

# **SRM VALLIAMMAI ENGINEERING COLLEGE**

**(An Autonomous Institution)**

SRM Nagar, Kattankulathur – 603 203

**DEPARTMENT OF  
ELECTRONICS AND COMMUNICATION ENGINEERING**

**QUESTION BANK**



**I SEMESTER**

**GE3132– BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING**

**Regulation – 2023**

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Department of Electronics and Communication Engineering



**SUBJECT : GE3132–BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING.**

**SEM / YEAR: I / I**

## UNIT I - AC CIRCUITS AND POWER SYSTEMS

### SYLLABUS

Three phase power supply – Star connection – Delta connection – Balanced and Unbalanced Loads- Power equation – Star Delta Conversion – Three Phase Power Measurement - Transmission & Distribution of electrical energy – Over head Vs Underground system – Protection of power system – types of tariff – power factor improvement

### PART –A

| Q.No. | Questions                                                                                                                                             | CO  | BT Level | Competence |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|------------|
| 1.    | State the advantages of 3 phase system over 1 phase system.                                                                                           | CO1 | BTL 2    | Understand |
| 2.    | Draw the phasor diagram of line currents and line voltages of a balanced delta connected load.                                                        | CO1 | BTL 1    | Remember   |
| 3.    | Define line voltage and line current.                                                                                                                 | CO1 | BTL 1    | Remember   |
| 4.    | Compare star and delta connected system.                                                                                                              | CO1 | BTL 2    | Understand |
| 5.    | Distinguish between balanced and unbalanced system.                                                                                                   | CO1 | BTL 2    | Understand |
| 6.    | Find the voltage across Y and B in A 3 $\phi$ balanced delta system with voltage across R and Y is 400 $\angle 0^\circ$ V. Assume RYB phase sequence. | CO1 | BTL 2    | Understand |
| 7.    | A 3 $\phi$ , 400 V supply is given to a balanced star connected load of impedance $8+j6$ ohms in each branch. Formulate the line current.             | CO1 | BTL 2    | Understand |
| 8.    | Write the expression for determining reactive and apparent power in a three-phase circuit.                                                            | CO1 | BTL 1    | Remember   |
| 9.    | List out the methods of power measurement in three phase balanced circuits.                                                                           | CO1 | BTL 1    | Remember   |
| 10.   | Define the Symmetrical System.                                                                                                                        | CO1 | BTL 2    | Understand |
| 11.   | List out the advantages of the underground system.                                                                                                    | CO1 | BTL 2    | Understand |
| 12.   | Mention the requirements of protection.                                                                                                               | CO1 | BTL 2    | Understand |
| 13.   | What are the requirements of a circuit breaker?                                                                                                       | CO1 | BTL 2    | Understand |
| 14.   | Differentiate between fuse and protective relay.                                                                                                      | CO1 | BTL 2    | Understand |
| 15.   | What is the importance of arc resistance?                                                                                                             | CO1 | BTL 2    | Understand |
| 16.   | Show the difference between recovery voltage and restriking voltage.                                                                                  | CO1 | BTL 2    | Understand |
| 17.   | Define the term maximum demand.                                                                                                                       | CO1 | BTL 1    | Remember   |
| 18.   | State the different types of power tariff.                                                                                                            | CO1 | BTL 1    | Remember   |
| 19.   | List the objectives of tariff and factors affecting it.                                                                                               | CO1 | BTL 1    | Remember   |
| 20.   | What is meant by relay operating time?                                                                                                                | CO1 | BTL 1    | Remember   |
| 21.   | What is meant by two-part tariff?                                                                                                                     | CO1 | BTL 2    | Understand |

