ST. ANNE'S COLLEGE OF ENGINEERING AND TECHNOLOGY
(Approved by AICTE, New Delhi. Affiliated to Anna University, Chennai)
ANGUCHETTYPALAYAM, PANRUTI 607 106

B.E ECE
II SEMESTER
BE3254-BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING
Regulation – 2021
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ST ANNES COLLEGE OF ENGINEERING
DEPARTMENTOF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

SUBJECT: BE3254-BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING

SEM / YEAR : II / I

DEPARTMENT : B.E. - ECE

UNIT-I TRANSFORMER			
Introduction – Ideal and Practical Transformer – Phasor diagram-– Per Unit System – Equivalent circuit- Testing- Efficiency and Voltage Regulation– Three Phase Transformers –Applications Auto Transformers, Advantages- Harmonics.			
PART – A			
Q. No	**Questions**	**BTL Level**	**Competence**
1.	What is meant by transformer? Formulate the expression for step up and stepdown transformer according to transformation ratio.	**2**	**Understand**
2.	Compare the following transformers (i) Core type transformer (ii) Shell type.	**5**	**Evaluate**
3.	Draw the circuit diagram of single phase transformer	**2**	**Understand**
4.	Write down the EMF equation of a transformer relative to the secondary winding.	**2**	**Understand**
5.	How do you reduce leakage flux in a transformer?	**2**	**Understand**
6.	Draw a single phase shell type transformer and name the parts.	**3**	**Apply**
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.	**3**	**Apply**
8.	Explain ideal transformer and draw its phasor diagram?	**1**	**Remember**
9.	Define voltage regulation of a transformer.	**1**	**Remember**
10.	List the different losses occurring in a transformer.	**1**	**Remember**
11.	Why transformer rating is in KVA?	**2**	**Understand**

12.	Does transformer draw any current when secondary is open? Why?	**2**	**Understand**
13.	Draw the no-load phasor diagram of a transformer.	**3**	**Apply**
14.	At what condition does a transformer operate at its maximum efficiency.	**4**	**Analyze**
15.	Give the different types of 3 phase transformer connections.	**2**	**Understand**
16.	What happen when a DC supply is applied to a Transformer?	**4**	**Analyze**
17.	List the advantages and applications of auto transformer.	**1**	**Remember**
18.	In a single phase transformer, N_p= 350 turns, N_s= 1050 turns, E_p= 400V.Calculate the value of secondary voltage (E_s).	**5**	**Evaluate**
19.	What is per unit system?	**2**	**Understand**
20.	What is name plate rating?	**2**	**Understand**
	PART-B		
1.	Describe the constructional details of different types of 1-phase transformer withneat diagrams. **(16)**	**4**	**Analyze**
2.	Draw a general schematic of a single phase transformer. Describe its workingprinciple and deduce the expression for emf in secondary winding. **(16)**	**2**	**Understand**
3	(i) Draw an ideal single phase transformer and explain the principle ofoperation, the concept of step up and step down transformer**.(8)**	**4**	**Analyze**
	(ii) Derive the EMF equation of a single-phase transformer with respect to itsprimary and secondary windings**.(8)**	**6**	**Create**
4.	Develop the equivalent circuit of a single phase transformer referred to primary and secondary. **(16)**	**2**	**Understand**
5.	Derive the equivalent circuit parameters and thereby find the regulation andefficiency of the transformer by performing OC test. **(16)**	**6**	**Create**
6.	Derive the equivalent circuit parameters and thereby find the regulation andefficiency of the transformer by performing SC tests. **(16)**	**6**	**Create**
7.	Draw and explain the phasor diagram for a single phase transformer supplying aleading power factor load. **(16)**	**3**	**Apply**
8.	The test results obtained on a 1 phase 20 KVA, 2200/220 Volts transformer are:OC test : 220 V, 1.1 A, 125 W; SC test : 52.7 V, 8.4 A, 287 W The transformer is fully loaded. Find the load p.f. for zero voltage regulation. **(16)**	**5**	**Evaluate**
9.	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. **(16)**	**5**	**Evaluate**
10.	Describe the various three phase transformer connection and parallel operation ofthree phase transformer. **(16)**	**1**	**Remember**
11.	What is meant by auto transformer? Explain the principle, construction, working ofa auto transformer. **(16)**	**4**	**Analyze**

