

II B.Tech I Semester Supplementary Examinations, March 2006
ELECTRICAL ENGINEERING
 (Common to Mechanical Engineering, Chemical Engineering, Mechatronics,
 Metallurgy & Material Technology, Production Engineering and Automobile
 Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
 All Questions carry equal marks

1. Calculate the unknown resistance R and the current flowing through it when the current in the branch OC is zero.(figure 1) [16]

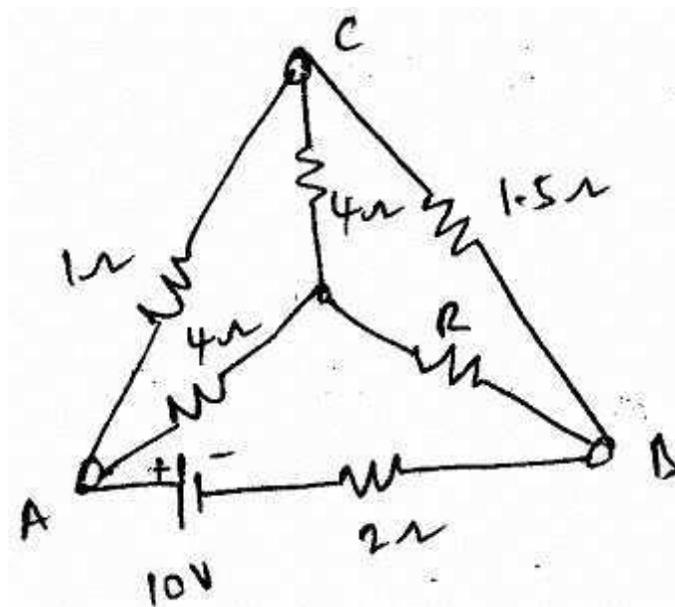


Figure 1:

2. (a) A sinusoidal source has a peak-to-peak value of 679V. Calculate r.m.s. power that it will deliver to a 40Ω heating element.
- (b) A current in a $2.2 \text{ k}\Omega$ resistor is $i = 5 \sin(2\pi 100t + 45^\circ)$ m A
- Write the mathematical expression for the voltage across the resistor.
 - What is the effective value of the resistor voltage?
 - What is the instantaneous value of the resistor voltage at 0.4ms? [16]
3. (a) With neat sketches, explain the construction and functions of the various parts of a d.c. machine.
- (b) Calculate the emf generated by a 6 pole lap wound armature with 65 slots and 12 conductors per slot, when driven at 1000 rpm. The flux/pole is 0.02 Wb.

[10+6]

4. (a) Why is the speed of a shunt motor practically constant?
(b) Draw the characteristics of shunt and series motors. [4+12]
5. A 10 KVA 6600/250V , 50 Hz , transformer gave the following test results.
OC Test 900 W at normal voltage.
SC Test 12A 290V 860 W data on LV side.
Calculate the % regulation at different power factors of both lagging and leading
At full load and draw the graph of % regulation verses power factor. Also locate
The maximum and minimum power factors from the graph. [16]
6. (a) Explain the rotating magnetic field developed in an Induction Motor.
(b) A 12 pole 3- phase alternator coupled to an engine running at 500rpm. It
supplies an induction motor which has a full load speed of 1440rpm. Find the
% slip and the number of poles of the motor. [9+7]
7. (a) Explain the construction of salient pole Alternator?
(b) A 3-phase star connected alternator has an open circuit line voltage of 6599
volts. The armature resistance and synchronous reactance are 0.6 ohms and
6 ohms per phase, respectively. Find terminal voltage and voltage regulation
if load current 180A at power factor of
 i. 0.9 lagging
 ii. 0.8 leading. [8+8]
8. A moving coil instrument which given full scale deflection with 15mA, has a copper
coil having a resistance of 1.5Ω at 15°C , and a temperature coefficient of $1/234.5$ at
 0°C in series with a resistor of 3.5Ω having a negligible temp coefficient. Determine
(a) the resistance of shunt required for a full scale deflection of 20A and
(b) the resistance required for a full scale deflection of 250v. If the instrument
reads correctly at 15°C , determine the percentage error in each case when the
temperature is 25°C . [16]

