*This question paper contains 4 printed pages.*

**3293** *Your Roll No.....*

**B.Tech.(E) / III** **J**

Paper I - POWER APPARATUS
(EEE - 301)

*Time : 3 hours* *Maximum Marks :70*

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

***Answer any five questions from eight questions.***

1. a) Explain how a 3 phase transformer Yd II of group no. 4 can be successfully operated in parallel with another transformer Dy II of group no. 3. *05*

   b) Explain with necessary diagram 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 the other side. *05*

   c) A load of 800kw at pf of 0.71 (lag) is shared by similar transformers connected in parallel. One has a resistive drop of 1.4% and reactive drop of 4.8% and the other has resistive drop of 1.8% and reactive drop of 5%. Calculate the load shared by each transformer and their power factor. *04*

2 a) Derive an expression for finding regulation of salient pole alternator using two reaction theory. Draw its Phasor diagram. *05*

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b) A 3 phase star-connected synchronous generator supplies current at 10A having phase angle of 20° lagging at 400V. Find the load angle and the components of armature current $I_d$ and $I_g$ if $X_d = 10\Omega$ and $X_q = 6.5\Omega$. Assume armature resistance is negligible. 04

c) A 20 hp, 3 phase, 400V synchronous motor operating on full load from infinite busbar has its excitation so adjusted that power factor is 0.87 lagging. Load being kept constant, excitation is now increased by 20%. Find the new power factor, synchronous reactance is 1.0 per unit. 05

3 a) A 100w, 2pole, 50Hz, 230V, single phase series motor with salient poles has a total resistance of $15\Omega$. leakage reactance of $40\Omega$, mutual reactance of $80\Omega$ (in d axis) and $50\Omega$ (in q axis). If the stray power losses are 20 watts, calculate the current, speed, and power factor of the motor at full load. 05

b) Explain the principle of operation of the repulsion induction motor. For what type of loads is this motor suitable ? Explain. 05

c) Explain double revolving field theory in single phase Induction motor. 04

4 a) Develop the phase diagram for the performance calculation of a single phase repulsion motor for a brush shift of $\alpha$ electrical degrees. 05

b) A 230V, 4 pole, single phase induction motor has the following data at stand still. Main winding $(1.5 + j\,4.0)\,\Omega$, starting winding $(2.2 + j\,5.5)\,\Omega$. For making the motor develop maximum starting torque find the values of
(i) resister, and
(ii) capacitor in series with standing winding *05*

c) Derive the condition of maximum starting torque for single phase Induction motor. *04*

5 a) Calculate the stepping angle for 3 phase, 24 pole permanent magnet type stepper motor. *04*

b) For small and sensitive Servo mechanism give reasons why AC Servo motors are generally preferred over dc Servo motors. *05*

c) Explain the operation and working of an amplidyne machine as a power amplifier. Indicate how this machine may be changed into metadyne. *05*

6 a) A 5kVA, 220V, star-connected 3 phase salient pole alternator with direct and quadrature axis reactance of $12\,\Omega$ and $7\Omega$ respectively delivers full load current at unit power factor. Calculate excitation voltage, neglect resistance. *05*

b) What are the causes of harmonics in the voltage waveform of an alternator ? How can they be minimized. *04*

c) Consider a 3300V delta connected synchronous motor having synchronous reactance per phase of

$18\Omega$. It operates at a leading p.f. of 0.707 when drawing 800kw from mains. Calculate the excitation emf and the rotor angle. *05*

7 a) Two Star connected transformers are used to supply a balanced load of 100kvA at 400V from a balanced 11kV, $3\phi$ supply. Determine
(1) current rating of each transformer
(2) kvA rating of the main and teaser connection. *05*

b) Discuss briefly the essential and desirable conditions to be fulfilled for operating two 3 phase transformer in parallel. *04*

c) A balanced 3 phase, 100kw load at 400kvA and 0.8 pf lag is to be obtained from a balanced two phase 1, 100V lines. Determine the kvA rating of each unit of the scott connected transformer. *05*

8 Write short notes on the following (Any three):
a) Induction generator
b) Linear Induction motor
c) 3 phase ac series commutator motor
d) phase advancer
e) scharge motor. *14*