	UNIT-II DC MACHINES		
	Introduction – Constructional Features– Motor and Generator mode – EMF and Torque equation – Circuit Model – Methods of Excitation- Characteristics – Starting and Speed Control – Universal Motor- Stepper Motors – Brushless DC Motors- Applications		
	PART – A		
Q. No	**Questions**	**BTL Level**	**Competence**
1.	Describe the working principle of operation of a DC generator	**2**	**Understand**
2.	How universal motor is different from DC motor?	**2**	**Understand**
3.	Classify the different types of DC generators	**3**	**Apply**
4.	Sketch the external characteristics of a DC series generator.	**3**	**Apply**
5.	Give the function of commutator in a DC machine.	**2**	**Understand**
6.	What is the function of interpoles?	**1**	**Remember**
7.	What is meant by armature reaction in dc machines?	**4**	**Analyze**
8.	Write the conditions which determines if a DC machine is generating orMotoring	**6**	**Create**
9.	Write the induced EMF equation when the machine act as DC motor and DC generator.	**6**	**Create**
10.	The starting current of a dc motor is high. Justify	**5**	**Evaluate**
11.	The starting torque of a dc series motor more than that of a dc shunt motor ofsame power rating. Justify	**5**	**Evaluate**
12.	Analyze on how can the direction of rotation of a DC shunt motor be reversed?	**4**	**Analyze**
13.	How can an universal motor be reversed?	**1**	**Remember**
14.	How hysteresis and eddy current losses are minimized?	**1**	**Remember**
15.	State any two application of Universal motor.	**1**	**Remember**
16.	What is the significance of back E.M.F. in a DC Motor?	**1**	**Remember**
17.	Write the speed equation and List the various methods of speed in DC seriesmotor.	**1**	**Remember**
18.	Give the necessity of a starter for a dc motor.	**2**	**Understand**
19.	Compare field and armature control methods.	**3**	**Apply**
20.	Point out the applications of DC series and shunt motors.	**4**	**Analyze**
	PART-B		
1.	**(i)** Draw and explain the construction and principle of operation of a DC generator**.(10)**	**5**	**Evaluate**
	(ii) Explain the armature reaction in a DC generator on no load and on load conditions. Also briefly explain the methods to overcome the adverse effects ofthe armature reaction**.(6)**	**2**	**Understand**
2	**(i)**Draw and describe the different types of D.C. generators with its winding diagram. **(10)**	**1**	**Remember**

