistance of 0.1 ohm and field resistance of 100 ohm. Calculate the value of additional resistance to be inserted in the armature circuit in order to reduce the speed to 800 rpm. Assume the load torque to be (i) proportional to the speed and (ii) proportional to square of the speed (15)	BTL5	Evaluating