|                 |                                                                                                                                                                                                                                                                                 |     |       |            |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|------------|
| 22.             | Define Power factor                                                                                                                                                                                                                                                             | CO1 | BTL 1 | Remember   |
| 23.             | Write the effect of the power factor in energy consumption billing.                                                                                                                                                                                                             | CO1 | BTL 2 | Understand |
| 24.             | Find the power factor if $V(t) = V_m \sin \omega t$ and $I(t) = I_m \sin(\omega t + 45^\circ)$ .                                                                                                                                                                                | CO1 | BTL 1 | Remember   |
| <b>PART – B</b> |                                                                                                                                                                                                                                                                                 |     |       |            |
| 1.              | (i) Explain the generation of a 3-phase supply with a phasor diagram. (10)<br>(ii) Draw and explain the three-phase connections. (6)                                                                                                                                            | CO1 | BTL 4 | Analyze    |
| 2.              | Explain the analysis of the following three-phase balanced loads. i) Star connected. ii) Delta connected. (16).                                                                                                                                                                 | CO1 | BTL 4 | Analyze    |
| 3.              | Explain the analysis of the following three-phase unbalanced loads. i) Star connected. ii) Delta connected. (16)                                                                                                                                                                | CO1 | BTL 4 | Analyze    |
| 4.              | Derive the relationship between the line voltage and phase voltage in star connection. (16)                                                                                                                                                                                     | CO1 | BTL 3 | Apply      |
| 5.              | Derive the relationship between the line current and phase current in Delta connection. (16)                                                                                                                                                                                    | CO1 | BTL 3 | Apply      |
| 6.              | A delta connected balanced load is supplied from 3 phase 400V supply. The line current is 20 A, total power taken by load is 10,000 W. Examine the impedance in each branch, the line current, power factor and total power consumption. (16)                                   | CO1 | BTL 4 | Analyze    |
| 7.              | Explain $3\phi$ power measurement by two-wattmeter method for star delta connected load and determine the power equation. (16)                                                                                                                                                  | CO1 | BTL 4 | Analyze    |
| 8.              | Explain $3\phi$ power measurement by one and three wattmeter methods for star delta connected load and determine the power equation. (16)                                                                                                                                       | CO1 | BTL 4 | Analyze    |
| 9.              | Explain about the conversion of star and delta conversion and write its expression for each conversion. (16)                                                                                                                                                                    | CO1 | BTL 4 | Analyze    |
| 10.             | Describe the single line diagram of an AC power system and discuss transmission and distribution of electrical energy in detail. (16)                                                                                                                                           | CO1 | BTL 3 | Apply      |
| 11.             | (i) A symmetrical three phase 400 V system supplies a balance delta connected load. The current in each branch circuit is 20 A and phase angle $40^\circ$ (lag). Calculate the line current and total power. (8)                                                                | CO1 | BTL 4 | Analyze    |
|                 | (ii) A three - phase delta connected load has $Z_{ab} = (100 + j0)$ ohms, $Z_{bc} = (-j100)$ ohms and $Z_{ca} = (70.7 + j0.7)$ ohms is connected to a balanced $3\phi$ , 400 V supply. Determine the line currents $I_a$ , $I_b$ and $I_c$ . Assume the phase sequence abc. (8) | CO1 | BTL 4 | Analyze    |
| 12.             | Write the advantages of high transmission voltage for the transmission of electrical power. (16)                                                                                                                                                                                | CO1 | BTL 3 | Apply      |
| 13.             | Describe a typical power system protection scheme with a suitable illustration. (16)                                                                                                                                                                                            | CO1 | BTL 3 | Apply      |
| 14.             | Compare overhead and underground transmission lines. (16)                                                                                                                                                                                                                       | CO1 | BTL 3 | Apply      |
| 15.             | (i) Discuss in detail about Transmission and Distribution of electrical energy with diagram. (10)                                                                                                                                                                               | CO1 | BTL 3 | Apply      |
|                 | (ii) Compare AC and DC transmissions. (6)                                                                                                                                                                                                                                       | CO1 | BTL 4 | Analyze    |

|     |                                                                             |     |       |       |
|-----|-----------------------------------------------------------------------------|-----|-------|-------|
| 16. | Examine in detail the importance and improvements of the power factor. (16) | CO1 | BTL 3 | Apply |
| 17. | Discuss tariffs and their types with its applications. (16)                 | CO1 | BTL 3 | Apply |

## UNIT II - TRANSFORMER

### SYLLABUS

Introduction - Ideal Transformer – Accounting for Finite Permeability and Core Loss – Circuit Model of Transformer – Per Unit System – Determination of Parameters of Circuit Model of Transformer – Voltage Regulation – Name Plate Rating – Efficiency – Three Phase Transformers - Auto Transformers