	(ii) The armature of a 4-pole wave wound D.C. shunt generator has 144 slots and3 conductors per slot. If the armature in rotated with a speed of 1200 rpm in a field of 0.025 weber per pole, Estimate the emf generated.(**6)**	**2**	**Understand**
3.	**(i)** Discuss in detail about armature reaction**.(4)**	**2**	**Understand**
	(ii) Derive the emf equation of DC generator**.(8)**	**6**	**Create**
	(iii) Sketch the characteristics of a DC shunt generator**.(4)**	**3**	**Apply**
4.	**(i)** Draw and explain the no-load and load characteristics of DC shunt, seriesand compound generators**.(10)**	**4**	**Analyze**
	(ii) A 25 kW, 250 V, DC shunt generator has armature and field resistance of 0.06Ω and 100Ω respectively. Determine the total armature power developed when working 1) as a generator delivering 25 kW output and 2) as a motor taking 25 kW input. **(6)**	**5**	**Evaluate**
5.	**(i)** Describe with neat sketch the construction of DC machines**.(8)**	**1**	**Remember**
	(ii) A 250 kW, 500 V, long shunt compound generator develops 480 V on no- load when running at 1000 rpm. The speed of the machine falls to 975 rpm on full load and the terminal voltage rises to 500 V. If the increase in flux from no- load to full load is 15%, calculate the value of the armature resistance. The series and shunt field resistances are 0.02 Ω and 100 Ω respectively. Assume a voltage drop of 1 V per brush. **(8)**	**3**	**Apply**
6.	A shunt generator delivers 50 kW at 250 V and 400 r.p.m. The armature andfield resistances are 0.2 and 50 ohms respectively.	**1**	**Remember**
7.	**(i)** Explain with a neat sketch the principle of operation of a dc motor. **(8)**	**4**	**Analyze**
	(ii) A 10 kW, 220 V, DC 6 pole shunt motor runs at 1000 rpm. Delivering full load. The armature has 534 lab connected conductors. Full load copper loss is 0.64 kW. The total brush drop is 1 volt. Determine the flux per pole neglectingshunt current. **(8)**	**5**	**Evaluate**
8.	**(i)** With neat schematic, explain the following methods for speed control of DC shunt motor **(1)** Armature Control Method **(5)** **(2)** Field Control Method.**(5)**	**4**	**Analyze**
	(ii) A 4 pole, 240 V wave connected shunt motor gives 1119 kW when running at 1000 RPM and drawing armature and field currents of 50 A and 1.0 A respectively. It has 540 conductors; its resistance is 0.1 ohm. Find (1) total torque (2) useful torque (3) useful flux per pole (4) rotational losses and (5) efficiency. Assuming a drop of 1 volt per brush.**(6)**	**3**	**Apply**
9.	**(i)** Using step by step approach, develop a mathematical expression for torque developed in DC machine**.(8)**	**6**	**Create**
	(ii) Discuss in detail about the N-Ia, T-Ia and N-T characteristics for a DC series motor, DC shunt motor and DC compound motor**.(8)**	**2**	**Understand**
10.	**(i)** Draw a neat diagram showing the salient parts of a DC motor. Explain the function of each in detail**.(10)**	**4**	**Analyze**

	(ii) A 400 V dc shunt motor runs at 1000 rpm taking an armature current of 65 A. Its armature resistance is 0.35 Ω. Calculate the speed required to develop braking torque of 280 Nm when the machine is operated with regenerative braking. **(6)**	**3**	**Apply**
11.	**(i)** With a neat sketch explain the operation of 4-point starter. What are the advantages of this starter over 3-point starter? **(10)**	**4**	**Analyze**
	(ii) An 8-pole D.C shunt generator with 778 waveconnected armature conductors and running at 500 r.p.m. supplies a load of 12.5Ω resistance at terminal voltage of 250 V. The armature resistance is 0.24Ω and the field resistance is 250Ω. Find the armature current, the induced e.m.f. and the flux per pole. **(6)**	**1**	**Remember**
12.	**(i)** A 250 V dc shunt motor has an armature resistance of 0.5 Ω and a field resistance of 250 Ω. When driving at 600 rpm, a load torque of which is constant, the armature current is 20 A. If it is desired to raise the speed from 600rpm to 800 rpm, find the resistance that must be inserted in the shunt field circuit, assuming magnetization curve to be a straight line**. (8)**	**1**	**Remember**
	(ii) Explain with neat diagram, the working of a 3-point starter**.(8)**	**2**	**Understand**
13.	**(i)** With the help of a neat sketch, compare the mechanical characteristics of different dc motors.**(8)**	**4**	**Analyze**
	(ii) Explain the speed control of a DC series motor by **(1)**Field diverters method **(4)** **(2)**Variable resistance in series with the motor. **(4)**	**2**	**Understand**
14.	Explain the construction, working principle, characteristics and applications of Universal motor with relevant diagrams.**(16)**	**1**	**Remember**

