

Marks Obtained:

KATHMANDU UNIVERSITY  
End Semester Examination [C]  
November, 2017

Level : B.E.  
Year : II

Course : EEG 207  
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date

NOV 17 2017

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose the most appropriate option.

1. Which material is used as a conducting material in electrical machines?  
a. Iron                      b. Aluminium                      c. Nickel                      d. Copper
2. Which of the following is the example for piezo-electric material?  
a. Lead zirconate titanate                      b. Copper  
c. Potassium niobate                      d. Gold
3. A material with unequal anti-parallel atomic magnetic moments is \_\_\_\_\_  
a. Ferrimagnet                      b. An antiferromagnet                      c. A ferrite                      d. Non-magnetic
4. What happens to the free electrons when electric field is applied?  
a. They move randomly and collide with each other  
b. They move in the direction of the field  
c. They remain stable  
d. They move in the direction opposite to that of the field
5. What is the level that acts as a reference which separates the vacant and filled states at 0 Kelvin?  
a. Excited level                      b. Ground level                      c. Valance orbit                      d. Fermi energy level
6. The drift velocity of free electrons with mobility of  $3.5 \times 10^{-3} \text{ m}^2/\text{Vs}$  in copper for an electric field strength of 0.5 V/m is \_\_\_\_\_  
a. 3.5 m/s                      b.  $1.75 \times 10^3 \text{ m/s}$                       c. 11.5 m/s                      d.  $1.75 \times 10^{-3} \text{ m/s}$
7. When a pure semiconductor is heated, its resistance \_\_\_\_\_  
a. Goes up                      b. Goes down                      c. Can't say                      d. Remains same
8. Fermi energy level for p-type extrinsic semiconductors lies \_\_\_\_\_  
a. At the middle of band gap                      b. Close to the conduction band  
c. Can't be predicted                      d. Close to the valance band
9. The  $\text{SiO}_2$  layer in an IC acts as \_\_\_\_\_  
a. Resister                      b. Capacitor                      c. Inductor                      d. Insulating layer
10. Packing efficiency of face centered cubic unit cell is \_\_\_\_\_  
a. 52%                      b. 68%                      c. 74%                      d. 82%

11. The responsivity of a photodiode having quantum efficiency of 1% at  $0.8\mu\text{m}$  is \_\_\_\_\_  
 a.  $6.4\text{ mA/w}$       b.  $4.5\text{ mA/w}$       c.  $2.4\text{ mA/w}$       d.  $0.4\text{mA/w}$
12. What is the process of producing electric dipoles inside the dielectric by an external electric field?  
 a. Polarisation      b. Dipole moment      c. Depolarisation      d. Magnetisation
13. If X represents the susceptibility, C represents the Curie constant,  $\theta$  represents the Curie temperature and T is absolute temperature which of the following represents Curie-Weiss law?  
 a.  $X = C/(T - \theta)$       b.  $X = C/(T + \theta)$       c.  $X = (T - \theta)/ C$       d.  $X = (T + \theta)/ C$
14. In IC fabrication process, metallization is done for \_\_\_\_\_  
 a. Protection      b. Packaging      c. Cleaning      d. Interconnection
15. The density of states in the conduction band for energy level E is proportional to \_\_\_\_\_  
 a. E      b.  $\sqrt{E}$       c.  $E^{1.5}$       d.  $E^2$
16. In which of these is reverse recovery time nearly zero?  
 a. Zener diode      b. Tunnel diode      c. Schottky diode      d. PiN diode
17. A varactor diode is used for  
 a. Tuning      b. Rectification  
 c. Amplification      d. Rectification and amplification
18. In which regions does BJT act like switch?  
 a. Reverse active and cut off      b. Cut off and forward active  
 c. Saturation and active      d. Cut off and saturation
19. A uniform silver wire has a resistivity of  $1.54 \times 10^{-18}\text{ ohm/m}$  at room temperature. For an electric field along the wire of 1 volt/cm. The mobility, assuming that there are  $5.8 \times 10^{28}$  conduction electrons/ $\text{m}^3$  is \_\_\_\_\_  
 a.  $1.54\text{ m}^2/\text{Vs}$       b.  $6.9973\text{ m}^2/\text{Vs}$       c.  $6.9973 \times 10^{-3}\text{ m}^2/\text{Vs}$       d.  $0.69973\text{ m}^2/\text{Vs}$
20. The dielectric strength of ferroelectric materials depends to a large extent on \_\_\_\_\_  
 a. Area of hysteresis loop for the material  
 b. Presence of magnetic materials in the vicinity  
 c. Intensity of electric field  
 d. Frequency of applied voltage

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November, 2017

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Level : B.E.  
Year : II  
Time : 2 hrs. 30 mins.

Course : EEG 207  
Semester : I  
F. M. : 40

SECTION "B"  
[4 Q × 10 = 40 marks]

Attempt ANY FOUR questions. Figure in the margin indicates the full mark. Symbols have their usual meaning. Students are required to answer in their own words as far as practicable.