### PART – A

| Q.No. | Questions                                                                            | CO  | BT Level | Competence |
|-------|--------------------------------------------------------------------------------------|-----|----------|------------|
| 1.    | Define ideal transformer.                                                            | CO2 | BTL 1    | Remember   |
| 2.    | Contrast between core type and shell type transformer.                               | CO2 | BTL 2    | Understand |
| 3.    | Why transformer core is laminated?                                                   | CO2 | BTL 2    | Understand |
| 4.    | Name the material used for transformer core.                                         | CO2 | BTL 2    | Understand |
| 5.    | What is the function of oil in transformer?                                          | CO2 | BTL 1    | Remember   |
| 6.    | Why transformer rating is in kVA?                                                    | CO2 | BTL 2    | Understand |
| 7.    | Name the various losses in a transformer.                                            | CO2 | BTL 2    | Understand |
| 8.    | Write the emf equation of transformer.                                               | CO2 | BTL 2    | Understand |
| 9.    | What is the condition for maximum efficiency in transformer?                         | CO2 | BTL 2    | Understand |
| 10.   | Why efficiency of a transformer is high as compared to other electrical machines?    | CO2 | BTL 2    | Understand |
| 11.   | Define eddy current loss.                                                            | CO2 | BTL 2    | Understand |
| 12.   | What is meant by copper loss?                                                        | CO2 | BTL 1    | Remember   |
| 13.   | Define core loss.                                                                    | CO2 | BTL 1    | Remember   |
| 14.   | Draw the equivalent circuit of a transformer at no load.                             | CO2 | BTL 2    | Understand |
| 15.   | Draw the phasor diagram of an ideal transformer.                                     | CO2 | BTL 1    | Remember   |
| 16.   | Draw the no load phasor diagram of a transformer.                                    | CO2 | BTL 1    | Remember   |
| 17.   | Define magnetizing current.                                                          | CO2 | BTL 1    | Remember   |
| 18.   | Why the core loss is neglected in open circuit test?                                 | CO2 | BTL 2    | Understand |
| 19.   | Define current ratio.                                                                | CO2 | BTL 2    | Understand |
| 20.   | Why the main flux remains physically constant from no load to full load?             | CO2 | BTL 2    | Understand |
| 21.   | Recall the expression for secondary resistance as referred to primary.               | CO2 | BTL 1    | Remember   |
| 22.   | Why the short circuit test is performed on the high voltage side of the transformer? | CO2 | BTL 2    | Understand |
| 23.   | Define transformation ratio.                                                         | CO2 | BTL 2    | Understand |
| 24.   | Define voltage regulation of transformer.                                            | CO2 | BTL 1    | Remember   |

