CODE : ES 201 (Pt-I-EE)

CS/B.Tech (NEW)/SEM-2/ES-201 (Pt-I-EE)/2013
2013
**BASIC ELECTRICAL & ELECTRONIC ENGINEERING – II
(EE PART)**

Full Marks : 35

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *five* of the
   following :   5 × 1 = 5

   i)   Iron loss of a transformer is 100 watt at half load. At full
   load the iron loss would be

        a)   100 watt   b)   50 watt

        c)   200 watt   d)   400 watt.

   ii) A series motor will run at very high speed when

        a)   the load is increased

        b)   the field is opened

        c)   the armature is opened

        d)   the load is removed.

2024   3   [Turn over

CS/B.Tech (NEW)/SEM-2/ES-201 (Pt-I-EE)/2013

iii) The resistance R_0 of the exciting branch of the equivalent circuit of a 3-phase induction motor represents

a) stator core loss

b) stator copper loss

c) friction and windage losses

d) rotor copper loss.

iv) If the capacitance between two successive plates is 0·5C as shown in figure, the value of capacitance of the equivalent system between P and Q is

a) 1 C   b) 0·5 C
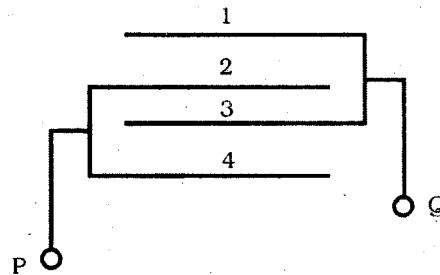
c) 1·5 C   d) 2 C.

v) In a 3-phase 4-wire, balanced system, the current in each phase is 10 A. The current through the neutral wire will be

a) 30 A   b) 10 A

c) 0   d) 15 A.

vi) In a transformer, the flux phasor

a) leads the induced *emf* by 90°

b) lags the induced *emf* by 90°

c) leads the induced *emf* by slightly less then 90°

d) lags the induced *emf* by slightly less than 90°.

CS/B.Tech (NEW)/SEM-2/ES-201 (Pt-I-EE)/2013

GROUP – B

(Short Answer Type Questions)

Answer any *two* of the following.　　　$2 \times 5 = 10$

2. A 3-phase induction motor is supplied with 3-phase balanced supply. Explain how rotating magnetic field is produced in the motor.

3. Deduce an expression showing the relation between electric field strength and potential.

4. Draw and explain the speed-torque characteristics of a (i) dc shunt motor (ii) dc series motor.

5. Draw and explain the phasor diagram of a single phase transformer under lagging p.f.

GROUP – C

(Long Answer Type Questions)

Answer any *two* of the following.　　　$2 \times 10 = 20$

6. a) Derive the *emf* equation of a *dc* generator.

   b) A shunt motor has a rated armature current of 40 A when connected to 200 V. The rated speed of the motor is 1000 rpm. The armature resistance is 0·2 ohm. Find the speed of the motor if total torque is reduced to 70% of that at rated load and a 3 ohm resistance is inserted in series with the armature.　　　$4 + 6$

CS/B.Tech (NEW)/SEM-2/ES-201 (Pt-I-EE)/2013

7. a) Explain why usually the low voltage winding is excited and the high voltage winding is open circuited for open circuit test of a transformer.

   b) Why is the core of a transformer laminated ?

   c) The open circuit and short circuit test data of a 6 kVA, 200/400 V, 50 Hz, single phase transformer are :
   open circuit test : primary voltage = 200 V, I = 0·75A, W = 75 W.

   Short circuit test : primary voltage = 18 V, short circuit current on the secondary side = 12·5A, W = 60W.

   Find the parameters of the equivalent circuit. 2 + 2 + 6

8. a) Discuss briefly the principle of speed control of a 3-phase induction motor by variation of input voltage frequency.

   b) A three phase, 415 V, 50 Hz star connected 4-pole induction motor has stator impedance $Z_1 = (0·2 + 10·5)\,\Omega$ and rotor- impedance referred to stator side is $Z_2 = (0·1 + 10·5)\,\Omega$ per phase. The magnetizing reactance is 10 Ω and resistance representing core loss is 40 Ω on per phase basis. Determine the rotor current at slip of 0·04. 4 + 6

9. a) State and Prove Gauss' law.

   b) What are meant by 'potential' & 'potential difference' ?

   c) Deduce an expression for electric field intensity due to isolated point charge $+ q$. 4 + 3 + 3

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ES-201 (Pt-II-ECE)

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GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *five* of the
   following :   5 × 1 = 5

   i)   The threshold voltage of an enhancement PMOS is

        a)   negative

        b)   positive

        c)   zero with respect to source

        d)   zero with respect to drain.

