**Code: A-10**                          **Subject: ELECTRICAL ENGINEERING**
**Time: 3 Hours**                                      **Max. Marks: 100**

**NOTE: There are 11 Questions in all.**

- **Question 1 is compulsory and carries 16 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.**
- **Answer any THREE Questions each from Part I and Part II. Each of these questions carries 14 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

**Q.1      Choose the correct or best alternative in the following:**                    **(2x8)**

a.      A 1:5 step-up transformer has 120V across the primary and 600 ohms resistance across the secondary.  Assuming 100% efficiency, the primary current equals

   **(A)** 0.2 Amp.                         **(B)** 5 Amps.
   **(C)** 10 Amps.                          **(D)** 20 Amps.

b.      A dc shunt generator has a speed of 800 rpm when delivering 20 A to the load at the terminal voltage of 220V.  If the same machine is run as a motor it takes a line current of 20A from 220V supply.  The speed of the machine as a motor will be

   **(A)** 800 r.p.m.                        **(B)** more than 800 rpm.
   **(C)** less than 800 rpm.                **(D)** both higher or lower than 800 rpm.

c.   A 50 Hz, 3-phase induction motor has a full load speed of 1440 r.p.m.  The number of poles of the motor are

   **(A)** 4.                                **(B)** 6.
   **(C)** 12.                               **(D)** 8.

d.   In a 3-phase synchronous motor

   **(A)** the speed of stator MMF is always more than that of rotor MMF.
   **(B)** the speed of stator MMF is always less than that of rotor MMF.
   **(C)** the speed of stator MMF is synchronous speed while that of rotor MMF is zero.
   **(D)** rotor and stator MMF are stationary with respect to each other.

e.   In a capacitor start single-phase induction motor, the capacitor is connected

   **(A)** in series with main winding.
   **(B)** in series with auxiliary winding.
   **(C)** in series with both the windings.
   **(D)** in parallel with auxiliary winding.

f.  A synchro has

(A)  a 3-phase winding on rotor and a single-phase winding on stator.
(B)  a 3-phase winding on stator and a commutator winding on rotor.
(C)  a 3-phase winding on stator and a single-phase winding on rotor.
(D)  a single-phase winding on stator and a commutator winding on rotor.

g.  As the voltage of transmission increases, the volume of conductor

(A)  increases.                          (B)  does not change.
(C)  decreases.                          (D)  increases proportionately.

h.  The size of the feeder is determined primarily by

(A)  the current it is required to carry.
(B)  the percent variation of voltage in the feeder.
(C)  the voltage across the feeder.
(D)  the distance of transmission.

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## PART I
## Answer any THREE Questions. Each question carries 14 marks.

**Q.2**   a.  Why does a practical transformer draw some current when its secondary winding is open?   **(4)**

b.  A 2.2 KVA, 440 / 220 V, 50 Hz, step-down transformer has the following parameters referred to the primary side : $Re_1 = 3\,ohms$, $Xe_1 = 4\,ohms$, $Rc_1 = 2.5K\,ohms$ and $X_{m1} = 2K\,ohms$. The transformer is operating at full-load with a power-factor of 0.707 lagging.  Determine the voltage  regulation  of  the  transformer.
**(10)**

**Q.3**   a.  Where are synchronous motors used?  **(4)**

b.  A 9-KVA, 208 V, 3-phase, Y-connected, synchronous generator has a winding resistance of 0.1 ohm per phase and a synchronous reactance of 5.6 ohms per phase. Determine the voltage generated (exciting emf) by the machine when it is delivering full-load at 0.8 power-factor lagging at rated voltage.  Calculate the voltage regulation for rated load at 0.8 power-factor (leading).                          **(10)**

**Q.4**   a.  How is the speed of a DC shunt motor controlled?                          **(5)**

b.  A 240-V, 20 hP, 850 r.p.m., shunt motor draws 72A when operating under rated conditions. The respective resistance of the armature and shunt field are 0.242 ohm and 95.2 ohms, respectively.  Determine the percent reduction in the field flux required to obtain a speed of 1650

r.p.m., while drawing an armature current of 50.4 A.          **(9)**

**Q.5**    a.   Why are starters used for starting 3-phase induction motors?       **(4)**

      b.   The power input to the rotor of a 3-phase, 50 Hz, 6 Pole induction motor is 80 kW. The rotor emf makes 100 complete alternations per minute. Find
          (i)    the slip (ii)   the motor speed and    (iii)   the mechanical power developed by the motor.      **(10)**

**Q.6**      Write notes on any **TWO** of the following:-

      (i)    Parallel operation of transformers.
      (ii)   Speed control of induction motors.
      (iii) Applications of induction machines.         **(2 x 7 = 14)**

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## PART II
### Answer any THREE Questions. Each question carries 14 marks.

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**Q.7**      Highlight the role of following in the generation of power
          (i)       Cogeneration.
          (ii)      Diesel generator.        **(7 x 2 = 14)**

**Q.8**    a.   Explain the functions and basic requirements of a protective relay.      **(7)**

      b.    Compare the merits and demerits of overhead lines with an underground distribution system.
   **(7)**

**Q.9**    a.   Explain the working of a welding machine.         **(7)**

      b.   What is inductive interference? How is it caused and what steps are necessary to reduce its effect?        **(7)**

**Q.10**               Identify the motor being used in the ceiling fan and explain the method of its control.        **(14)**

**Q.11**             Write short notes on any **TWO** : -

      (i)       A.C. tachometer.
      (ii)      Energy conservation.
      (iii)     Carrier current protection.        **(2 x 7 = 14)**