| PART – B |                                                                                                                                                                                                                                                                                                                                     |     |       |         |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|---------|
| 1.       | Draw an ideal single-phase transformer and explain the principle of operation, the concept of step up and step-down transformer. (16)                                                                                                                                                                                               | CO2 | BTL 3 | Apply   |
| 2.       | Describe the constructional details of different types of 1 $\phi$ transformers with neat diagrams. (16)                                                                                                                                                                                                                            | CO2 | BTL 3 | Apply   |
| 3.       | Draw a general schematic of a single-phase transformer. Describe its working principle and deduce the expression for emf in secondary winding. (16)                                                                                                                                                                                 | CO2 | BTL 3 | Apply   |
| 4.       | Derive the EMF equation of a 1 $\phi$ transformer with respect to its primary and secondary windings. (16)                                                                                                                                                                                                                          | CO2 | BTL 3 | Apply   |
| 5.       | Derive the condition for maximum efficiency of a transformer. (16)                                                                                                                                                                                                                                                                  | CO2 | BTL 3 | Apply   |
| 6.       | The primary and secondary of a 25kVA transformer has 500 and 400 turns respectively. If the primary is connected to 3000 V, 50 Hz mains. Calculate primary and secondary current at full load, the secondary emf and the maximum flux in the core (16)                                                                              | CO2 | BTL 4 | Analyze |
| 7.       | Discuss about the Transformer losses and efficiency. (16)                                                                                                                                                                                                                                                                           | CO2 | BTL 3 | Apply   |
| 8.       | Examine the equivalent circuit of a single phase transformer referred to primary and secondary. (16)                                                                                                                                                                                                                                | CO2 | BTL 3 | Apply   |
| 9.       | Draw and explain the phasor diagram for a 1 $\phi$ transformer on no load. (16)                                                                                                                                                                                                                                                     | CO2 | BTL 3 | Apply   |
| 10.      | The following data were obtained on a 20 kVA, 50 Hz, 2000/200 V distribution transformer:<br>(i) OC test with HV open-circuited: 200 V, 4 A and 120 W (ii) SC test with LV short-circuited : 60 V, 10 A and 300 W<br>Estimate all the parameters of the equivalent circuit referred to the HV and LV sides of the transformer. (16) | CO2 | BTL 4 | Analyze |
| 11.      | (i) A 40 kVA, 3300/240V, 50Hz, 1 $\phi$ transformer has 660 turns on the primary. Determine<br>a) The number of turns on the secondary<br>b) The Maximum value of flux in the core<br>c) The approximate value of primary and secondary full load current. (10)                                                                     | CO2 | BTL 4 | Analyze |
|          | (ii) Describe the term voltage regulation of a transformer and derive the expression for voltage regulation. (6)                                                                                                                                                                                                                    | CO2 | BTL 3 | Apply   |
| 12.      | Discover the equivalent circuit parameters and thereby find the regulation and efficiency of the transformer by performing OC and SC test. (16)                                                                                                                                                                                     | CO2 | BTL 3 | Apply   |
| 13.      | Draw and explain the phasor diagram for a 1 $\phi$ transformer supplying a leading power factor load. (16)                                                                                                                                                                                                                          | CO2 | BTL 4 | Analyze |
| 14.      | Draw and explain the phasor diagram for a 1 $\phi$ transformer supplying a lagging power factor load. (16)                                                                                                                                                                                                                          | CO2 | BTL 4 | Analyze |
| 15.      | (i) Discuss in detail about the per unit system. (10)                                                                                                                                                                                                                                                                               | CO2 | BTL 3 | Apply   |

|     |      |                                                                                                                   |     |       |       |
|-----|------|-------------------------------------------------------------------------------------------------------------------|-----|-------|-------|
|     | (ii) | Write a short note on name plate rating. (6)                                                                      | CO2 | BTL 3 | Apply |
| 16. |      | Categorize the various three phase transformer connection and parallel operation of three phase transformer. (16) | CO2 | BTL 3 | Apply |
| 17. |      | Discuss about the working of Auto transformer. (16)                                                               | CO2 | BTL 3 | Apply |

### UNIT III - DC MACHINES

#### SYLLABUS

Introduction – Constructional Features– Motoring and generation principle - Emf and Torque equation – Circuit Model – Methods of Excitation and magnetisation characteristics – Starting and Speed Control – Universal Motor

#### PART – A

| Q. No. | Questions                                                                | CO  | BT Level | Competence |
|--------|--------------------------------------------------------------------------|-----|----------|------------|
| 1.     | State the Faraday's law of electromagnetic induction.                    | CO3 | BTL 1    | Remember   |
| 2.     | State Flemings left hand rule.                                           | CO3 | BTL 1    | Remember   |
| 3.     | Name the different types of DC generators.                               | CO3 | BTL 1    | Remember   |
| 4.     | What is meant by excitation?                                             | CO3 | BTL 2    | Understand |
| 5.     | Name the types of excitation.                                            | CO3 | BTL 2    | Understand |
| 6.     | What is meant by self excitation?                                        | CO3 | BTL 2    | Understand |
| 7.     | What are the necessary conditions for the generators to be self-excited? | CO3 | BTL 2    | Understand |
| 8.     | Name the types of armature winding.                                      | CO3 | BTL 1    | Remember   |
| 9.     | Mention the purpose of field winding of a DC Machines.                   | CO3 | BTL 1    | Remember   |
| 10.    | What is meant by commutator?                                             | CO3 | BTL 1    | Remember   |
| 11.    | Specify the function of the commutator in a DC machine.                  | CO3 | BTL 2    | Understand |
| 12.    | State the function of brushes in a DC machine.                           | CO3 | BTL 1    | Remember   |
| 13.    | Write the equation for emf induced in a DC machine.                      | CO3 | BTL 2    | Understand |
| 14.    | How many numbers of parallel paths are available in Lap & wave windings? | CO3 | BTL 1    | Remember   |
| 15.    | Write the torque equation of DC motor.                                   | CO3 | BTL 2    | Understand |
| 16.    | What is meant by back emf in DC motor?                                   | CO3 | BTL 2    | Understand |
| 17.    | Draw the load characteristics of DC shunt generator.                     | CO3 | BTL 2    | Understand |
| 18.    | State the losses in a DC machine.                                        | CO3 | BTL 1    | Remember   |
| 19.    | Relate, why DC series motor should always be started with load.          | CO3 | BTL 2    | Understand |
| 20.    | State two applications of DC shunt motor and series motor.               | CO3 | BTL 1    | Remember   |
| 21.    | Draw the speed torque characteristics of DC shunt motor                  | CO3 | BTL 2    | Understand |
| 22.    | List the starters used for starting in DC motors.                        | CO3 | BTL 1    | Remember   |
| 23.    | Mention the different methods of speed control of DC series motor        | CO3 | BTL 2    | Understand |
| 24.    | Justify the name Universal motor.                                        | CO3 | BTL 2    | Understand |

