

**B.TECH SEM – IV (2007 COURSE) (ELECTRICAL ENGG.) :**  
**WINTER - 2017**

**SUBJECT: TRANSFORMER THEORY & DESIGN**

Day: **Tuesday**  
Date: **21/11/2017**

Time: **02.30 PM TO 05.30 PM**  
Max. Marks: **80**

**W-2017-2411**

**N.B.:**

- 1) **Q. No. and Q. No. 5** are **COMPULSORY**. Out of the remaining attempt any **TWO** questions from each section.
- 2) Figures to the right indicate **FULL** marks.
- 3) Answers to both the sections should be written in **SAME** answer book.
- 3) Draw diagrams **WHEREVER** necessary.

**SECTION-I**

- Q.1** a) Derive the condition for maximum efficiency and determine the load current at which maximum efficiency occurs. **(05)**
- b) Distinguish between single three phase unit and three single phase unit. **(05)**
- c) List different methods of testing of transformer coil as per IS specification. **(04)**
- Q.2** a) Derive an EMF equation of transformer and explain voltage transformation ratio. **(06)**
- b) A 20 KVA, 440/ 220V, 1  $\phi$ , 50 Hz transformer has iron loss of 324 W. the copper loss at half load current is 100W. Determine: **(07)**  
i) efficiency at full load 0.8 p.f. load  
ii) The maximum efficiency  
iii) KVA at which maximum efficiency occurs.
- Q.3** a) Explain in detail standard connections of 3  $\phi$  transformer with their applications. **(06)**
- b) Explain the function and principle of operation of load and on load tap changing transformer. **(07)**
- Q.4** a) Describe Back to Back test for separation of losses in two identical transformers. **(06)**
- b) A 10 KVA, 200 / 400 V, 50Hz, 1  $\phi$  transformer give the following test result. **(07)**  
Open circuit test: 200V, 1.3A, 120W – on LV side  
Short circuit test: 22V, 30A, 200W – on HV side  
Calculate:  
i) Efficiency and secondary terminal voltage when supplying full load at 0.8 loading p.f.  
ii) Load at unity p.f. corresponding to maximum efficiency.

**P. T. O.**

## SECTION - II

- Q.5** a) Derive the output equation of  $3\phi$  core type transformer with usual notations. **(06)**
- b) Define & draw the sketches of mechanical forces developed in a transformer. **(04)**
- c) In connection with  $3\phi$  winding define: **(04)**  
i) Phase spread  
ii) Pole phase groups
- Q.6** a) Explain the procedure of design of Tank of transformer. Also explain the method to determine number of cooling tubes. **(08)**
- b) Explain various methods of cooling used in transformers in brief. **(05)**
- Q.7** a) Assuming equal heights of HV and LV winding derive the expression for leakage reactance of  $3\phi$  core type transformer. **(08)**
- b) Explain the procedure used in design for calculation of no load current of transformer. **(05)**
- Q.8** a) Develop and draw a mush winding for a  $3\phi$ , 4 pole, 24 slots armature. **(09)**  
Assuming winding is full pitched.
- b) With example explain the difference between integral and fractional slot windings. **(04)**

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