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1. Two coils A and B are wound on the same iron core. These are 500 turns as A and 3000 turns as B. A current of 5 amperes through coil A produces a flux of 600×10^{-6} wb in the core. If this current is reversed in $0.02 \mu\text{sec}$, calculate the average emf induced in coils A and B. [16]

2. (a) Briefly explain how alternating voltages are generated.
(b) A square coil of 10cm side and 100 turns is rotated at a uniform speed of 1000 revolutions per minute, about an axis at right angles to a uniform magnetic field of $0.5\text{wb}/\text{m}^2$. Calculate the instantaneous value at induced electromotive force, when the plane at the coil in
 - i. at right angles to the field
 - ii. in the plane of the field.[10+6]

3. (a) Give a brief note on lap and wave windings.
(b) A lap connected d.c. generator has 8 poles and 120 slots with 8 conductors in each slot. If the flux/pole is 0.035Wb
 - i. find the emf generated when the speed is 600rpm.
 - ii. What should be the speed of rotation if the induced emf is to be 500V?[6+10]

4. (a) Derive an expression for the torque developed in N-m and in Kf-m in a dc motor.
(b) Determine the value of torque in Kg-m developed by the armature of a 6-pole wave-wound motor having 492 conductors, 30mwb per pole when the total armature current is 40A. [8+8]

5. (a) In a test for the determination of the losses of a 440V, 50Hz transformer, the total iron losses were found to be 2500W at normal voltage and frequency. When the applied voltage and frequency were 220V, 25Hz, the iron loss were found to be 850W. Calculate the hysteresis and eddy current losses at normal voltage and frequency.

- (b) The following readings were obtained from OC and SC tests on 8KVA, 400/120V, 50Hz , transformer.

OC Test	on LV side	120V	4A	75W
SC Test	on HV side	9.5V	20A	110W

Calculate the voltage regulation and efficiency at full load 0.8 P.F lagging.

[8+8]

6. (a) Draw the torque slip characteristic and explain why it is in the shape of rectangular hyperbola.
- (b) If the electromotive force in the stator of an 8 pole induction motor has a frequency of 50Hz and that in the rotor is 1.5Hz .At what speed is the motor running and what is the slip?

[8+8]

7. (a) What are the three voltage drops occurring in an alternator on-load?
- (b) A 550 V, 55 KV A, single phase alternator has an effective resistance of 0.2 ohm. A field current of 10A produces an armature current of 200 A on short circuit, and an emf of 450 V on open circuit. Calculate
- The synchronous reactance;
 - The full- load regulation with power factor 0.8 lagging.

[8+8]

8. A voltage of 80.0V is applied to a circuit comprising two resistors of resistance 105Ω and 55Ω respectively. The voltage across the 55Ω resistor is to be measured by a voltmeter of internal resistance $100\Omega/V$. Given that the meter is set to a scale of 0-50V. Determine the voltage indicated.

[16]

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1. (a) Explain "Self and mutual Inductance".
(b) If a coil of 150 turns is linked with a flux of 0.01 wb when carrying of 10A, calculate the inductance of the coil. [8+8]
2. (a) Deduce the relationship between the phase and line voltage in a 3- ϕ
 - i. star and
 - ii. delta connected circuits.(b) A 3- ϕ , 400 V, star connected alternator supplies a 3- ϕ , 112 Kw mesh- connected induction motor of efficiency and p.f. 0.88 and 0.86 respectively. Find the current
 - i. in each phase
 - ii. in each generator lphase and
 - iii. active and reactive components of currents in each case.[8+8]
3. (a) Explain the classification of d.c generators with neat diagrams and corresponding voltage equations for each.
(b) A 250V short shunt compound generator is delivering 80A. The armature, series and Shunt field resistances are 0.05, 0.03, and 100 ohms respectively. Calculate the voltage induced allowing a brush drop of 2V. [10+6]
4. (a) Explain DC motor principle and its working
(b) A 250v shunt motor on no-load runs at 1000rpm and takes 5A the total armature and shunt field resistances are 0.2 Ω and 250 Ω respectively calculate the speed when loaded and taking current of 50A if armature reaction weakens the filed by 3%. [6+10]
5. (a) Explain the principle of operation of a 1- phase transformer
(b) A single phase transformer has 400 primary and 1000 secondary turns. The net constructional area of the core is 60 cm². If the primary winding is connected to a 50Hz supply at 520V. Calculate

- i. Peak value of flux density in the core.
- ii. Voltage induced in the secondary winding.
- iii. Transformation ratio.
- iv. EMF induced per turn in both the windings.