2024   7·   [Turn over

CS/B.Tech (NEW)/SEM-2/ES-201 (Pt-II-ECE)/2013

ii) For a source follower circuit, the voltage gain is

    a) zero

    b) slightly greater than unity

    c) slightly less than unity

    d) none of these.

iii) The expression of closed loop gain $\left(A_f \right)$ for positive feedback amplifier is

    a) $\dfrac{A}{1 + A\beta}$ b) $\dfrac{A}{1 - A\beta}$

    c) $\dfrac{1}{1 + A\beta}$ d) $\dfrac{1}{1 - A\beta}$.

iv) CMRR of an OPAMP is the ratio of

    a) $\dfrac{\text{Differential Gain}}{\text{Common mode Gain}}$ b) $\dfrac{\text{Common mode Gain}}{\text{Differential Gain}}$

    c) $\dfrac{\text{Slew Rate}}{\text{Common mode Gain}}$ d) $\dfrac{\text{Slew Rate}}{\text{Differential Gain}}$

v) Conversion of $(444 \cdot 456)_{10}$ into its octal equivalent is

    a) 673·5136   b) 674·35136

    c) 674·735   d) none of these.

vi) NOR and NAND are called Universal logic gates because

    a) they are independent of input voltage starts

    b) any logic function can be realized by these gates

    c) it provides minimization technique

    d) none of these.

CS/B.Tech (NEW)/SEM-2/ES-201 (Pt-II-ECE)/2013

GROUP – B

Answer any *two* of the following. $2 \times 5 = 10$

2. Draw schematically the structure of an *n*-channel JFET and define the terms source, drain, gate and channel. Explain the importance of the term "Field effect".

3. With the help of a block diagram, explain the working principle of a feedback amplifier. Derive an expression for the voltage gain with feedback.

4. What is an operational amplifier (Op-Amp) ? Mention the properties of an ideal Op-Amp. What type of feedback is used in an Op-Amp adder ?

5. a) Perform the following number conversions :

    (i) $(10110.1101)_2 = (?)_{10}$

    (ii) $(143.3125)_{10} = (?)_2$

    b) Realize the Boolean expression using minimum number of NOR gates.

    $Y = (A + \overline{B})\ (\overline{A} + B)$ $3 + 2$

2024   9   [Turn over

CS/B.Tech (NEW)/SEM-2/ES-201 (Pt-II-ECE)/2013

GROUP – C

Answer any *two* of the following.   2 × 10 = 20

6. a) What are the advantages of FET over BJT ?

    b) What do you mean by pinch-off voltage ?

    c) As V_{GS} is changed from –1 V to – 1·5 V keeping V_{DS} constant, I_D of FET drops from 7 to 5 mA. What is the transconductance of FET ? If the ac drain resistance is 200 kΩ, find also the amplification factor of the FET.

    3 + 2 + 5

7. a) Draw and explain the operation of an Op-Amp integrator circuit.

    b) An inverting amplifier has R_F = 500 kΩ, R_I = 5 kΩ. Determine the voltage gain, output voltage and input current if the input voltage is 0·1 V.   5 + 5

8. a) Draw the circuit diagram of an emitter follower and explain the nature of feedback in this circuit. What is the feedback topology of emitter follower ?

    b) The open loop gain of an amplifier changes by 20% due to the changes in the parameters of the active amplifier device. If a change of gain by 2% is allowable, what type of feedback has to be applied ? If the amplifier gain with feedback is 10, find the minimum value of the feedback ratio and the open loop gain.   4 + 6

CS/B.Tech (NEW)/SEM-2/ES-201 (Pt-II-ECE)/2013

9. Write short notes on any *two* of the following : 2 × 5

   a) Enhancement type MOSFET

   b) Barkhausen Criteria

   c) CMRR

   d) De Morgan's Theorem.

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