1.
  - a. Find the percentage of empty space in body centered cubic unit cell (BCC). [5]
  - b. Derive an expression to locate the Fermi energy level in n type semiconductor material. [5]
2.
  - a. Obtain expression for the energy of an electron in a potential well. Also explain the fact that energy of electron is quantized. [3+1]
  - b. A 0.46  $\mu\text{m}$  thick sample of GaAs is illuminated with monochromatic light having photon energy of 2eV. The absorption coefficient is  $5 \times 10^4 \text{ cm}^{-1}$ . The power incident on the sample is 10 mW.
    - (i) Find the total energy absorbed by the sample per second
    - (ii) Find the rate of excess thermal energy given up by the electrons to the lattice before recombination
    - (iii) Assuming perfect quantum efficiency, find the number of photons per second given off from recombination events. [3]
  - c. How does a tunnel diode work? Explain with VI curve. [3]
3.
  - a. Differentiate between direct band gap and indirect band gap semiconductor materials with examples. [2]
  - b. A sample of Si, doped with  $10^{17}$  pentavalent atoms per  $\text{cm}^3$ . If width of conductor is 100 $\mu\text{m}$ , magnetic field strength is  $10^{-5} \text{ Wb/cm}^2$ , current density is 1  $\text{mA/cm}^2$  and mobility is equal to 700 $\text{cm}^2$ . Find its resistivity and Hall volage. [2]
  - c. Derive the time independent form of Schrodinger wave equation and explain the significance of Schrodinger equations. [4]
  - d. List the general considerations for the selection of materials for any applications. [2]
4.
  - a. What are the applications of superconductors? How do you classify the superconductors? Explain with examples. [2+3]
  - b. What does monolithic integrated circuit refer? Describe the general IC fabrication process with reference to PNP bipolar junction transistor. [1+4]

5.

- a. Briefly explain the frequency dependence of polarizability in dielectric materials. [2]
- b. Calculate the Curie constant for a paramagnetic material that was inserted at room temperature (300K) in a magnetic field of  $1.2 \times 10^4$  A/m and whose magnetic induction was measured to be 0.05T. Assume that Curie temperature is zero. [2]
- c. Explain the hysteresis and eddy-current loss in magnetic materials. [2]
- d. Write short notes on: [2 × 2]
  - (i) Fermi-Dirac distribution function
  - (ii) Effective mass of electron



# KATHMANDU UNIVERSITY

OFFICE OF THE CONTROLLER OF EXAMINATIONS

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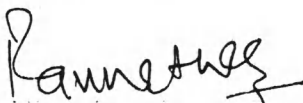
December 26, 2017