[8+8]

6. (a) Draw the torque slip characteristic and mark the operating region of the motor in regard to its safety.
- (b) A 3- phase , 6 pole , 50Hz induction motor has a slip of 1% at no load and 3% at full load. Find
- i. Synchronous speed
 - ii. No load speed
 - iii. Full load speed
 - iv. Frequency of rotor current at standstill
 - v. Frequency of rotor current at full load.

[6+10]

7. The following test results are obtained on a 6600V alternator.

OC Voltage in volts	3100	4900	6400	7500	8300
Field current in Amps	16	25	37.5	50	70

A field current of 20 Amps is required to circulate full load current as short circuit of armature. Calculate full load regulation at 0.8 PF lag by synchronous impedance method. [16]

8. (a) Explain with the aid of a circuit diagram, how a DC voltmeter may be calibrated by means of a potentiometer method.
- (b) By a moving coil instrument, used as a voltmeter, has a coil of 150 turns with a width of 3cm and an active length of 3cm. The gap flux density is 0.15 T. If the full-scale reading is 150V and the total resistance of the instrument is 100000Ω find the torque exerted by the control springs at full scale.

[8+8]

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1. (a) What are the losses takes place due to the effects hysteresis and eddy currents.
(b) Explain the application of “Lenzs law:” [10+6]

2. (a) Explain the principle behind the generation of 3- ϕ e.m.f and phase sequence
(b) Three inductive coils, each with a resistance of 15 ohms and an inductance of 0.03 H are connected
 - i. in star and
 - ii. in delta, to 3- ϕ 400 V, 50 Hz supply. Calculate for each of the above case
 - i. phase current and line current and
 - ii. total power absorbed.[8+8]

3. (a) With neat sketches, explain the construction and functions of the various parts of a d.c. machine.
(b) Calculate the emf generated by a 6 pole lap wound armature with 65 slots and 12 conductors per slot, when driven at 1000 rpm. The flux/pole is 0.02 Wb.
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4. (a) Explain DC motor principle and its working
(b) A 250v shunt motor on no-load runs at 1000rpm and takes 5A the total armature and shunt field resistances are 0.2 Ω and 250 Ω respectively calculate the speed when loaded and taking current of 50A if armature reaction weakens the filed by 3%.
[6+10]

5. (a) In a 50 KVA, 11 KV/400V Transformer, the Iron and Copper losses are 500W and 600W respectively under rated conditions.
 - i. Calculate the efficiency on unity power factor at full load.
 - ii. Find the load for maximum efficiency of the Iron and Copper losses corresponding to this load.
(b) What are the various losses taking place in a Transformer? State the parts of a Transformer in which they occur classify them into constant, and variable losses.
[8+8]

6. (a) Explain the principle of operation of a 3 phase induction motor.
(b) A 3 phase, 4 pole, delta connected induction motor has a full load slip of 5%. If the supply frequency is 50Hz, find the full load speed, synchronous speed and rotor frequency.
- [9+7]
7. (a) Explain Pessimistic method of finding regulation of a given alternator.
(b) The effective resistance of a 2200V, 50Hz, 440KVA, 1-phase alternator is 0.5 Ohms. On short circuit a field current of 40 Amps gives the full load current of 200Amps. The EMF on open circuit with the same field excitation is 1160V. Calculate
- i. Synchronous impedance
 - ii. Synchronous reactance
 - iii. % regulation at 0.707 PF leading
- [8+8]
8. (a) Sketch and describe the construction of a moving coil ammeter and give the principle of operation.
(b) A moving coil instrument gives full scale deflection with 15mA and has a resistance of 5Ω . Calculate the resistance of the necessary components in order that the instrument may be used as
- i. a 2A - Ammeter
 - ii. a 100V voltmeter.

[8+8]
