

Code No: A109210801

**R09****Set No. 2**

II B.Tech I Semester Examinations, MAY 2011

**ELECTRICAL ENGINEERING**Common to Chemical Engineering, Mechatronics, Metallurgy And Material  
Technology

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions  
All Questions carry equal marks

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1. (a) Explain the term Mutual induction.  
(b) Discuss the performance of the two magnetic coils, if the coupling coefficient between them is low.  
(c) How to identify that two series connected magnetic coils flux is aiding each other. [15]
2. Explain the emf method for finding out the regulation of synchronous machine. [15]
3. (a) Derive an expression for induced emf in a transformer.  
(b) A single phase, 2200/250 V, 50 Hz transformer has a net core area of  $36 \text{ cm}^2$  and a maximum flux density of  $6 \text{ Wb/m}^2$ . Calculate the number of turns of primary and secondary. [15]
4. (a) Why is it preferred to obtain the Magnetization characteristic of a shunt Machine by exciting its field separately?  
(b) Why a DC Shunt generator is used for Battery charging?  
(c) Explain why a commutator and brush arrangement is necessary in DC machine? [15]
5. (a) Derive the expression for the starting torque of the 3- $\phi$  induction motor.  
(b) A 6 pole, 50 Hz squirrel cage induction motor runs on load at a shaft speed of 970 rpm. Calculate:
  - i. the percentage slip
  - ii. the frequency of induced current in the rotor. [15]
6. Explain the measurement of Power in a three phase unbalanced circuit using two wattmeter method with neat circuit and phasor diagrams. [15]
7. With the help of neat sketch. Explain the various protecting mechanisms used in the three point starter. [15]
8. (a) What are the main advantages of moving coil instruments?  
(b) A moving coil voltmeter with a resistance of  $20 \Omega$  gives a full scale deflection of 1200 when a potential difference of 100 mV is applied across it. The moving coil has dimensions of  $30 \text{ mm} \times 25 \text{ mm}$  and is wound with 100 turns. The

Code No: A109210801

R09

Set No. 2

control spring constant is  $0.375 \times 10^{-6}$  Nm/degree. Find the flux density in the air gap. Find also the diameter of copper wire of coil winding if 30% of instrument resistance is due to coil winding. Specific resistance of copper is  $1.7 \times 10^{-8}$   $\Omega$ m. [15]

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FIRSTRANKER

Code No: A109210801

**R09****Set No. 4**

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1. (a) Outline carefully the procedure for performing the short circuit test on a single-phase transformer.
- (b) Explain the procedure for conducting open circuit test. [15]
2. (a) State the logic supporting the Kirchhoff's Laws of Electrical Circuit?
- (b) A coil has a resistance of 22 ohms when its mean temperature is 20 degree centigrade and 26 ohms when its mean temperature is 70 degree centigrade. Find its mean temperature rise, when its resistance is 28 ohms and the ambient temperature is 15 degree centigrade. [15]
3. Discuss in detail the synchronous impedance method. [15]
4. (a) What are the factors which effect the speed of a DC shunt motors?
- (b) Is it possible to obtain the speed of DC shunt motor above its rated speed? Discuss in detail. [15]
5. What are the different effects used in producing deflecting torque in an analog instrument? Cite examples in which these effects are used. [15]
6. (a) Why the rotor of a three phase induction motor is set into rotation?
- (b) A 3- $\phi$  induction motor has 2 poles and is connected to 400V, 50 Hz supply. Calculate the actual rotor speed and rotor frequency when the slip is 4%. [15]
7. (a) In a 110 Volt Compound generator, the armature, shunt and series windings resistances are 0.06 ohm, 25 ohm and 0.04 ohm respectively. The load consists of 200 lamps each rated at 55 Watt, 110 volts. Find the total emf and armature current, when the machine is connected for:
  - i. long shunt &
  - ii. short shunt. How will the ampere turns of the series windings are changed if a diverter of 0.1 ohm resistance is connected across the series field in long shunt.
- (b) What is meant by reactance voltage in DC machines? What are its effects on the performance of a DC generator? [15]
8. (a) Explain in detail about the concepts of parallel resonance with suitable circuit.
- (b) Discuss active power, reactive power and apparent power in a single phase AC circuit. [15]

