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AQ

JD 2014

GENERAL ENGINEERING / सामान्य इंजीनियरी

PAPER II / प्रश्न-पत्र II

Time allowed : 2 Hours *Maximum Marks : 300*

निर्धारित समय : दो घण्टे *अधिकतम अंक : 300*

Attention :

1. *Paper consists of* **Part A** *(Civil and Structural) and* **Part B** *(Electrical) and* **Part C** *(Mechanical) and only one Part is to be attempted as per option given in the Application Form. Candidates should attempt* ***5 questions in all.*** *All questions carry* ***equal*** *marks.*
2. *Each candidate will be* ***given one*** *Answer Book.*
3. *Answers to all questions must be written in one language, i.e., either in English or in Hindi according to the option given by the candidate in his/her Application Form. Candidates are not allowed to write the answers partly in English and partly in Hindi.*
4. *Candidates must write their Name, Roll No., Ticket No., Name of the Examination and Subject at the prescribed place on the cover page of the Answer Book correctly. Candidates must also put their signature, and left-hand thumb impression on the cover page at the prescribed place. The above instructions must be fully complied with failing which the Answer Book will not be evaluated and* **zero** *mark will be awarded.*
5. *No credit will be given for answers written in a language other than the one opted by the candidate.*
6. *Necessary tables of IS 456 : 2000 Code of Practice are given at the end of Part A for use of candidates attempting Civil and Structural part.*
7. ***"Mobile phones and wireless communication devices are completely banned in the examination halls/rooms. Candidates are advised not to keep mobile phones/any other wireless communication devices with them, even switching it off, in their own interest. Failing to comply with this provision will be considered as using unfair means in the examination and action will be taken against them including cancellation of their candidature."***

SEAL

ध्यान दीजिए :

1. *प्रश्न-पत्र में* ***भाग क*** *(सिविल एवं संरचनात्मक) और* ***भाग ख*** *(विद्युत) एवं* ***भाग ग*** *(यांत्रिक) और आवेदन-पत्र में दिए गए विकल्प के अनुसार केवल एक भाग का ही उत्तर दिया जाना है । अभ्यर्थियों को* ***कुल पाँच प्रश्नों*** *का उत्तर देना है । सभी प्रश्नों के अंक* ***बराबर*** *हैं ।*
2. *प्रत्येक अभ्यर्थी को केवल* ***एक उत्तर-पुस्तिका*** *दी जाएगी ।*
3. *सभी प्रश्नों के उत्तर अभ्यर्थी द्वारा अपने आवेदन-पत्र में दिए गए विकल्प के अनुसार किसी एक भाषा में अर्थात् अंग्रेज़ी या हिन्दी में, दिए जाने चाहिए । अभ्यर्थियों को कुछ उत्तर अंग्रेज़ी में और कुछ उत्तर हिन्दी में लिखने की अनुमति नहीं है ।*
4. *अभ्यर्थी उत्तर-पुस्तिका के आवरण पृष्ठ पर निर्धारित स्थान में अपना नाम, रोल नंबर, टिकट नंबर, परीक्षा का नाम तथा विषय सही-सही अवश्य लिखें । अभ्यर्थी आवरण पृष्ठ पर निर्धारित स्थान में अपने हस्ताक्षर एवं बाएँ हाथ के अँगूठे का निशान भी अवश्य लगाएँ । उपर्युक्त अनुदेशों का पूरी तरह अनुपालन किया जाए, अन्यथा उत्तर-पुस्तिका को नहीं जाँचा जाएगा और* ***शून्य*** *अंक दे दिया जाएगा ।*
5. *अभ्यर्थी द्वारा दिए गए विकल्प की भाषा के अतिरिक्त किसी अन्य भाषा में दिए गए उत्तरों के लिए कोई अंक नहीं दिए जाएँगे ।*
6. *सिविल एवं संरचनात्मक भाग की परीक्षा देने वाले अभ्यर्थियों के प्रयोग के लिए आई.एस. 456 : 2000 प्रेक्टिस कोड की आवश्यक सारणियाँ भाग क के अन्त में दी गई हैं ।*
7. ***"परीक्षा हालों/कमरों में मोबाइल फोन तथा बेतार संचार साधन पूरी तरह निषिद्ध है । प्रत्याशियों को उनके अपने हित में सलाह दी जाती है कि मोबाइल फोन/किसी अन्य बेतार संचार साधन को स्विच ऑफ करके भी अपने पास न रखें । इस प्रावधान का अनुपालन न करने को परीक्षा में अनुचित उपायों का प्रयोग माना जाएगा और उनके विरुद्ध कार्रवाई की जाएगी, उनकी अभ्यर्थिता रद्द कर देने सहित ।"***

PART B

General Engineering

(ELECTRICAL)

1. (a) A copper wire has a resistance of 0·85 Ω at 20°C. What will be its resistance at 40°C ? Temperature coefficient of resistance of copper at 0°C is 0·004°C. *10*

(b) In the circuit shown in Figure 1, what is the value of V ? *10*

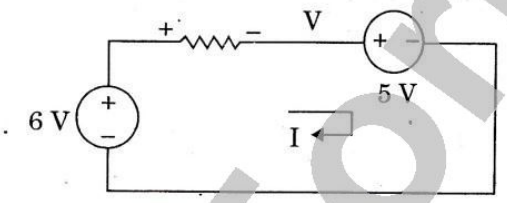

Figure 1

(c) What is the value of Thevenin voltage E_{Th} in the given circuit of Figure 2 ? *10*