UNIT III AC ROTATING MACHINES			
Principle of operation of three-phase induction motors – Construction –Types – Equivalent circuit, Speed Control – Single phase Induction motors -Construction– Types–starting methods. Alternator: Working principle–Equation of induced EMF – Voltage regulation, Synchronous motors- working principle-starting methods – Torque equation			
PART – A			
Q. No	**Questions**	**BTL Level**	**Competence**
1.	Give the advantages and disadvantages of three phase induction motor.	**2**	**Understand**
2.	Define the term slip of an 3-phase induction motor.	**1**	**Remember**
3.	Draw the slip-torque characteristics of a three phase induction motor	**3**	**Apply**
4.	State condition at which starting torque developed in a 3 phase induction motor is maximum	**1**	**Remember**
5.	Name the test conducted for obtaining the equivalent circuit parameters of 3phase induction motor	**1**	**Remember**
6.	List the methods available to control the speed and various starters used for starting a of an induction motor.	**1**	**Remember**
7.	Estimate the synchronous speed of an induction motor running at 2900 r.p.m. with 50 Hz supply?	**2**	**Understand**
8.	Why an induction motor will never run at its synchronous speed?	**1**	**Remember**
9.	Why a single phase induction motor is not self starting?	**1**	**Remember**
10.	Compare Brushless DC motor and Stepper motor.	**4**	**Analyze**
11.	What are the principal advantages of rotating field type construction in alternators?	**2**	**Understand**
12.	Classify the different types of alternators and single Phase induction motor.	**3**	**Apply**
13.	Write the essential elements for generating EMF in alternators.	**6**	**Create**
14.	What is hunting in a synchronous machine? Explain	**3**	**Apply**
15.	Write the purpose of damper winding.	**6**	**Create**
16.	What is synchronous condenser? Explain.	**5**	**Evaluate**
17.	Give the various torques associated with synchronous motors.	**2**	**Understand**
18.	Why a synchronous motor is not a self starting machine? Analyze	**4**	**Analyze**

19.	Alternators rated in kVA and not in kW. Justify	**5**	**Evaluate**
20.	Analyze the different methods used to start a synchronous motor.	**4**	**Analyze**
	PART-B		
1.	**(i)** Draw and explain the constructional details and operating principles of an alternator. **(8)**	**4**	**Analyze**
	(ii) Derive and show the emf equation of a 3ϕ alternator**.(8)**	**3**	**Apply**
2.	**(i)** Draw and explain the principle of operation of a synchronous motor. **(11)**	**4**	**Analyze**
	(ii) Explain the advantages of stationary armature and rotating field in an alternator**.(5)**	**3**	**Apply**
3.	**(i)** Show that the starting torque of a synchronous motor is zero**.(11)**	**3**	**Apply**
	(ii) Discuss in detail the phenomenon of 'hunting' in a synchronous machine. How is it remedied?**(5)**	**2**	**Understand**
4.	**(i)** Derive an expression for the power developed in an synchronous motor**.(8)**	**6**	**Create**
	(ii) Discuss 'V' and inverted 'V' curve of a synchronous motor**.(8)**	**2**	**Understand**
5.	Draw and explain the construction and principle of operation of three phase slip ring induction motor. How is the construction different in squirrel cage induction motor? **(16)**	**3**	**Apply**
6.	**(i)** Explain and Derive the relationship between **(a)** Full load torque and maximum torque **(4)** **(b)** Starting torque and maximum torque. **(4)**	**3**	**Apply**
	(ii) Derive the equation for torque under running conditions in a 3-phase induction motor**.(8)**	**6**	**Create**
7.	**(i)** Draw and Discuss the slip-torque characteristics of 3-phase induction motor**.(8)**	**2**	**Understand**
	(ii) Explain the working of autotransformer starter of a 3 phase induction motor with a neat diagram**.(8)**	**3**	**Apply**
8.	**(i)** Explain the star-delta method of starting of 3ϕ induction motor**.(8)**	**3**	**Apply**
	(ii) Discuss briefly different methods of stator side control of speed of a 3ϕ induction motor**.(8)**	**2**	**Understand**
9.	**(i)**Compare squirrel cage induction motor and slipring induction motor.**(5)**	**4**	**Analyze**
	(ii) Derive the condition for maximum torque.**(6)**	**6**	**Create**
	(iii) Correlate the operation of a transformer andinduction motor. **(5)**	**4**	**Analyze**
10.	Briefly describe the speed control of three phase induction motors by **(i)** Frequency **(8)** **(ii)** Number of poles. **(8)**	**1**	**Remember**

