Code No: RT22025 **R13** SET - 1

II B. Tech II Semester Regular Examinations, April/May - 2016
ELECTRICAL MACHINES - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

~~~~~~

PART- A

1. a) What is all day efficiency? How it is different from normal efficiency.
   b) What are the typical information that can be had by performing OC and SC tests?
   c) Write the advantages and disadvantages of tap changers.
   d) Write the merits and demerits of slip-ring induction motor.
   e) Write the effects of crawling and cogging on the performance of induction motor.
   f) Define specific electric and magnetic loading. (4M+4M+4M+3M+4M+3M)

PART- B

2. a) With the help of phasor diagram, explain the operation of a transformer under no load and load conditions.
   b) The core of a 100 kVA, 11000/550 V, 1-phase core type transformer has a cross-section of 400 cm^2. Find (i) the number of HV and LV turns per phase and (ii) the e.m.f per turn if the maximum core density is not density is not exceeding 1.3 Tesla. Assume a stacking factor of 0.9. What will happen if its primary voltage is increased by 10% on no-load? (8M+8M)

3. a) Explain the procedure to conduct the Sumner's test and obtain the different circuit parameters to estimate the performance of the transformer.
   b) A 50 kVA, 2200 V/1100 V single phase 50 Hz transformer has a full-load efficiency of 95% and iron loss of 500 W. The transformer is connected as an Auto-transformer to a 3300 V supply. When it delivers a load of 50 kW at unity power factor at 1100 V, calculate the currents in the windings. Find also the increase in output as auto-transformer also calculate the copper losses as two winding transformer. (8M+8M)

4. a) Explain about the star-star, star-delta and delta-star connections used in 3-phase connection of transformers. Discuss their advantages and disadvantages.
   b) A balanced 3-phase, 100 kW load at 400V and 0.8 p.f. lag is to be obtained from a balanced 2-phase, 1100V lines. Determine the kVA rating of each unit of the Scott-connected transformer. (8M+8M)
~~~~~~

Code No: RT22025 **R13** SET - 1

5. a) Describe with neat sketch the construction and principle of operation of a 3-phase cage type induction motor.
   b) A 3-phase slip-ring, induction motor with star-connected rotor has an induced e.m.f. of 120V between slip-rings at standstill with normal voltage applied to the stator. The rotor winding has a resistance per phase of 0.3 Ω and standstill leakage reactance per phase of 1.2 Ω. Calculate (i) Rotor current/phase when running short-circuited with 4% slip and (ii) the slip and rotor current per phase when the rotor is developing maximum toque. (8M+8M)

6. a) What is the purpose of using deep-bar cage rotors? Explain the construction and working of a deep-bar cage motor.
   b) A 50 kW, 6-pole, 50 Hz, 450 V, 3-phase slip ring induction motor furnished following test figures:
   No load test: 450 V, 20 A, p.f = 0.15
   Blocked rotor test : 200 V, 150 A, p.f=0.3
   The ratio of stator to rotor copper losses on short circuit was 5:4. Draw the circle diagram and determine (i) The full load current and power factor (ii) The maximum torque and the maximum power input (iii) Slip at full load (iv) Efficiency at full load. (7M+9M)

7. a) Derive the output equation of a three phase transformer and explain the factor affecting it.
   b) Find the main dimensions of a 15 kW, 3-phase, 400 V, 50 Hz, 2810 rpm, squirrel cage induction motor having an efficiency of 0.88 and a full load power factor of 0.9. Assume: specific magnetic loading=0.5 Wb/m^2; specific electric loading=25000 A/m. Take the rotor peripheral speed as approximately 20 m/s at synchronous speed. (7M+9M)

Code No: RT22025 **R13** SET - 2

II B. Tech II Semester Regular Examinations, April/May - 2016
ELECTRICAL MACHINES - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

~~~~~~

PART- A

1. a) What is the need of laminating the core of the transformer.
   b) What is the need of parallel operation? What are the conditions to be satisfied for parallel operation of transformers?
   c) What advantages has the star connection over the delta connection of the transformer.
   d) What is the necessity of short-circuited rotor conductors in squirrel cage induction motor?
   e) What is the principle of induction generator?
   f) What is a helical winding? What are its properties? (4M+4M+4M+4M+3M+3M)

PART- B

2. a) Draw the approximate equivalent circuit of a transformer referred to the primary side and indicate how it differs from the exact equivalent circuit.
   b) A transformer with normal voltage impressed has a flux density of 1.4 Wb/m^2 and a core loss comprising of 1000W eddy current loss and 3000W Hysterisis loss. What do these losses become under the following conditions?
      i) Increasing the applied voltage by 10% at rated frequency.
      ii) Reducing the frequency by 10% with normal voltage impressed.
      iii) Increasing both impressed voltage and frequency by 10%. (8M+8M)

3. a) State the essential and desirable conditions which should be satisfied before two single phase transformers may be operated in parallel.
   b) A 2-winding 10 kVA, 440/110 V transformer is reconnected as a step-down 550/440 V auto transformer. Compare the volt-ampere rating of the autotransformer with that of original 2-winding transformer. Calculate the power transferred to the load: (i) inductively (ii) conductively. (8M+8M)
~~~~~~

