

**II B.Tech II Semester Supplementary Examinations,
November/December 2005
ELCTRICAL AND ELECTRONICS ENGINEERING
(Aeronautical Engineering)**

Time: 3 hours**Max Marks: 80**

**Answer any FIVE Questions
All Questions carry equal marks**

1. (a) Derive an expression for mutual inductance for a coupled circuit.
(b) A ballistic galvanometer, connected to a search coil for measuring flux density in a core, gives a throw of 100 scale divisions on reversal of flux. The galvanometer coil has a resistance of 180 ohm. The galvanometer constant is 100 micro C per scale division. The search coil has an area of 50cm^2 , wound with 1000 turns having a resistance of 20 ohm. Calculate the flux density in the core. [6+10]
2. (a) Discuss the principle of operation of motor.
(b) The following information is given for a 300kW, 600V, long -shunt compound generator : shunt field resistance = 75Ω , armature resistance including brush resistance = 0.012Ω , diverter resistance = 0.036Ω . When the machine is delivering full load, calculate the voltage and power generated by the armature. [6+10]
3. (a) How do you predetermine the efficiency of a transformer? Explain.
(b) A 25kVA, 2200/220V, 50Hz, single phase transformer has the following resistance and leakage reactances. $R_1=0.8$ ohm, $X_1=3.2$ ohm, $R_2=0.01$ ohm, $X_2=0.03$ ohm. Calculate the equivalent resistance and reactance referred to secondary side. [6+10]
4. (a) Calculate the rms value of the induced emf per phase of a 10-pole, 3-phase, 50 Hz alternator with 2 slots per pole per phase and 4 conductors per slot. The coil span is 150° , the flux per pole is 0.12 Wb.
(b) A 3-phase, star-connected alternator has the following data : Voltage required to be generated on open circuit = 400V (at 50Hz) ; speed = 500 rpm ; stator slots / pole / phase = 3; conductors / slot = 12. Calculate
 - i. Number of poles and
 - ii. Useful flux pole.[8+8]
5. (a) Explain the crystal structure of N - type Semi Conductor with neat diagram
(b) Derive an expression for conductivity of Intrinsic Semi Conductor. [8+8]
6. Compare the input characteristics of CB and CE configurations. What is the effect of base width modulation on these characteristics? [16]
7. (a) State and explain the applications of Tunnel diode.

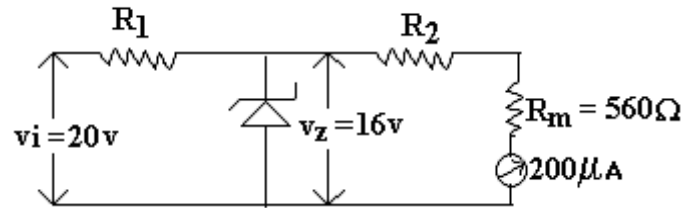


Figure 1:

(b) In the following circuit find values of R_1 and R_2 . (Figure 1)

[8+8]

8. Sketch the block diagram of CRT , explain every part in it in detail.

[16]

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1. (a) Derive an expression for Parallel Resonance AC circuit.
(b) An RLC series resonant circuit has the following parameters : Resonance frequency = $5000/2\pi$ Hz; impedance at resonance = 56 ohms and Q-factor = 25. Calculate the capacitance of the capacitor and the inductance of the inductor. Assuming that these values are independent of the frequency, find the two frequencies at which the circuit impedance has a phase angle of $\pi/4$ radian. [6+10]
2. (a) Explain the back emf in motor.
(b) A long-shunt compound generator delivers a load current of 50A at 500V and has armature, series field and shunt field resistances of 0.05Ω , 0.03Ω and 250Ω respectively. Calculate the generated voltage and the armature current. Allow 1 V per brush for conduct drop. [6+10]
3. (a) Why is efficiency of transformer is generally high?
(b) A 200kVA, single phase transformer has an efficiency of 98 percent at F.L. if the maximum efficiency occurs at $3/4$ F.L. Calculate
 - i. the iron loss,
 - ii. the copper loss at F.L.
 - iii. the efficiency at half – load. Assume a p.f. of 0.8 at all loads. [6+10]
4. (a) The stator of a 3-phase, 8-pole synchronous generator driven at 750 rpm has 72 slots. The winding has been made with 36 coils having 10 turns per coil. Calculate the rms value of induced emf per phase if the flux per pole is 0.162 web, sinusoidally distributed. Assume that full pitch coils have been used.
(b) The power input to the rotor of a 440V, 50Hz, 6-pole, 3-phase inductor motor is 80KW. The rotor electromotive force is observed to make 100 complete alternations per minute. Calculate
 - i. Slip
 - ii. rotor speed
 - iii. rotor copper losses per phase
 - iv. mechanical power developed and
 - v. the rotor resistance per phase if the rotor current is 60A. [8+8]
5. (a) Classify the Conductors , Insulators and Semi Conductors based on energy band theory.

