

Code No: Z0521/R07

Set No. 1**I B.Tech Supplementary Examinations, Nov/Dec 2011****BASIC ELECTRICAL ENGINEERING****(Common to Computer Science & Engineering, Information Technology
and Computer Science & Systems Engineering)****Time: 3 hours****Max Marks: 80****Answer any FIVE Questions
All Questions carry equal marks**

1. (a) State ohm's law. What are its limitations?
(b) Derive an expression for the effective resistance of three resistors connected in series.
(c) Derive an expression for the effective resistance of three resistors connected in parallel. [4+6+6]
2. (a) Give a detailed comparison of series and parallel circuit.
(b) What are the applications, merits and demerits of a series circuit?
(c) What are the applications and advantages of a parallel circuit? [6+5+5]
3. (a) Calculate the amount of energy stored per unit volume.
(b) Field winding of a dc machine consists of 8 coils in series each containing 1200 turns. When the current is 3 A the flux in each coil is 20 mwb. Calculate
 - i. Energy stored
 - ii. Average value of induced emf if the circuit is broken in 0.1sec.
Find out the energy density of a coil having a magnetic flux density 1.5 wb/sq.m and a relative permeability of 1500. [6+10]
4. (a) A voltage of $200\sqrt{30}$ volts is applied to the parallel combination of two branches. The currents in the branches are $20\sqrt{60}$ A and $40\sqrt{30}$ A. Find the following
 - i. Branch impedance and its components
 - ii. Total impedance and its components
 - iii. Total admittance
 - iv. Power factor of the combined circuit.
(b) Two circuits A and B are connected in parallel to a 230V, 50Hz supply. Circuit A consists of a resistance $10\ \Omega$ in series with an inductive reactance of $10\ \Omega$ and circuit B consists of a resistance $20\ \Omega$ in series with a capacitive reactance of $10\ \Omega$. Determine total current drawn from the supply by admittance method. [8+8]
5. (a) Explain the principle of working of a single phase transformer.
(b) Derive from the first principles, the emf equation of a single phase transformer. [8+8]

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6. What are the main parts of a DC machine? State the function of each part with relevant figures. [6+10]
7. (a) Derive the condition for maximum torque
- i. Under running condition
 - ii. At starting condition.
- (b) A 400V, 4 pole 3 phase, 50 Hz ,star connected induction motor has a rotor resistance and reactance per phase equal to 0.01Ω and 0.1Ω respectively. Determine
- i. Starting torque
 - ii. Slip at which maximum torque will occur
 - iii. Speed at which maximum torque will occur
 - iv. Maximum torque at running condition. [8+8]
8. Explain with neat sketch the construction and working of a MI ammeter and MC ammeter. [8+8]

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1. (a) A 100W, 250V bulb is put in series with a 40W, 250V bulb across a 500V supply. What will be the power consumed by each bulb? Will such a combination work?
(b) State and explain Kirchoffs current law and voltage law. [10+6]
2. (a) Give a detailed comparison of series and parallel circuit.
(b) What are the applications, merits and demerits of a series circuit?
(c) What are the applications and advantages of a parallel circuit? [6+5+5]
3. Define the following:
 - (a) Magnetic field
 - (b) Magnetic circuit
 - (c) Magnetic flux
 - (d) Magnetic flux density
 - (e) MMF
 - (f) Reluctance
 - (g) Magnetic field strength
 - (h) Permeability [16]
4. (a) A capacitor having a capacitance of $10 \mu\text{F}$ is connected in series with a non inductive resistance of 120Ω across 100V, 50Hz. Calculate the power, current and the phase difference between current and voltage.
(b) In a R-C series circuit, voltage across the combination is given by $40 \sin(2000t+45)$, $R = 10 \Omega$. The current leads the voltage by $\pi/3$ radians. Find the value of C. Also find the expression for current. [8+8]
5. (a) A 6600 / 440V 1 phase 600 KVA transformer has 1200 primary turns. Find
 - i. Transformation ratio
 - ii. Secondary turns
 - iii. Voltage per turn
 - iv. Secondary current when it supplies a load of 400 KW at 0.8 p.f lagging.

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- (b) The number of turns on the primary and secondary windings of a single phase transformer are 350 turns and 35 turns respectively. If the primary is connected to a 2.2 KV, 50 Hz supply, determine the secondary voltage on no-load. [8+8]
6. (a) A short shunt compound generator supplied 7.5 KW at 230 V. The shunt field, series field and armature resistances are 100 Ω , 0.3 Ω and 0.4 Ω respectively. Calculate the induced emf and the load resistance.
- (b) Write down the similarities and dissimilarities between motors and generators.
- (c) Explain the motoring and generating actions of a DC machine. [6+5+5]
7. (a) Derive the condition for maximum torque
- Under running condition
 - At starting condition.
- (b) A 400V, 4 pole 3 phase, 50 Hz, star connected induction motor has a rotor resistance and reactance per phase equal to 0.01 Ω and 0.1 Ω respectively. Determine
- Starting torque
 - Slip at which maximum torque will occur
 - Speed at which maximum torque will occur
 - Maximum torque at running condition. [8+8]
8. What is meant by underdamping and critical damping? Explain. [8+8]

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1. (a) A copper wire of diameter 1cm has resistance of 0.15Ω . It was drawn under pressure so that its diameter was reduced to 50%. What is the new resistance of the wire?
- (b) State and explain Faradays law of electromagnetic induction. [10+6]
2. Calculate the current through $2+j3\Omega$ impedance by superposition theorem as shown in figure 2. [16]