11.	Describe the construction, working principle and applications of single phase induction motor with neat diagrams**.(16)**	**1**	**Remember**	
12.	With a neat diagram describe the working principle of Brushless DC motor. **(16)**	**1**	**Remember**	
13.	Describe the construction and principle of working of Stepper motor with neat diagrams and mention its applications**.(16)**	**1**	**Remember**	
14.	With neat sketches, using the double field revolving field theory, explain why a single phase induction motor is not self-starting. **(16)**	**5**	**Evaluate**	
UNIT VI MEASUREMENT AND INSTRUMENTATION				
Functional elements of an instrument , Standards and calibration, Operating Principle , types –Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT,DSO- Block diagram- Data acquisition				
PART – A				
Q. No	**Questions**	**BTL Level**	**Competence**	
1.	Define 'error' in measurement.	**2**	**Understand**	
2.	What is a transducer?	**1**	**Remember**	
3.	What is piezoelectric effect?	**3**	**Apply**	
4.	What are the basic elements of a generalised measurement system?	**1**	**Remember**	
5.	List any four static characteristics of a measuring system.	**1**	**Remember**	
6.	Define the term 'accuracy'.	**1**	**Remember**	
7.	Define the term 'precision'.	**2**	**Understand**	
8.	Differentiate zero drift and span drift.	**1**	**Remember**	
9.	What is measurement and how it is classified?	**1**	**Remember**	
10.	Mention the basic requirements of measuring instruments.	**4**	**Analyze**	
11.	What is meant by dynamic characteristics of instruments?	**2**	**Understand**	
12.	Distinguish between active and passive transducer.	**3**	**Apply**	
13.	List the factors to be considered for selecting a transducer.	**6**	**Create**	
14.	Mention the uses of capacitive transducer.	**3**	**Apply**	
15.	Define 'gauge factor' of a strain gauge.	**6**	**Create**	
16.	What is drift?	**5**	**Evaluate**	
17.	What is a primary sensing element?	**2**	**Understand**	
18.	Distinguish between reproducibility and repeatability.	**4**	**Analyze**	
19.	Define 'static error'. How are static errors classified?	**5**	**Evaluate**	