#### PART – B

|    |                                                                 |     |       |         |
|----|-----------------------------------------------------------------|-----|-------|---------|
| 1. | Describe the construction of DC machines with neat sketch. (16) | CO3 | BTL 3 | Apply   |
| 2. | Explain the working principle DC generator. (16)                | CO3 | BTL 4 | Analyze |
| 3. | Explain the working principle DC motor. (16)                    | CO3 | BTL 4 | Analyze |
| 4. | Derive the EMF equation of the DC generator. (16).              | CO3 | BTL 3 | Apply   |
| 5. | Derive Torque equation of DC machines. (16)                     | CO3 | BTL 3 | Apply   |

|     |                                                                                                                                                                                                                                                                                                                                                                          |     |       |         |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|---------|
| 6.  | Explain the DC machine circuit model with neat diagram. (16)                                                                                                                                                                                                                                                                                                             | CO3 | BTL 4 | Analyze |
| 7.  | Explain in detail about the methods of excitation of DC machines. (16)                                                                                                                                                                                                                                                                                                   | CO3 | BTL 4 | Analyze |
| 8.  | (i) Draw the different types of DC generator. (8)<br>(ii) Draw the different types of DC motor. (8)                                                                                                                                                                                                                                                                      | CO3 | BTL 3 | Apply   |
| 9.  | Explain the magnetization characteristics with neat diagram. (16)                                                                                                                                                                                                                                                                                                        | CO3 | BTL 4 | Analyze |
| 10. | A DC motor takes an armature current of 110 A at 480 V. The armature current resistance is 0.2. The machine has 6 poles and the armature is lap connected with 864 conductors. The flux per pole is 0.05 Wb. Calculate (i) The speed (ii) the gross torque developed by the armature. (16)                                                                               | CO3 | BTL 4 | Analyze |
| 11. | The armature winding of a 200 V, 4 pole, and series motor is lap connected. There are 280 slots and each slot has 4 conductors. The current 45A and the flux per pole is 18 mWb. The field resistance is 0.3, armature resistance is 0.5 and the iron and friction losses total 800 W. The pulley diameter is 0.41 m. Find the pull in Newton at the rim of pulley. (16) | CO3 | BTL 4 | Analyze |
| 12. | A 400 V DC shunt motor takes 5 A at no load. Its armature resistance (including brushing) is 0.5 and shunt field resistance is 200. Estimate the efficiency when the motor takes 50 A on full load. (16)                                                                                                                                                                 | CO3 | BTL 4 | Analyze |
| 13. | A 220 V shunt motor has an armature resistance of 0.2 $\Omega$ and field resistance of 110 $\Omega$ . The motor draws 5 A at 1500 rpm at no load. Calculate the speed and shaft torque if the motor draws 52 A at rated voltage. (16)                                                                                                                                    | CO3 | BTL 4 | Analyze |
| 14. | Explain with a neat diagram, the working of a 3-point Starter. (16)                                                                                                                                                                                                                                                                                                      | CO3 | BTL 4 | Analyze |
| 15. | Explain the working of a four - point Starters with a neat diagram, (16)                                                                                                                                                                                                                                                                                                 | CO3 | BTL 4 | Analyze |
| 16. | Explain with a neat diagram, the armature control and field control method of speed control of DC shunt motor. (16)                                                                                                                                                                                                                                                      | CO3 | BTL 4 | Analyze |
| 17. | Explain the construction, working principle, characteristics and applications of Universal motor with relevant diagrams. (16)                                                                                                                                                                                                                                            | CO3 | BTL 4 | Analyze |

