

Seat No.: \_\_\_\_\_

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# GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V(New) • EXAMINATION – WINTER 2016

Subject Code:2150908

Date:22/11/2016

Subject Name:Electrical Power System – I

Time:10:30 AM to 01:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

MARKS

## Q.1 Short Questions

14

- 1 Strain type insulator are used where the conductors
  - a) dead ended
  - b) at intermediate anchor towers
  - c) any of the above
  - d) none of the above
- 2 The effective resistance of a conductor will be the same as ohmic resistance when
  - a) The current in true sine wave
  - b) voltage is low
  - c) power factor is unity
  - d) current is uniformly distributed over cross sectional area.
- 3 Ferranti effect on long transmission line is experienced when it is
  - a) lightly loaded
  - b) heavily loaded
  - c) on full load unity power factor.
  - d) In all these cases
- 4 The underground system cannot be operate above
  - a) 440v
  - b) 33KV
  - c) 66KV
  - d) 132Kv
- 5 In a transmission system the weight of copper used is proposional to
  - a)  $E^2$
  - b)  $E$
  - c)  $1/E^2$
  - d)  $1/E$
- 6 Galvanized steel wire is generally used as
  - a) Earth wire
  - b) stay wire
  - c) structural component
  - d) all of above
- 7 The inductance of transmission line is minimum when
  - a) GMD is high.
  - b) GMR is high
  - c) Both GMD and GMR high.
  - d) GMD is low and GMR is high.
- 8 In order to eliminate sheath losses, a successful method is:
  - a) Transpose the cable along with cross bonding.
  - b) Transpose the cable only
  - c) Only cross bonding enough
  - d) None of above is effective.
- 9 A feeder is mainly designed from point of view of :
  - a) Voltages drop in it.
  - b) Atmospheric temperature
  - c) its current carrying capacity
  - d) operating voltage

- 10 Proximity of a line to the earth surface  
 a) Increase the capacitance to neutral  
 b) Decrease the capacitance to neutral  
 c) Does not affect the capacitance to neutral
- 11 The area of X-section of neutral is generally..... that of any line conductor.  
 a) Half b) double c) slightly smaller d) same
- 12 The spacing between sub conductors of a bundle is approximately  
 a) 20cm b) 40 cm c) 80 cm d) 10 cm.
- 13 Single core cables are usually not provided by armoring  
 a) Make the cable non-hygroscopic  
 b) make cable more flexible  
 c) avoid excessive losses in armour  
 d) none of the above
- 14 The pu impedance of line to 50 MVA, 132 kv base is 0.4 the pu impedance to a 100 MVA, 132KV base will be  
 a) 0.2 b) 04 c) 0.8 d) 1.4
- Q.2** (a) Define per unit value. Write criteria for selection of base value and the equation for per unit impedance if a change of base occurs. **03**
- (b) Represent p.u model of transformer with and without tap changer. **04**
- (c) A 90 MVA 11 KV 3-ph generator has reactance of 25 % . **07**  
 The generator supplies two motors through transformers and transmission line as shown in figure 1. Draw the p.u. reactance diagram. Taking generator rating as base, line reactance  $100 \Omega$ . Motors are rated 50 MVA and 40 MVA, 10 kV, 20% reactance. Transformer 1: Delta -Y connected 100MVA; 10/132KV with 6% reactance Transformer 2: Y-Delta connected 30MVA; 132/10KV with 5% reactance.
- OR**
- (c) Discuss the relative merits and demerits of underground and overhead systems. **07**
- Q.3** (a) Define and explain primary and secondary distribution system with single line diagram. **03**
- (b) Discuss briefly the design considerations in distribution system. **04**
- (c) 2-wire d.c. distributor ABCDEA in the form of a ring main is fed at point A at 250 V and is loaded as under : **07**  
 10A at B ; 20A at C ; 30A at D and 10 A at E.  
 The resistances of various sections (go and return) are :  
 $AB = 0.1 \Omega$  ;  $BC = 0.05 \Omega$  ;  $CD = 0.01 \Omega$  ;  $DE = 0.025 \Omega$  and  $EA = 0.075 \Omega$ . Determine :  
 (i) the point of minimum potential  
 (ii) current in each section of distributor
- OR**
- Q.3** (a) List out line supports with its three features **03**
- (b) Give reasons for the following : **04**  
 (i) A.C.S.R. conductors are preferred for transmission and distribution lines.  
 (ii) Conductors are not fully stretched between supports.
- (c) Compare the volume of conductor material required for a d.c. 3-wire system and 3-phase, 3-wire system on the basis of equal **07**

maximum potential difference between one conductor and earth.  
Make suitable assumptions

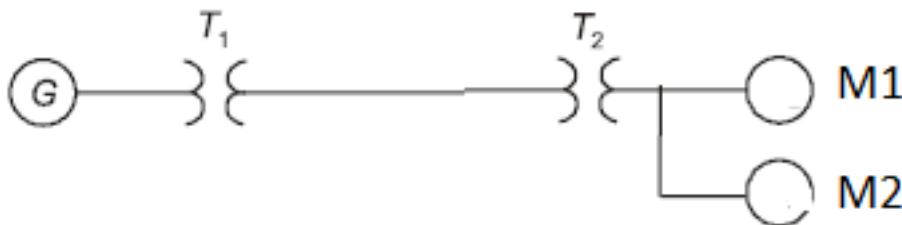
- Q.4** (a) State advantages of High voltage Transmission. **03**  
 (b) Calculate the capacitance of a 100 km long 3-phase, 50 Hz overhead transmission line consisting of 3 conductors, each of diameter 2 cm and spaced 2.5 m at the corners of an equilateral triangle. **04**  
 (c) Derive the expression for the capacitance between conductors of single phase line. Deduce the expression for line to neutral capacitance. **07**

**OR**

- Q.4** (a) Name the important components of an overhead transmission line. Give reasons for unequal potential distribution over a string of suspension insulators. **03**  
 (b) An insulator string consists of three units, each having a safe working voltage of 15 kV. The ratio of self- capacitance to shunt capacitance of each unit is 8:1. Find the maximum safe working voltage of the string. Also find the string efficiency. **04**  
 (c) Explain function of insulators and Discuss a) Pin Insulators b) Suspension Insulator. **07**
- Q.5** (a) Define skin effect and give reason: it is absent in D.C system. **03**  
 (b) Calculate the inductance of each conductor in a 3-phase, 3-wire system when the conductors are arranged in a horizontal plane with spacing such that  $D_{31} = 4$  m;  $D_{12} = D_{23} = 2$  m. The conductors are transposed and have a diameter of 2.5 cm. **04**  
 (c) Derive expression for capacitance for single core cable and 3-core cable **07**

**OR**

- Q.5** (a) Classify underground cable. **03**  
 (b) The capacitance per kilometre of a 3-phase belted cable is  $0.18 \mu\text{F}$  between two cores with the third core connected to sheath. Calculate the kVA taken by 20 km long cable when connected to 3-phase, 50 Hz, 3300 V supply. **04**  
 (c) Derive expression for inductance per phase for 3-ph overhead transmission line when conductors are asymmetrically placed but transposed. **07**



**Figure 1**