Code No: RT22025 **R13** SET - 2

4. a) Explain with the help of connection and phasor diagram, how the Scott connections are used to obtain two-phase supply from 3-phase supply mains.
   b) A 400 kVA load at 0.7 power factor lagging is supplied by three 'single-phase' transformers connected in Δ – Δ. Each of the Δ – Δ transformer is rated at 2000 kVA, 2300/230 V. If one defective transformer is removed from the service, calculate for the V – V connection: (i) the kVA load carried by each transformer (ii) percent rated load carried by each transformer (iii) total kVA rating of the transformer bank in V – V (iv) ratio of V – V to Δ – Δ bank transformer ratings. (8M+8M)

5. a) Explain the principle of production of rotating magnetic field in a 3-phase induction motor.
   b) A 10 kW, 400 V, 3-phase, 4 pole, 50 Hz delta connected induction motor is running at no load with a line current of 8 A and an input power of 660 W. At full load, line current is 18 A and input power is 11.20 kW. Stator effective resistance per phase is 1.2 Ω and friction, windage loss is 420 W. For negligible rotor ohmic losses at no load, calculate (i) stator core loss (ii) total rotor losses at full load (iii) total rotor ohmic losses at full load (iv) full load speed. (8M+8M)

6. a) Derive the torque-slip equation for a 3-phase induction motor and also the equation for slip at which maximum torque occurs.
   b) An 8-pole, 50Hz, 3-phase slip ring induction motor has effective resistance of 0.08 Ω/ phase. The speed corresponding to maximum torque is 650 rpm. What is the value of resistance to be inserted in rotor circuit to obtain maximum torque at starting? (8M+8M)

7. a) Derive the output equation of a three phase induction motor and explain the factor affecting it.
   b) Discuss factors to be considered in designing number of rotor slots in a induction motor.

(8M+8M)

Code No: RT22025 **R13** SET - 3

II B. Tech II Semester Regular Examinations, April/May - 2016
ELECTRICAL MACHINES - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

~~~~~~

PART- A

1. a) Draw phasor diagram of the transformer with lagging, leading and unity power factor loads.
   b) Give the applications, merits and demerits of auto transformer.
   c) What are the differences between off load and on load tap changing transformers. Why taps are provided in the distribution transformer.
   d) Why the air gap between stator core and rotor of an induction motor is made very small.
   e) Rotor resistance starting is preferred to reduced voltage starting of a wound rotor induction motor. Why?
   f) Write the output equation of a transformer and three phase induction motor.
   (4M+4M+4M+3M+4M+3M)

PART- B

2. a) Discuss the effect of variation of frequency and supply voltage on losses in a transformer.
   b) A 100 kVA transformer has 400 turns on the primary and 80 turns on the secondary. The primary and secondary resistances are 0.3 Ω and 0.01 Ω respectively and the corresponding leakage reactance are 1.1 Ω and 0.035 Ω. The supply voltage is 2200V. Calculate
   (i) equivalent impedance referred to primary and (ii) the voltage regulation and the secondary terminal voltage for full load having a power factor of 0.8 leading. (8M+8M)

3. a) Discuss how will you perform open-circuit and short-circuit tests on a single phase transformer in the laboratory. From test results how will you find efficiency and regulation of the transformer?
   b) Two transformers A and B are connected in parallel to a load of (2+j1.5) Ω. Their impedances in secondary terms are Z_A = (0.15+j0.5) Ω and Z_B = (0.1+j0.6) Ω. Their no load terminal voltages are $E_A = 207\angle 0^0$ volt and $E_B = 205\angle 0^0$ volt. Find the power output and power factor of each transformer. (8M+8M)

4. a) Describe the configuration and working principle of on load tap changer with neat sketches?
   b) Two single phase transformers are supplied at 250V from a 6600 V, 3-phase system through a pair of Scott-connected transformers. If the load on the main transformer is 85 kW at 0.9 p.f. lagging and that on teaser transformer is 69 kW at 0.8 p.f. lagging, find the values of line currents on the 3-phase side. Neglect the magnetizing and core loss currents in the transformers? (8M+8M)
~~~~~~