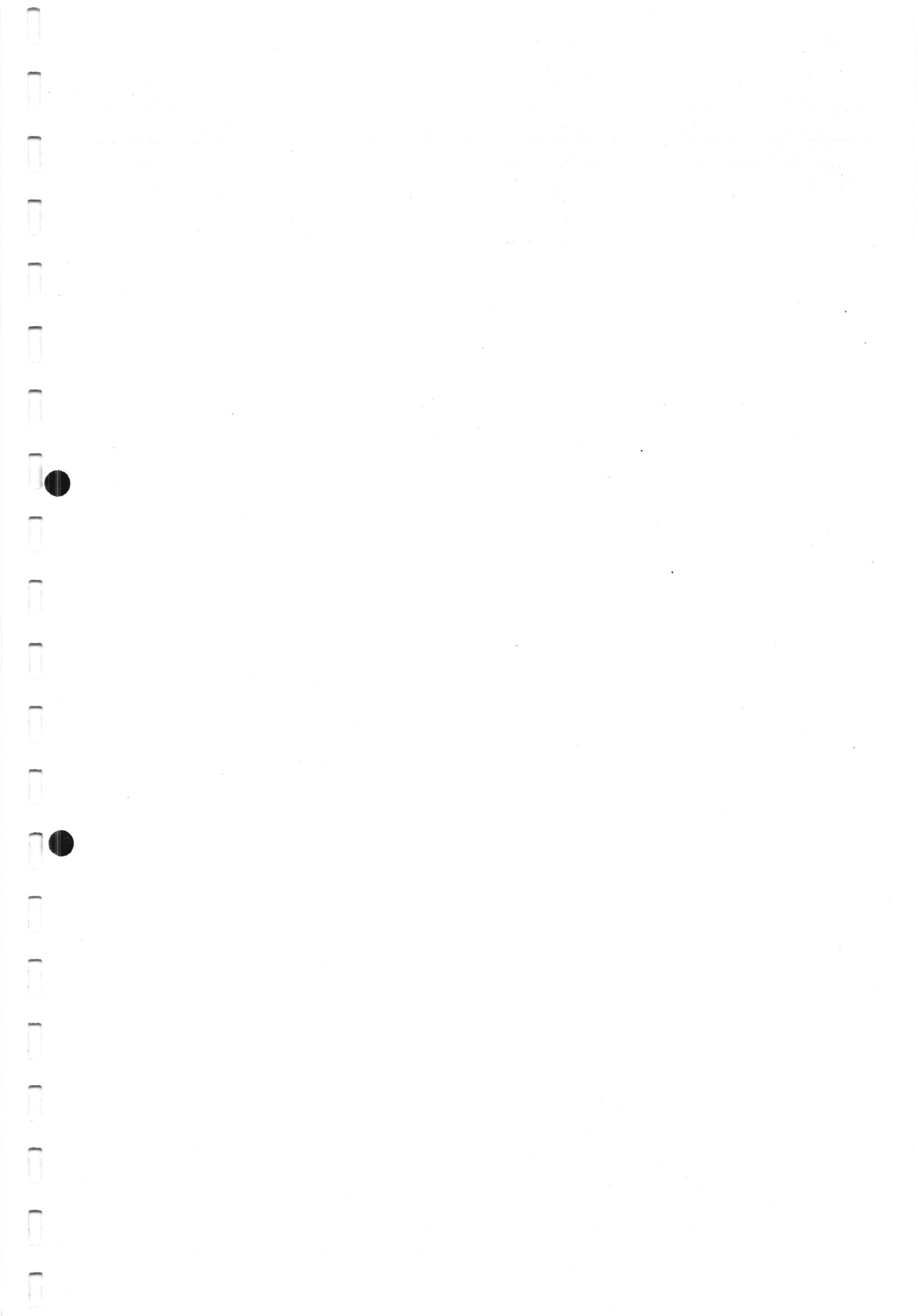
## NOTICE

End-Semester Compartmental Examinations of B.E./B.Sc./B.Pharm./B.Tech. students will be held according to the following schedule.

Date	Day	Courses
January 5, 2018	Friday	MATH 104, MATH 102, MEEG 202, EEEG 309, CIEG 308, BIOT 307, ENVS 303, GEOM 313, MEEG 309, PHAR 315
January 7, 2018	Sunday	BIOL 206, BIOT 207, CIEG 208, GEOM 204, INAN 211, EEEG 303, CIEG 312, MEEG 306.
January 8, 2018	Monday	ENGG 112, CHEM 102, MATH 208, PHYS 311, BIOT 308, ENVS 331, PHAR 311, CIEG 317, GEOM 315
January 9, 2018	Tuesday	BIOT 209, CIEG 212, CIEG 209, MEEG 206, COMP 232, COMP 201, COMP 204, CHEM 203, COMP 302, COMP 315, CIEG 313
January 10, 2018	Wednesday	COMP 116, COMP 102, MGTS 301, COEG 304, EPEG 318, ETEG 305, CIEG 309, PHYS 312, BIOT 309
January 11, 2018	Thursday	MEEG 207, BIOT 210, COMP 231, COMP 304, COMP 323, MEEG 316, CIEG 314, ENVS 306, GEOM 319
January 12, 2018	Friday	PHYS 102, EEEG 202, COEG 301, PHYS 313, BIOT 306, COMP 314, CIEG 310, MATH 322, COMP 409, MEPP 433
January 14, 2018	Sunday	BIOT 206, ENVE 205, MATH 207, PHYS 212, PHAR 212, ENVS 318, ENVS 328, MGTS 302, COMP 341, MEEG 318
January 16, 2018	Tuesday	ENVE 101, PHAR 111, BIOT 101, MATH 103, MCSC 202, PHYS 314, BIOT 305, COMP 317, COMP 342, MEEG 317, PHAR 316
January 17, 2018	Wednesday	ENGT 102, ENVS 101, STAT 101, COMP 202, EEEG 215, CHEM 212, MCSC 201, BIOT 208, PHYS 213, MEEG 301, COMP 306, COMP 316, MEEG 308 <i>MEPP-403</i>

Examination Time : 11.00 A.M. to 2.00 P.M.  
Examination Center : Kathmandu University, Dhulikhel.

  
Prof. Panna Thapa, Ph. D.  
Controller of Examinations





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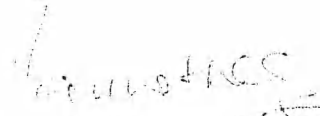
November 5, 2017

## NOTICE.

Final Year End-Semester Compartmental/ GPA make-up Examinations of B.E./B.Sc./B.Pharm. - /B.Tech. students will be held according to the following schedule.

Date	Day	Courses
November 15, 2017	Wednesday	COEG 402, ETEG 417, BIOT 407, MEEG 301
November 17, 2017	Friday	MEEG 315, MGTS 301, COEG 304, MEPP 412, EEG 207, EEG 313, COMP 421
November 19, 2017	Sunday	MGTS 403, EEG 314, MATH 101, PHAR 303

Examination Time : 11.00 A.M. to 2.00 P.M.  
Examination Center : Kathmandu University, Dhulikhel.

  
Prof. Panna Thapa, Ph. D.  
Controller of Examinations

Special compartment for Convocation

