Total No. of Printed Pages : 5 **Roll No. ....**

1(CCE.M)2

Electrical Engineering—I

(09)

Time : Three Hours] [Maximum Marks : 300

INSTRUCTIONS

(i) Answers must be written in English.

(ii) The number of marks carried by each question is indicated at the end of the question.

(iii) The answer to each question or part thereof should begin on a fresh page.

(iv) Your answer should be precise and coherent.

(v) The part/parts of the same question must be answered together and should not be interposed between answers to other questions.

(vi) Candidates should attempt question nos. **1** and **5** which are compulsory and any **three** more out of the remaining questions, selecting at least **one** question from each Section.

(vii) If you encounter any typographical error, please read it as it appears in the text-book.

(viii) Candidates are in their own interest advised to go through the General Instructions on the back side of the title page of the Answer Script for strict adherence.

(ix) No continuation sheets shall be provided to any candidate under any circumstances.

(x) Candidates shall put a cross (×) on blank pages of Answer Script.

(b) Describe the essential details of electrodynamometer type wattmeter. Derive an expression for the torque. 20

(c) Draw the circuit of Kelvin's double bridge for the measurement of low resistance. Derive the condition for balance. 20

4. (a) Derive an expression for magnetic induction $\vec{B}$ at a point P on the axis of circular current carrying loop. 20

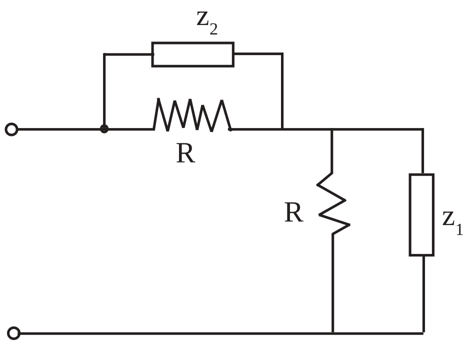
(b) State Gauss's Law and hence find the electric field at a point anywhere outside the surface of a sphere filled with uniform distribution of charge. 20

(c) Show that the divergene of electric field at a point due to a point charge at the origin is zero. 20

SECTION–B

5. Answer any **three** of the following :

(a) Determine the condition under which the input impedance of the network shown below is equal to R.



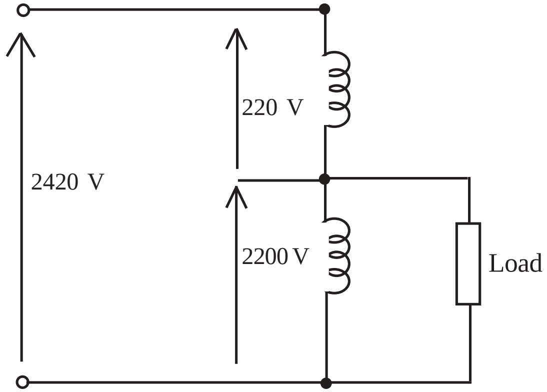
20

(b) How can the introduction of negative feedback be employed to alter the characteristics of electronic circuits ? 20

(c) A 2200/220 V transformer is rated at 15 KVA as a two winding transformer. It is connected as an autotransformer shown below. This autotransformer is excited by 2420 volt supply. Find :

(i) Current distribution in the winding

(ii) KVA output. 20



(d) Discuss torque-slip characteristic of an induction motor with increasing value of rotor resistance. 20

6. (a) Derive an expression for the small signal voltage gain of a Common Emitter amplifier. 20

(b) With the aid of suitable Energy Band Diagram, explain the operation of a Tunnel Diode. 20

(c) Explain the operation of Colpitts Oscillator in detail. 20

7. (a) Derive the torque equation of a d.c. motor. Also draw the power flow diagram for it. 20

(b) What is a critical field resistance of a d.c. shunt generator ? What is its physical significance ? 20

(c) A 200V d.c. series motor runs at 1000 r.p.m. and takes 20A. Armature and field circuit resistance is 0.4 ohm. Calculate the

(xi) No blank page be left in between answer to various questions.

(xii) No programmable Calculator is allowed.

(xiii) No stencil (with different markings) is allowed.

SECTION–A

1. Answer any **three** of the following :

   (a) State and prove maximum power transfer theorem for a.c. networks. 20

   (b) With neat circuit and phasor diagram, explain the measurement of power in 3 phase circuit by two wattmeter method. 20

   (c) Explain clearly why electrostatic voltmeter is not used for sensitive low voltage measurement. 20

   (d) Bring out the important differences between ground wave propagation and space wave propagation. Also highlight the application area of each of them. 20

2. (a) State and prove Norton's theorem. 20

   (b) Discuss briefly important properties of Fourier Transform. 20

   (c) Two circuits having the same numerical impedance are connected in parallel. The power factor of one circuit is 0.8 and that of the other 0.6. Determine the power factor of the combination. 20

3. (a) Two capacitors one having $140 \pm 2.3\ \mu F$ capacitance and other $110 \pm 1.4\ \mu F$ are connected in parallel. Calculate the limiting error of resultant capacitance in μF and in per cent. 20

resistance to be inserted in series to reduce the speed to 800 r.p.m. Assume torque to vary as square of the speed and unsaturated field. 20

8. (a) Prove that for a 3 phase induction motor :

   Where T_{st} = Starting torque

   T_{max} = Maximum torque

   S_m = Slip for maximum torque. 20

   (b) Discuss the essential and desirable conditions to be fulfilled for satisfactory operation of two single phase transformers in parallel. Also state briefly why all transformers cannot be operated in parallel. 20

   (c) When a 100KVA single phase transformer was tested, the following results were obtained :

   On open circuit power loss = 1200 watts

   On short circuit at full

   load current power loss = 1300 watts

   Determine the efficiency of the transformer when working at half full load at 0.8 p.f. lagging. 20