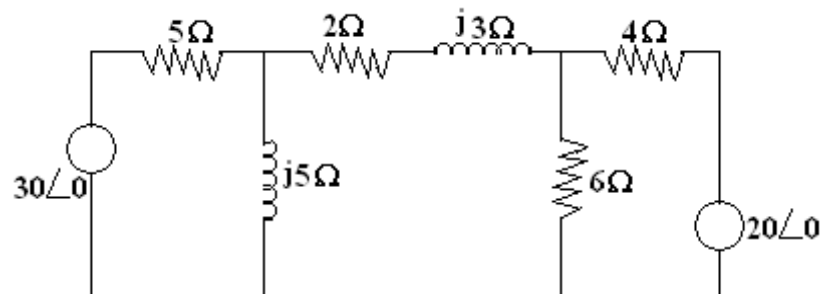


Figure 2

3. (a) From first principles, obtain an expression for the energy stored in a magnetic field.
- (b) An iron ring of cross sectional area 800 sq.mm and of mean radius 170 mm has two windings connected in series one of 500 turns and the other 700 turns. If the relative permeability of iron is 1200, find [6+10]
 - i. Self inductance of each coil
 - ii. Mutual inductance assuming that there is no leakage.
4. An inductive coil of resistance 20Ω and reactance 31.4Ω is connected in parallel with a capacitance of $72.1\mu\text{F}$ across a 100 V, 50Hz supply. Find the total current, power factor, power absorbed. Draw the phasor diagram of the circuit. [4×4]
5. (a) Explain the principle of working of a single phase transformer.
- (b) Derive from the first principles, the emf equation of a single phase transformer. [8+8]
6. (a) Based on the type of excitation classify the DC generators.

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- (b) A 4 pole DC generator with a shunt field resistance of 100Ω and armature resistance of 1Ω has 378 wave connected conductors in its armature. The flux per pole is 0.02 Wb . If a load resistance of 10Ω is connected across the Armature terminals and the generator is driven at 1000 rpm, calculate the power absorbed by the load. [6+10]
7. (a) Derive the equation for torque of a three phase induction motor.
- (b) A three phase slip ring induction motor gives a reading of 55 V across the slip rings on a open circuit, when at rest with normal stator voltage applied. the rotor is star connected and has an impedance of $0.7+j5 \Omega/\text{ph}$. Find the rotor current when the machine is
- At standstill with slip rings joined to a star connected starter with phase impedance of $4+j3 \Omega$ and
 - Running normally with 5% slip. [6+10]
8. Classify different types of MI instruments and give one example each. [16]

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Answer any FIVE Questions
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1. Explain the following terms:

- (a) Charge
- (b) Electric potential
- (c) Potential difference
- (d) Electric current
- (e) Resistance
- (f) Conductance
- (g) Power
- (h) Electrical energy

[2+2+2+2+2+2+2+2]

2. Find the voltage across AB by using superposition theorem as shown in figure 2.

[16]

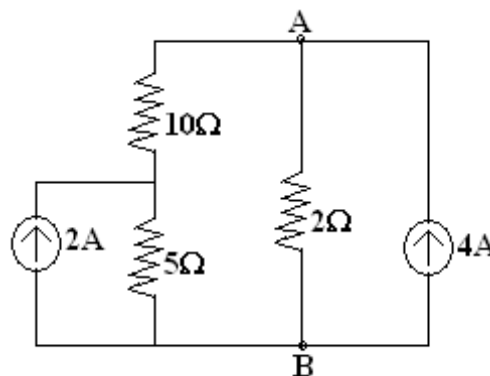


Figure 2

3. (a) Explain as to what you understand by

- i. Static
- ii. Dynamic inducement of electromotive force. Illustrate by the help of simple sketches.

(b) A coil of 100 turns is linked by a magnetic flux of 20mwb. If this magnetic flux is reversed in a time of 2ms, calculate the average emf induced. [6+10]

4. An inductive coil of resistance $12\ \Omega$ and inductance $0.0398\ \text{H}$ is connected in parallel with a capacitive branch having resistance of $20\ \Omega$ and capacitance of $265.2\ \mu\text{F}$. The

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combination is connected across 220 V, 40 Hz mains. Calculate the total current taken by the combination. It is desired to raise the power factor of the combination as such a capacitor of capacitance $67.5 \mu\text{F}$ is connected in parallel with the above combination. Find the power factor of the resultant circuit. [8+8]

5. (a) What do you understand by efficiency of a transformer? Derive the condition for maximum efficiency.
- (b) A single phase transformer with a ratio of 440/110V takes a load current of 5A at 0.2 power factor lagging. If the secondary supplies a current of 120A at power factor of 0.8 lagging, estimate the current taken by the primary. [8+8]
6. (a) Based on the type of excitation classify the DC generators.
- (b) A 4 pole DC generator with a shunt field resistance of 100Ω and armature resistance of 1Ω has 378 wave connected conductors in its armature. The flux per pole is 0.02 Wb. If a load resistance of 10Ω is connected across the Armature terminals and the generator is driven at 1000 rpm, calculate the power absorbed by the load. [6+10]
7. Explain in detail the construction of a three phase induction motor specifying in detail the squirrel cage and slip ring rotor construction. [8+8]
8. What is the necessary torque required in indicating instrument? Explain. [8+8]