#### UNIT IV - AC MACHINES

##### SYLLABUS

Principle of operation of three-phase induction motors – Construction –Types –Equivalent circuit, Single phase Induction motors -Construction– Types–starting and speed control methods. Alternator- working principle–Equation of induced EMF – Voltage regulation, Synchronous motors working principle-starting methods – Torque equation – Stepper Motors – Brushless DC Motors

##### PART-A

| Q. No | Questions                                                              | CO  | BT Level | Competence |
|-------|------------------------------------------------------------------------|-----|----------|------------|
| 1.    | Illustrate the effect of armature reaction .                           | CO4 | BTL 2    | Understand |
| 2.    | Illustrate double field revolving theory.                              | CO4 | BTL 2    | Understand |
| 3.    | Contrast between squirrel cage and slip ring Induction motor.          | CO4 | BTL 2    | Understand |
| 4.    | State the advantages and disadvantages of three phase induction motor. | CO4 | BTL 1    | Remember   |
| 5.    | Write the applications of 3 $\phi$ Induction motor.                    | CO4 | BTL 1    | Remember   |
| 6.    | What is the condition for producing maximum torque in                  | CO4 | BTL 1    | Remember   |

|                 |                                                                                                             |     |       |            |
|-----------------|-------------------------------------------------------------------------------------------------------------|-----|-------|------------|
|                 | a 3 $\phi$ Induction motor?                                                                                 |     |       |            |
| 7.              | Define slip.                                                                                                | CO4 | BTL 2 | Understand |
| 8.              | What is slip of 3 $\phi$ induction motor?                                                                   | CO4 | BTL 1 | Remember   |
| 9.              | What are types of speed control induction motors?                                                           | CO4 | BTL 1 | Remember   |
| 10.             | Draw Torque slip characteristics of 3 $\phi$ Induction motor.                                               | CO4 | BTL 2 | Understand |
| 11.             | What are the losses in 3 $\phi$ Induction motor?                                                            | CO4 | BTL 1 | Remember   |
| 12.             | Why single phase induction motor is not self starting?                                                      | CO4 | BTL 2 | Understand |
| 13.             | Draw the basic circuit of capacitor start capacitor run motor.                                              | CO4 | BTL 2 | Understand |
| 14.             | List out the types of alternators.                                                                          | CO4 | BTL 1 | Remember   |
| 15.             | What is meant by Turbo-alternators?                                                                         | CO4 | BTL 1 | Remember   |
| 16.             | Why alternators are rated in kVA rather than in KW?                                                         | CO4 | BTL 2 | Understand |
| 17.             | What is meant by synchronous impedance of alternator?                                                       | CO4 | BTL 1 | Remember   |
| 18.             | What type of rotor is adopted for high speed alternators?                                                   | CO4 | BTL 2 | Understand |
| 19.             | Why are salient pole alternators more suitable for low speed & non salient pole for high-speed operation?   | CO4 | BTL 2 | Understand |
| 20.             | Compare salient & non-salient pole synchronous machines.                                                    | CO4 | BTL 2 | Understand |
| 21.             | Show the relation between the number of poles, frequency and speed of the alternator.                       | CO4 | BTL 1 | Remember   |
| 22.             | Why induction motor are called as asynchronous motors?                                                      | CO4 | BTL 2 | Understand |
| 23.             | List out the applications of stepper motor.                                                                 | CO4 | BTL 2 | Understand |
| 24.             | What are the advantages of brushless DC motor?                                                              | CO4 | BTL 2 | Understand |
| <b>PART – B</b> |                                                                                                             |     |       |            |
| 1.              | Explain the principle of operation of a 3 $\phi$ induction motor. (16)                                      | CO4 | BTL 4 | Analyze    |
| 2.              | Explain the constructional of a three phase induction motor. (16)                                           | CO4 | BTL 4 | Analyze    |
| 3.              | Derive the torque equation for 3 phase induction motor.(16)                                                 | CO4 | BTL 3 | Apply      |
| 4.              | Develop the equivalent circuit of 3 $\phi$ Induction motor. (16)                                            | CO4 | BTL 3 | Apply      |
| 5.              | Give the classification of single-phase motors. Explain any one type of single-phase induction motors. (16) | CO4 | BTL 3 | Apply      |
| 6.              | Explain with neat sketch of DOL starters for 3 $\phi$ Induction motor.(16)                                  | CO4 | BTL 4 | Analyze    |
| 7.              | Explain with neat sketch of Star-Delta starters for 3 $\phi$ Induction motor.(16)                           | CO4 | BTL 4 | Analyze    |
| 8.              | Explain the speed control of 3 phase Induction motors. (16)                                                 | CO4 | BTL 4 | Analyze    |
| 9.              | Describe the constructional features and working principle of an Alternator with a neat diagram. (16)       | CO4 | BTL 3 | Apply      |
| 10.             | Derive an EMF equation of an alternator. (16)                                                               | CO4 | BTL 3 | Apply      |
| 11.             | Explain the working principle of synchronous motor and starting methods. (16)                               | CO4 | BTL 4 | Analyze    |
| 12.             | Compare salient & non-salient pole synchronous machines.(16)                                                | CO4 | BTL 3 | Apply      |
| 13.             | Explain how to calculate regulation using emf method.                                                       | CO4 | BTL 4 | Analyze    |

