Printed Pages : 4   **EE – 402**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2022   Roll No. [   ]

B. Tech.

(SEM. IV) EXAMINATION, 2006-07
ELECTRICAL MACHINES

Time : 3 Hours]   *[Total Marks : 100*

Note :   *Attempt all the five questions.*

1   Answer any **four** of the following :   **5×4=20**

   (a)   With neat sketch, explain two-pole arrangement of elementory **dc** machines. Mention important parts of the **d.c.** machine and discuss its material aspects.

   (b)   A **50kW, 250 V, 10**-pole lap wound **dc** generator has **960** conductors. Calculate the demagnetising and cross-magnetising armature reaction ampere turns per pole per electrical degree of brush shift.

   (c)   What are the necessary conditions for voltage build up in a self excited **dc** generator. Also explain the process of voltage build up in it.

   (d)   A **120V, 40A, 1800 rpm dc** shunt motor has armature and field circuit resistance of **0.2** Ω and **60** Ω respectively. While the motor is operating at rated speed and rated full load the brush volt drop is **3V**; calculate speed of motor at half load.

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(e) Discuss in brief speed control methods of **dc** shunt motor.

(f) Explain why a **dc** motor draws high current at starting. Also give constructional details of a **3**-point starter.

2 Answer any **four** of the following : 5×4=20

(a) With the help of speed torque charactristics, explain motoring and regenerative braking quadrant operation of **dc** separately excited motor.

(b) Explain various losses involved in **dc** machine and discuss how they vary.

(c) Derive e.m.f. equation of a single phase transformer and show that for an ideal transformer, voltages are transformed in direct ratio of turns while currents in the inverse ratio of turns. Find the transformation ratio of impedances.

(d) No-load measurements on a **230 V/115 V** transformer give the following readings measured on the low voltage side:

115 V, 60 Hz, 80 W and **3 A.**

Determine parameters and shunt branch of equivalent circuit if primary winding impedance is **(0.02 + j 0.1)** Ω

(e) Draw full load phasor diagram of a single phase transformer supplying a lagging pf load. Explain significance of each phasor.

(f) A **20 kVA, 50 Hz, 2000/200 V,** single phase transformer has iron loss of **120 W** and full load copper loss of **300 W**. Low voltage side of the transformer is loaded at **0.8** lagging power factor. Calculate maximum efficiency of transformer.

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3   Answer any **two** parts of the following :   **10×2=20**

  (a)   The stator of a **3**-phase induction motor is supplied a balanced three phase ac voltage, show that the resultant magnetic field has a constant amplitude and rotates in space at constant speed.

  (b)   Explain construction and working of a single phase autotransformer. Also compare it with a two winding transformer.

  (c)   A three phase transformer bank is used to step down the voltage of a **3**-phase, **6600 V** transmission line. If the primary line current is **10 A**, calculate the secondary line current, voltage and output **kVA** for the following connection :
       (i)   Star/delta and
       (ii)   delta/star.
       The turns ratio is **12**. Neglect losses.

4   Answer any **two** parts of the following :   **10×2=20**

  (a)   Draw ane explain torque-speed characteristic of single winding single phase induction motor and explain why this motor is not a self starting? Also describe how this motor can be made self starting.

  (b)   Derive, draw and explain torque-slip characteristic of three phase induction motor. Also show the effect of increase of rotor resistance on it.

  (c)   The power supplied to a **3**-phase **4** pole, **50 Hz** induction motor is **40 kW** and the corresponding stator losses are **1.5 kW**. While motor is operating with **4%** slip, the mechanical losses are **0.8 kW.** Calculate efficiency of the motor and shaft torque.

5   Answer any **two** parts of the following :   **10×2=20**

(a)   A **3**-phase **8** pole **900 rpm** star connected alternator has **72** slots on the armature and each slot has **10** conductors. The winding is short pitched by **1** slot. Assuming flux per pole **0.10 Wb,** determine induced **e.m.f.** between lines.

(b)   Describe experimental method of determination of voltage regulation of a **3**-phase synchronous generator following synchronous impedance method.

(c)   Explain construction, starting and operation of synchronous motor. Also show the effect of excitation current on the motor armature current.

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