



PAPER ID-411539

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Subject Code: KEE402

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**BTECH**  
**(SEM IV) THEORY EXAMINATION 2023-24**  
**ELECTRICAL MACHINES-I**

**TIME: 3 HRS****M.MARKS: 100****Note:** 1. Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

| Q no. | Question                                                                            | Marks | CO |
|-------|-------------------------------------------------------------------------------------|-------|----|
| a.    | Define leakage flux.                                                                | 02    | 1  |
| b.    | Define magnetic reluctance.                                                         | 02    | 1  |
| c.    | How the direction of rotation of the dc shunt motor can be changed?                 | 02    | 2  |
| d.    | List the different types of losses in D.C machine                                   | 02    | 2  |
| e.    | Write the application of stepper motor.                                             | 02    | 3  |
| f.    | What is the need for starter in a DC motor?                                         | 02    | 3  |
| g.    | Define all day efficiency of Transformer?                                           | 02    | 4  |
| h.    | How to minimized hysteresis and eddy current losses in transformer?                 | 02    | 4  |
| i.    | Why transformer is not working on dc supply?                                        | 02    | 5  |
| j.    | What are distinguishing features of delta-star and delta-delta 3-phase connections? | 02    | 5  |

**SECTION B****2. Attempt any three of the following:****3 x 10 = 30**

|    |                                                                                                                                                                                                                                                                                |    |   |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|
| a. | For an electromagnetic system show that mechanical work done is equal to the area enclosed between the two magnetization curve at open and closed position of the armature and the $\psi$ -I locus during instantaneous armature movement.                                     | 10 | 1 |
| b. | 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. | 10 | 2 |
| c. | Write the construction and operation of DC Servo motor and write their application.                                                                                                                                                                                            | 10 | 3 |
| d. | Develop the equivalent circuit of a single phase transformer referred to primary and secondary                                                                                                                                                                                 | 10 | 4 |
| e. | Obtain the generalized conditions for parallel operation of Transformer. Also, explain the effect of load sharing due to impedance variation between transformers during parallel operation.                                                                                   | 10 | 5 |

**SECTION C****3. Attempt any one part of the following:****1 x 10 = 10**

|    |                                                                                                                     |    |   |
|----|---------------------------------------------------------------------------------------------------------------------|----|---|
| a. | Derive an expression for dynamical equation of electromechanical system.                                            | 10 | 1 |
| b. | Derive an expression for the torque in a doubly excited system having salient pole type of stator as well as rotor. | 10 | 1 |

**4. Attempt any one part of the following:****1 x 10 = 10**

|    |                                                                                                                                                                                                                                                                     |    |   |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|
| a. | Explain the armature reaction and commutation in detail for a DC Machine.                                                                                                                                                                                           | 10 | 2 |
| b. | 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. | 10 | 2 |



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**TIME: 3 HRS****M.MARKS: 100****5. Attempt any one part of the following:****1 x 10 = 10**

|    |                                                                                     |    |   |
|----|-------------------------------------------------------------------------------------|----|---|
| a. | Explain Swinburne's test on DC machines? What are its advantages and disadvantages? | 10 | 3 |
| b. | Describe Hopkinson test in detail. What are its advantages and disadvantages?       | 10 | 3 |

**6. Attempt any one part of the following:****1 x 10 = 10**

|    |                                                                                                                                                                                                                                       |    |   |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|
| a. | Explain the back-to-back method of testing for two identical single-phase transformers.                                                                                                                                               | 10 | 4 |
| b. | 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 | 10 | 4 |

**7. Attempt any one part of the following:****1 x 10 = 10**

|    |                                                                                                                                                                                                                                                                                                                     |    |   |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|
| a. | A three-phase transformer bank consisting of three 1-phase transformers is used to step down the voltage of a 3-phase, 6600 V transmission line. If the primary line current is 20A, calculate the secondary line voltage, line current, and output kVA for the connections of star-delta (Y-Δ). Turns ratio is 24. | 10 | 5 |
| b. | Discuss the open-Delta connection in 3-Φ transformers with reference to the VA rating. Draw the connection diagram of the open-delta connection and the phasor diagram corresponding to a balanced load of lagging power factor. State the applications                                                             | 10 | 5 |