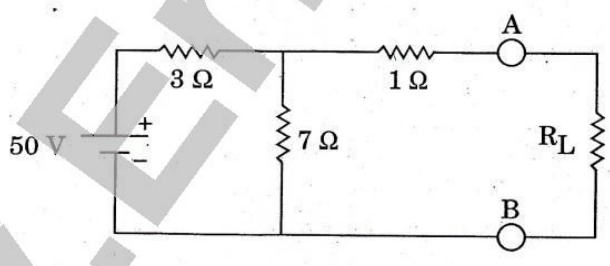

Figure 2

(d) In Figure 3, find the value of resistance R. *30*

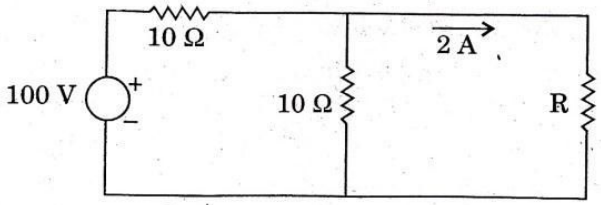

Figure 3

2. (a) Define the following terms : *5+5+5+5=20*

(i) Magnetic field intensity

(ii) Magnetic flux density

(iii) Magnetomotive force

(iv) Reluctance

(b) In a pair of coupled coils, coil 1 has a continuous current of 2 A and the corresponding fluxes φ_{11} and φ_{21} are 0·3 and 0·6 mWb respectively. If the turns are $N_1 = 500$ and $N_2 = 500$, find L_1, L_2, M, and K. *10*

(c) An AC voltage of 50 Hz has a maximum value of 50 V. What will be its voltage after 1/600 second ? *10*

(d) A circuit with a resistor, inductor, and capacitor in series is resonant of f_0 Hz. If all the component values are now doubled, find the new resonant frequency. *20*

3. (a) A 100 μA ammeter has internal resistance of 100 Ω. For extending its range to measure 500 μA, calculate the value of shunt resistance (in Ω). *10*

(b) A wattmeter is connected as shown in Figure 4. What will be the wattmeter reading of power consumed either by Z_1 or Z_2 ? *10*

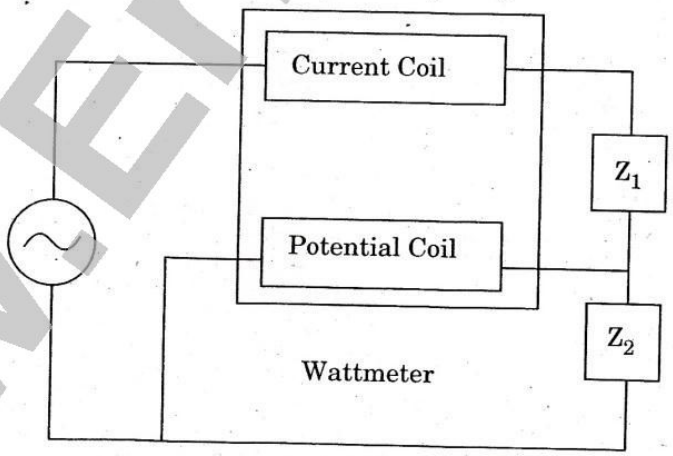

Figure 4

(c) A CRO screen has ten divisions on the horizontal scale. If a voltage signal 5 sin (314 t + 45°) is examined with a line base setting of 5 msec/div, find the number of cycles of signal displayed on the screen. *20*

(d) Prove that the power in AC circuit is equal to VI cos φ. *20*

4. (a) Explain the various losses in DC machines. *20*

(b) A DC machine induces an EMF of 240 V at 1500 rpm. Find the developed torque for an armature current of 25 A. *10*

(c) A 3300/300 V single phase transformer gives 0·6 A and 60 W as ammeter and wattmeter readings when supply is given to the low voltage winding and high voltage winding is kept open. What is the power factor of no load current ? *15*

(d) A 3 hp, 3-phase, 4-pole, 400 V, 50 Hz induction motor runs at 1440 rpm. What will be the frequency of the rotor-induced EMF ? *15*

5. (a) Explain the need for connecting a capacitor in the auxiliary winding of a single phase induction motor. *15*

(b) Why are two alternators connected in parallel to supply a common load ? What are the necessary conditions for parallel connection ? *15*

(c) What are the advantages and disadvantages of AC over DC ? *15*

(d) Overhead power transmission lines are preferred over underground power cables. Discuss. *8*

(e) What are the main advantages of SF6 circuit breakers ? *7*

6. (a) A residential flat has the following average electrical consumptions per day :

(i) 4 tube lights of 40 watts working for 5 hours per day;

(ii) 2 filaments of 60 watts working for 8 hours per day;

(iii) 1 water heater rated 2 kW working for 1 hour per day;

(iv) 1 water pump of 0·5 kW rating working for 3 hours per day.

Calculate the cost of energy per month if 1 kWh of energy (i.e., 1 unit of energy) costs ₹ 3·50. *20*

(b) Cite the advantages and disadvantages of electric drives. *20*

(c) A silicon diode is connected across a 3 V supply with a series resistance of 20 Ω as shown in Figure 5. Neglecting diode resistance, find the diode current. *20*

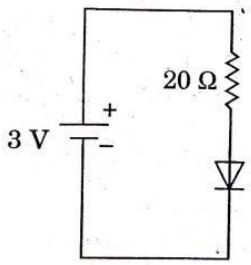

Figure 5