|     |                                                                                                                                                                                                                                            |     |       |         |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|---------|
|     | (16)                                                                                                                                                                                                                                       |     |       |         |
| 14. | A six-pole, three-phase synchronous generator driven at 1000 rpm supplies power to an induction motor which runs at a speed of 1440 rpm on full load. Calculate the percentage slip of the motor and the number of poles of the motor (16) | CO4 | BTL 4 | Analyze |
| 15. | Choose the industrial applications of Stepper motor along with the construction and principle. (16)                                                                                                                                        | CO4 | BTL 3 | Apply   |
| 16. | Describe the construction and principle of working of stepper motor with a neat diagram. (16)                                                                                                                                              | CO3 | BTL 3 | Apply   |
| 17. | Elaborate the working principle of Brushless DC motor with a neat diagram. (16)                                                                                                                                                            | CO4 | BTL 3 | Apply   |

## UNIT V - MEASUREMENT AND INSTRUMENTATION

### SYLLABUS

Type of Electrical and electronic instruments – Classification- Types of indicating Instruments – Principles of Electrical Instruments –Multimeters, Oscilloscopes- Static and Dynamic Characteristics of Measurement – Errors in Measurement –Transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical

### PART – A

| Q.No | Questions                                                                                             | CO  | BT Level | Competence |
|------|-------------------------------------------------------------------------------------------------------|-----|----------|------------|
| 1.   | Classify the measuring instruments.                                                                   | CO5 | BTL 1    | Remember   |
| 2.   | What is an absolute instrument? Give examples?                                                        | CO5 | BTL 1    | Remember   |
| 3.   | Why MI instruments can be used on both AC and DC?                                                     | CO5 | BTL 2    | Understand |
| 4.   | Compare static and dynamic characteristics.                                                           | CO5 | BTL 2    | Understand |
| 5.   | What is meant by Standard and list out its types?                                                     | CO5 | BTL 1    | Remember   |
| 6.   | Define Sensitivity and Resolution.                                                                    | CO5 | BTL 2    | Understand |
| 7.   | Define Reproducibility and Repeatability.                                                             | CO5 | BTL 2    | Understand |
| 8.   | Define Accuracy and Precision.                                                                        | CO5 | BTL 2    | Understand |
| 9.   | Define Span and Zero drift.                                                                           | CO5 | BTL 2    | Understand |
| 10.  | Define error.                                                                                         | CO5 | BTL 2    | Understand |
| 11.  | List the types of errors in the measurement system.                                                   | CO5 | BTL 2    | Understand |
| 12.  | Define transducer.                                                                                    | CO5 | BTL 2    | Understand |
| 13.  | Compare active and passive transducer.                                                                | CO5 | BTL 2    | Understand |
| 14.  | Contrast between analog and digital transducer.                                                       | CO5 | BTL 2    | Understand |
| 15.  | Compare primary transducer with secondary transducer ? Give examples for each.                        | CO5 | BTL 2    | Understand |
| 16.  | What is meant by variable resistance type or potentiometer ? How the potentiometer can be classified? | CO5 | BTL 2    | Understand |
| 17.  | Define strain gauge and compare with the term Piezo resistive effect.                                 | CO5 | BTL 2    | Understand |
| 18.  | Why thermistor is said to be Negative Temperature Coefficient of Resistance(NTCR).                    | CO5 | BTL 2    | Understand |
| 19.  | What is meant by RTD ? Write the mathematical expression for RTD?                                     | CO5 | BTL 2    | Understand |
| 20.  | Why RTD is said to be Positive Temperature Coefficient of Resistance(PTCR)?                           | CO5 | BTL 2    | Understand |
| 21.  | Draw the schematic diagram of parallel plate                                                          | CO5 | BTL 2    | Understand |