- (b) Find the concentration of holes and electrons in P – type germanium at 300°K if the resistivity is $0.1\ \text{ohm} - \text{cm}$. If $\mu_n = 3800\ \text{cm}^2 / \text{volt} - \text{sec}$, $\mu_p = 1800\ \text{cm}^2 / \text{volt} - \text{sec}$, $n_i = 2.5 \times 10^{13}$. Assume any necessary data. [8+8]
6. (a) Explain the current components of a PNP transistor with neat sketch.
(b) For an NPN transistor if $\alpha = 0.98$ and $I_E = 2\text{mA}$ find I_C and I_B . Neglect reverse saturation current. [10+6]
7. Explain the operation of Tunnel diode with help of energy band diagrams. [16]
8. (a) Derive electrostatic deflection sensitivity.
(b) In a CRT the distance of the screen from centre of the magnetic field is $20\ \text{cm}$. The deflecting magnetic field of flux density $0.1\ \text{mWb} / \text{sq.m}$ extends for a length of 2cm along the tube axis. The final anode voltage is 800V . Calculate the deflection of the spot. [12+4]

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1. A shunt field coil is required to develop 1,500AT with an applied voltage of 60V. The rectangular coil is having a mean length of turn of 50 cm. Calculate the wire size. Resistivity of copper may be assumed to be micro ohm-cm at the operating temperature of the coil. Estimate also the number of turns if the coil is to be worked at a current density of 3 A/mm^2 . [16]
2. (a) Explain the back emf in motor.
(b) A long-shunt compound generator delivers a load current of 50A at 500V and has armature, series field and shunt field resistances of 0.05Ω , 0.03Ω and 250Ω respectively. Calculate the generated voltage and the armature current. Allow 1 V per brush for conduct drop. [6+10]
3. (a) Why is efficiency of transformer is generally high?
(b) A 200kVA, single phase transformer has an efficiency of 98 percent at F.L. if the maximum efficiency occurs at $3/4$ F.L. Calculate
 - i. the iron loss,
 - ii. the copper loss at F.L.
 - iii. the efficiency at half – load. Assume a p.f. of 0.8 at all loads. [6+10]
4. (a) A 550V, 55KVA, single-phase alternator has an effective resistance of 0.25 ohm. A field current of 10A produces an armature current of 200A on short circuit and an emf of 500V on open circuit. Calculate
 - i. synchronous impedance
 - ii. synchronous reactance
 - iii. Full-load voltage regulation at 0.8 pf lag.
(b) A three phase, 6-pole, 50Hz induction motor has to full load output of 15kW at 970 rpm. The mechanical losses are 350W and stator losses are 1000W, calculate
 - i. The full load slip
 - ii. the rotor copper loss
 - iii. the rotor input power
 - iv. stator input power
 - v. rotor frequency
 - vi. the full load efficiency. [8+8]

5. (a) Explain the following terms for P – N junction.
- i. Potential barrier
 - ii. Depletion region
- (b) The resistivities of the two sides of a step graded silicon diode are 2 ohm – cm (p - side) and 1 ohm – cm (n - side). Calculate the height of E_0 of the potential energy barrier. . If $n = 1300 \text{ cm}^2 / \text{volt} - \text{sec}$, $\mu_p = 500 \text{ cm}^2 / \text{volt} - \text{sec}$, $n_i = 1.5 \times 10^{10}$. Assume any necessary data. [8+8]
6. (a) Explain the current components of a PNP transistor with neat sketch.
- (b) For an NPN transistor if $\alpha = 0.98$ and $I_E = 2\text{mA}$ find I_C and I_B .Neglect reverse saturation current. [10+6]
7. Sketch and explain the drain and transfer characteristics of JFET. [16]
8. Write short notes on the following.
- (a) Delay line
 - (b) Time base generator
 - (c) CRO probes. [16]

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1. (a) Explain the current division in a parallel circuit.
(b) A series circuit with a resistor of 100 ohm capacitor of 25 micro Farad and inductance of 0.15H is connected across 220V, 60Hz supply. Calculate
 - i. current
 - ii. power and
 - iii. power factor in the circuit.[6+10]
2. (a) What are the various Industrial applications for D.C. motors.
(b) A 400V, 20kW shunt motor takes 50A and runs at 1200 rpm. The $R_{sh} = 200\Omega$. Calculate the Resistance to be connected in series with the armature to reduce the speed to 900rpm. Assume the load torque varies as the square of the speed. Neglect iron, friction losses. [6+10]
3. (a) Why is efficiency of transformer is generally high?
(b) A 200kVA, single phase transformer has an efficiency of 98 percent at F.L. if the maximum efficiency occurs at $3/4$ F.L. Calculate
 - i. the iron loss,
 - ii. the copper loss at F.L.
 - iii. the efficiency at half – load. Assume a p.f. of 0.8 at all loads.[6+10]
4. (a) Why are alternator rated in kVA?
(b) A 3-phase induction motor is wound for 4 poles and is supplied from 50Hz system. Calculate
 - i. the synchronous speed
 - ii. the rotor speed when slip is 4% and
 - iii. rotor frequency when rotor runs at 600 rpm.[6+10]
5. (a) Explain the variations of charge density , electric field and potential of open circuit P – N junction.
(b) The resistivities of the two sides of a step graded germanium diode are 2 ohm – cm (p - side) and 1 ohm - cm (n - side). Calculate the height of E_o of the potential energy barrier. If $n = 3800 \text{ cm}^2 / \text{volt - sec}$, $\mu_p = 1800 \text{ cm}^2 / \text{volt - sec}$, $n_i = 2.5 \times 10^{13}$. Assume any necessary data. [8+8]
6. (a) Explain the current components of a PNP transistor with neat sketch.

- (b) For an NPN transistor if $\alpha = 0.98$ and $I_E = 2\text{mA}$ find I_C and I_B .Neglect reverse saturation current. [10+6]
7. What is meant by FET configuration? Classify and explain the different FET configurations. [16]
8. (a) Define magnetic force . Discuss electron movement in uniform magnetic field.
(b) Explain horizontal deflection system of CRO. [8+8]