20.	Compare analog and digital instruments.	**4**	**Analyze**
	PART – B		
1.	(i). List and define the Static characteristics of an instrument.**(8)**	**1**	**Remember**
	(ii). Explain the static characteristics of an instrument with an example.**(8)**	**3**	**Apply**
2.	(i). List and define various types of errors associated in measurement.**(8)**	**1**	**Remember**
	(ii). How these errors can be minimized.**(8)**	**3**	**Apply**
3.	(i). Explain working principle of strain gauge with neat diagram.**(8)**	**1**	**Remember**
	(ii). Derive the expression for the strain gauge.**(8)**	**6**	**Create**
4.	(i). Illustrate the working Principle of piezoelectric transducers with neat sketch.**(8)**	**5**	**Evaluate**
	(ii). Derive the expression foe the piezoelectric transducers.**(8)**	**5**	**Evaluate**
5.	(i). Explain the working principle of LVDT with neat diagram.**(8)**	**1**	**Remember**
	(ii). Explain the operation of LVDT with an application.**(8)**	**3**	**Apply**
6.	Describe the different criteria for selection of transducer for a particular application and classification.**(16)**	**4**	**Create**
7.	Explain the construction and working of DMM with all its self diagnostic features.**(16)**	**2**	**Understand**
8.	With a neat Block diagram, briefly explain about the general purpose oscilloscope.**(16)**	**2**	**Understand**
9.	List and define the dynamic characteristics of transducers with detail diagram.**(16)**	**2**	**Understand**
10.	(i). List the types of capacitive transducers with diagram.**(8)**	**1**	**Remember**
	(ii). Derive the design procedure of a capacitive transducer.**(8)**	**6**	**Create**
11.	Compare the advantage and disadvantages of thermoelectric over electrical transducers.**(16)**	**3**	**Apply**
12.	Sketch and explain the Photoelectric transducer principle with an application.**(16)**	**1**	**Remember**
13.	Differentiate the advantage and disadvantage of mechanical and electrical and electronic instruments with five features.**(16)**	**4**	**Analyze**
14.	(i). Draw and explain the principal of Hall effect.**(8)**	**1**	**Remember**
	(ii). Derive the Hall coefficient with an application.**(8)**	**6**	**Create**

UNIT V BASICS OF POWER SYSTEMS

Power system structure -Generation , Transmission and distribution , Various voltage levels, Earthing – methods of earthing, protective devices- switch fuse unit- Miniature circuit breaker moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

PART – A

Q. No	Questions	BTL Level	Competence
1.	What is the voltage level of a sub-transmission system?	**2**	**Understand**
2.	What is sub transmission network?	**1**	**Remember**
3.	What are the principle divisions of an electric power system?	**3**	**Apply**
4.	List out the types of power generation system?	**1**	**Remember**
5.	What is the generating voltage level in India?	**1**	**Remember**
6.	What is mean by distribution system?	**1**	**Remember**
7.	What are the parts of the distribution system?	**2**	**Understand**
8.	What are the different types of distribution?	**1**	**Remember**
9.	What is meant by earthing?	**1**	**Remember**
10.	What are the merits of earthing?	**4**	**Analyze**
11.	List out different earthing methods?	**2**	**Understand**
12.	Mention characteristics of fuse element	**3**	**Apply**
13.	Define fusing factor?	**6**	**Create**
14.	Define breaking capacity of fuse?	**3**	**Apply**
15.	How fuses are classified?	**6**	**Create**
16.	What are the classification of MCB?	**5**	**Evaluate**
17.	Mention the different types of ELCB?	**2**	**Understand**
18.	What is first aid?	**4**	**Analyze**
19.	Explain the first aid treatment for heat stroke	**5**	**Evaluate**
20.	List out various artificial respiration methods	**2**	**Understand**

	PART – B		
1.	**Explain with a simple diagram ,the basic structure of electric power system to deliver electricity to the consumer place. May 2018**	**1**	**Remember**
2.	**Draw and explain structure of electric power system?**	**1**	**Remember**
3.	**What are the different types of generating station?**	**1**	**Remember**
4.	**Explain in details about distribution system.**	**5**	**Evaluate**
5.	**What are the classification of distribution system?**	**1**	**Remember**
6.	**Explain in detail about AC distribution system?**	**4**	**Create**
7.	**Explain in detail about DC distribution system?**	**2**	**Understand**
8.	**(i) What is meant by earthing?**	**2**	**Understand**
	(ii) explain n detail about different types of earthing?	**2**	**Understand**
9.	**Explain the construction , operation and types of miniature circuit breaker (MCB) with neat sketch**	**1**	**Remember**
10.	**Explain the constructional details, operation and types of earth leakage circuit breaker(ELCB) with neat sketch**	**3**	**Apply**