Code No: RT22025 **R13** SET - 3

5. a) Show that the voltage generated in the rotor circuit of a 3-phase induction motor at any slip '*s*' is equal to '*s*' times the voltage generated at stand-still.
   b) The power input to rotor of a 400 V, 50 Hz, 6-pole, three-phase induction motor is 90 kW. The rotor e.m.f is observed to make 150 cycles per minute. Calculate (i) slip, (ii) rotor speed, (iii) mechanical power developed (iv) speed of rotor field with respect to rotor (v) speed of stator field with respect to rotor. (8M+8M)

6. a) Explain the relation between torque and rotor power factor in 3 phase induction motors.
   b) The impedances at standstill of the inner and outer windings of a double cage rotor are (0.01+j0.5) ohms and (0.05+j0.1) ohms respectively. Calculate the ratio of torques due to the two winding (i) at starting (ii) when running with a slip of 5 %. (8M+8M)

7. a) Write a short note on specific electric and magnetic loadings in three phase induction motor.
   b) Explain about various types of windings used in the core and shell type transformers. Mention merits and demerits of each type of winding. (8M+8M)

Code No: RT22025 **R13** SET - 4

II B. Tech II Semester Regular Examinations, April/May - 2016
ELECTRICAL MACHINES - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

~~~~~~

PART- A

1. a) Draw the exact and approximate equivalent circuits of a single phase transformer.
   b) An auto transformer is supplying a power to a load of 3 kW, 115 V unity power factor from 230 V supply. Calculate the power supplied inductively and conductively.
   c) What are the characteristics of Scott connection?
   d) Why the slots on the rotor of an induction motor are usually skewed.
   e) Write is the principle of double cage induction motor.
   f) What are the steps to be followed in the design of stator of three phase induction motor? (4M+4M+4M+3M+4M+3M)

PART- B

2. a) What is voltage regulation of a transformer? Derive the conditions for maximum and zero voltage regulation in a transformer.
   b) A transformer has resistance and reactance drop of 2.5% and 5% respectively. Find the percentage voltage regulation of the transformer at full load and at 0.8 p.f lagging. Also find the power factor at which regulation is maximum. (8M+8M)

3. a) Derive an expression for approximate relative weights of conductor material in an autotransformer and 2-winding transformer, the primary voltage being V_1, and secondary voltage V_2. Compare the weights of conductor material when the transformation ratio is 3. Ignore the magnetizing current?
   b) A 6 kVA, 250/500V, 1-phase, 50 Hz, transformer has the following readings tests results:
   i) O.C. test (LV side): 250 V, 1.2 A, 80 W
   ii) S.C. test (HV side): 25 V, 10 A, 95 W
   Calculate regulation and efficiency of the transformer at full load and half load 0.8 power factor lagging. (8M+8M)

4. a) Explain with necessary diagrams how two 3-phase transformers can be used to convert a 3-phase supply to a 2-phase one. If the load is balanced on one side, show that it will be balanced on other side.
   b) Two single-phase furnaces working at 100V are connected to 3300-V, 3-phase mains through Scott-connected transformers. Calculate the current in each line of the 3-phase mains when the power taken by each furnace is 400-KW at a power factor of 0.8 lagging. Neglect losses in the transformer. (8M+8M)
~~~~~~

Code No: RT22025 **R13** SET - 4

5. a) Explain why a three-phase induction motor, at no-load, operates at a very low power factor and at full-load, operates at good power factor.
   b) An induction motor has an efficiency of 0.9 when the shaft load is 45 kW. At this load, stator ohmic loss and rotor ohmic loss each is equal to the iron loss. The mechanical loss is one-third of the no-load losses. Neglect ohmic losses at no-load. Calculate the slip. (8M+8M)

6. a) Derive an expression for developed torque in a 3-phase induction motor and find the condition for maximum torque.
   b) For a 3-phase induction motor, the rotor ohmic loss at maximum torque is 16 times that at full load torque. The slip at full load torque is 0.03. If stator resistance and rotational losses are neglected, then calculate the starting torque in terms of full load torque. (8M+8M)

7. Determine the main dimensions, number of stator slots and number of turns per phase of a 3.7 kW, 400 V, 3-phase, 4-pole, 50 Hz squirrel cage induction motor to be started by a star delta starter. Work out winding details. Assume: Average flux density in the gap=0.45 Wb/m^2, Ampere conductors per meter=23000, efficiency=0.85 and power factor=0.84.
   Machines rated at 3.7 kW, 4-pole is sold at a competitive price and therefore choose the main dimensions to give a cheap design. Assume: winding factor=0.955, stacking factor=0.9. (16M)