Code No: A109210801

R09

Set No. 4

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Code No: A109210801

**R09****Set No. 1**

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1. (a) What is meant by the saturation of the magnetic circuit of a DC machine?  
(b) What is the function of a brush in DC machine? Where are they located in DC machine?  
(c) Mention the three applications of DC shunt, series, differential compound and cumulative compound generators. [15]
2. Derive the expression for KVA output corresponding to the maximum efficiency of a 1- $\phi$  transformer and explain voltage regulation. [15]
3. (a) Derive an expression for the pitch factor of an alternator armature winding short chorded by some angle.  
(b) Derive an expression for the winding factor of an alternator. [15]
4. (a) Explain the 3-point starter used for starting DC motors. And also draw the connection diagram of a 3 point starter.  
(b) A 500 V DC shunt motor draws 5 Amperes on no-load. The armature resistance is 0.2 ohms and shunt field resistance is 1.1 Amperes. Estimate the output and efficiency when the input current is 25 Amperes. [15]
5. (a) A coil having 100 turns is placed in the magnetic field of 0.9 mwebers. Calculate the average e.m.f induced in the coil when it is moved in 0.05 sec from the given field to the field of 0.3 mwebers. If the resistance of the coil is 180 ohms, find the current e.m.f in the coil.  
(b) A wire of length 80 cm moves at right angles to its length at 35m/sec in a uniform magnetic field of flux density 1.0 wb/sq. m. Calculate the electromotive force induced in the conductor when the direction of motion is perpendicular to the field and inclined at 45 degrees to the direction of the field. [15]
6. (a) Derive an expression for the frequency of rotor currents of three phase induction motor.  
(b) A 4 pole, 3- $\phi$  induction motor is run at 1450 rpm from a 50 Hz supply system. Calculate the percentage slip and frequency of rotor currents. [15]
7. The control torque of an indicating instrument is exerted by two flat springs. The full scale torque is  $40 \times 10^{-6}$  N-m for a deflection of  $90^\circ$ . The modulus of elasticity and maximum stress for the string material are  $120 \text{ GN/m}^2$  and  $20 \text{ MN/m}^2$  respectively. Calculate the number of turns required and thickness of one spring if its width is 0.75 mm and its mean diameter is 11 mm. [15]

Code No: A109210801

R09

Set No. 1

8. (a) Three non inductive loads 10 Kwatts, 8 Kwatts and 6 Kwatts are connected between the three lines and neutral of a 3 - phase star connected system with a line voltage of 400 volts, 50 Hz. Calculate the current in each line and neutral.
- (b) A balanced three phase star connected load of 120 Kwatts draws a leading current of 60 Amperes from the supply mains when connected to a 3-phase 1200 V, 50 Hz AC mains. Find the load circuit constants per phase. [15]

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FIRSTRANKER

Code No: A109210801

**R09****Set No. 3**

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1. (a) Derive the condition for maximum efficiency.  
(b) Derive the expression for output KVA corresponding to the maximum efficiency of a 1- $\phi$  transformer. [15]
2. (a) Explain the behaviour of a Series R-C Circuit excited by a sinusoidal source under steady state with relevant waveforms and phasor diagram.  
(b) A single phase circuit consists of 3 parallel branches, admittance of the branches are  $Y_1 = 0.4 + j 0.6$  S,  $Y_2 = 0.1 + j 0.42$  S and  $Y_3 = 0.06 + j 0.23$  S. Determine the total admittance and impedance of the circuit. [15]
3. Discuss about Moving Iron instruments. [15]
4. (a) Explain why the predetermination of efficiency of DC series motor cannot be obtained from no load test?  
(b) A DC shunt generator delivers 50 Kwatts at 240 volts when running at 400 RPM. The armature resistance and field winding resistance are 0.02 ohms and 50 ohms respectively. Calculate the speed of the machine when running as a shunt motor and taking 50 Kwatts input at 240 volts. [15]
5. Explain the following:
  - (a) Working principle of alternator
  - (b) Pitch factor
  - (c) Distribution factor. [15]
6. (a) Obtain the Equivalent resistance as seen between nodes A and C for the circuit shown in figure 6a

Code No: A109210801

R09

Set No. 3

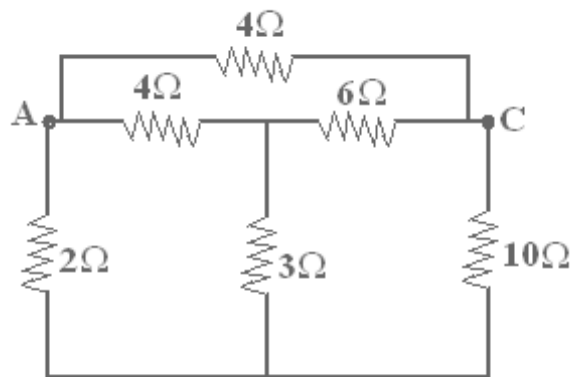


Figure 6a

- (b) A magnetic circuit has a mean core length of 150 cm and uniform cross sectional area of  $5 \text{ cm}^2$ . It has an airgap of 0.8 mm and is wound with a coil of 1000 turns. Determine the self inductance of the coil if the core material has a relative permeability of 1500. [15]
7. (a) Obtain an expression for the torque produced in a 3- $\phi$  induction motor.  
 (b) A 3- $\phi$  induction motor having a star connected rotor has an induced emf of 80 V between slip rings at stand still on open circuit. The rotor has a resistance and reactance per phase of  $1 \Omega$  and  $4 \Omega$  respectively. Calculate current per phase and power factor when the slip rings are connected to a star connected rheostat of  $3 \Omega$  per phase. [15]
8. Explain in detail the method of obtaining Load characteristics of DC Shunt generator with the help of neat circuit. And also mention the reasons for voltage drop at full load. [15]

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