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| **Scheme of Valuation/Answer Key** | | | | | |
| **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2019 | | | | | |
| **Course Code: EE202** | | | | | |
| **Course Name: SYNCHRONOUS AND INDUCTION MACHINES (EE)** | | | | | |
| Max. Marks: 100 | | |  | Duration: 3 Hours | |
| **PART A** | | | | | |
|  |  | ***Answer all questions, each carries 5 marks.*** | | | Marks |
| 1 |  | Derivation of  volts ….. 4 marks  Expression  and  ….. 1 mark | | | ( 5) |
| 2 |  | Phasor diagram at Unity pf ….. 2 ½ marks  Phasor diagram at leading pf ….. 2 ½ marks | | | ( 5) |
| 3 |  | Conditions for synchronization (voltage, frequency, phase sequence & phase) (no explanation is required) …. 5 marks | | | (5) |
| 4 |  | Explanation for synchronous motor not self-starting ….. 5 marks | | | (5) |
| 5 |  | Definition of crawling …… 2 marks  Methods for elimination …… (Chording, using fractional slot windings, skewing (making non-parallel) either stator or rotor slots, increasing the air gap length,) …… 3 marks | | | (5) |
| 6 |  | Speed control using V/f control – explanation …. 5 marks | | | (5) |
| 7 |  | Synchronous induction motor diagram ….. 2 marks  Explanation ….. 3 marks | | | (5) |
| 8 |  | Reason for not self starting ….. 4 marks  Torque-slip curve of 1-phase induction motor without any starting method …. 1 mark | | | (5) |
| **PART B** | | | | | |
| ***Answer any two full questions, each carries 10 marks.*** | | | | | |
| 9 | a) | Atleast 4 comparisons of salient-pole & cylindrical rotor …. 4 marks | | | (4 ) |
|  | b) | *T =*  …… 2 marks  ….. 1 mark  …… 1 mark  ….. 2 marks  (or  ….. 1 mark …… 1 mark) | | | (6) |
| 10 |  | Note: 1-phase, 3-phase star/delta will not affect the answers.  Plot OCC ….. 4 marks (Full marks shall be given even if the voltage is divided by √3 considering as 3-phase star)  (from OCC corresponding to Ef = 6600V)  ……. 1 mark  A …….. 1 mark (to circulate rated armature current)  …… 2 marks  Ef = 7600V (from OCC corresponding to If = 52A) ……. 1 mark  Voltage regulation =  ……. 1 mark | | | ( 10) |
| 11 | a) | Atleast 3 causes of harmonics in alternator (concentrated winding, full pitched, integer slot, airgap irregularity etc) …… 3 marks  Elimination of harmonics – atleast 3 methods - (distribution, chording, skewing, fractional slot winding, alternator connections) ……. 2 marks  Detailing is not required. | | | (5) |
|  | b) | ….. 1 mark =  = ……. 2 marks  Line voltage = 11244V …… 1 mark  Voltage regulation =  …… 1 mark | | | (5) |
| **PART C** | | | | | |
| ***Answer any two full questions, each carries 10 marks.*** | | | | | |
| 12 | a) | Circuit diagram for slip test ….. 2 marks  Explanation …. 3 marks | | | ( 5) |
|  | b) | Circuit diagram …. 2 marks  Explanation …. 3 marks | | | ( 5 ) |
| 13 | a) | Explanation of any one method of synchronous motor …… 4 marks | | | (4) |
|  | b) | …… 3 marks  Power factor ,  …… 1 mark  Power input == …… 1 mark  Power developed = Power input – Armature Cu loss = 669025W  Torque developed = …… 1 mark | | | (6) |
| 14 | a) | Explanation – effect of change of excitation in alternator with phasor diagram ….. 5 marks | | | (5) |
|  | b) | ….. 1 mark  Starting torque,  ….. 2 marks  Slip at maximum torque,  …… 1 mark  Maximum torque,  …… 1 mark | | | (5) |
| **PART D** | | | | | |
| ***Answer any two full questions, each carries 10 marks.*** | | | | | |
| 15 |  | Draw circle diagram ….. 5 marks  Line current OP = 30A ….. 3 marks  Power factor at full-load = cos30° = 0.866 ….. 2 marks | | | ( 10) |
| 16 | a) | Sketch the connections of star-delta start at start & run …… 1 mark  Explanation …… 2 marks  …… 1 mark  …….. 1 mark | | | (5) |
|  | b) | Atleast 3 comparisons (IG less complicated as no brushes/sliprings, separate DC excitation required for SG, IG frequency is regulated by power supply, IG efficiency power, draws large reactive power from supply, operates only at leading power factor) …… 5 marks | | | (5) |
| 17 | a) | Circuit of split-phase IM with explanation ….. 2 marks  Circuit of capacitor-star IM with explanation ….. 2 marks  Circuit of capacitor start & run IM with explanation ….. 2 marks  Circuit of shaded-pole IM with explanation ….. 2 marks | | | (8) |
|  | b) | Sketch the equivalent circuit and mark all parameters …. 2 marks | | | (2) |
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