|               |                                                                                                                                                                                  |     |       |            |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|------------|
|               | capacitor. And also write the mathematical expression for it.                                                                                                                    |     |       |            |
| 22.           | Mention any four applications of capacitance type transducer.                                                                                                                    | CO5 | BTL 2 | Understand |
| 23.           | What is meant by piezo electric effect ? Give any 4-materials used for piezo electric effect.                                                                                    | CO5 | BTL 1 | Remember   |
| 24.           | What is meant by variable inductive transducer ? Mention the different types of variable inductive transducer.                                                                   | CO5 | BTL 2 | Understand |
| <b>PART B</b> |                                                                                                                                                                                  |     |       |            |
| 1.            | Explain the functional elements of generalized instrumentation systems. (16))                                                                                                    | CO5 | BTL 4 | Analyze    |
| 2.            | What are the classifications of indicating instruments and explain any one types? (16)                                                                                           | CO5 | BTL 4 | Analyze    |
| 3.            | Describe the working principle of the Electronic Multimeter. (16)                                                                                                                | CO5 | BTL 3 | Apply      |
| 4.            | Explain in detail the block diagram of the Digital storage oscilloscope (DSO). (16)                                                                                              | CO5 | BTL 4 | Analyze    |
| 5.            | Describe the Static and Dynamic Characteristics of the measurement system. (16)                                                                                                  | CO5 | BTL 3 | Apply      |
| 6.            | Explain in detail about errors in the measurement system and its types. (16)                                                                                                     | CO5 | BTL 4 | Analyze    |
| 7.            | (i) Explain types of error in measurement and instrumentation systems. (8)<br>(ii) Explain units and standards. (8)                                                              | CO5 | BTL 4 | Analyze    |
| 8.            | Explain in detail the classification of transducer. (16)                                                                                                                         | CO5 | BTL 4 | Analyze    |
| 9.            | Explain the working principle of the resistive transducer and give some of its applications. (16)                                                                                | CO5 | BTL 4 | Analyze    |
| 10.           | Describe the working of potentiometer with merits, demerits and applications. (16)                                                                                               | CO5 | BTL 3 | Apply      |
| 11.           | Describe the working of the following sensors<br>i) Strain Gauge. (8)<br>ii) Thermistor. (8)                                                                                     | CO5 | BTL 3 | Apply      |
| 12.           | Explain the different types of strain gauges (16)<br>(i) Wire wound type. (ii) Bonded metal foil.<br>(iii) Thin film type. iv) Semi-conductor type.<br>(v) Rosettes.             | CO5 | BTL 4 | Analyze    |
| 13.           | Explain the working principle of LVDT with a neat diagram. (16)                                                                                                                  | CO5 | BTL 4 | Analyze    |
| 14.           | Explain the following types of capacitive type transducers (i) Parallel plate capacitors (ii) Cylindrical plate capacitors (iii) Capacitor type transducers as microphones. (16) | CO5 | BTL 4 | Analyze    |
| 15.           | Explain in detail about Piezoelectric and Photoelectric transducers. (16)                                                                                                        | CO5 | BTL 4 | Analyze    |
| 16.           | Explain in detail about the Hall effect transducer. (16)                                                                                                                         | CO5 | BTL 4 | Analyze    |
| 17.           | Explain the operation: i) Capacitor microphone. (8)<br>ii) Mechanical transducer. (8)                                                                                            | CO5 | BTL 4 | Analyze    |