



**KUVEMPU UNIVERSITY**  
OFFICE OF THE DIRECTOR  
DIRECTORATE OF DISTANCE EDUCATION  
JnanaSahyadri, Shankaraghatta – 577 451, Karnataka



Phone: 08282-256426; Fax: 08282-256370; Website: www.kuvempuuniversitydde.org  
E-mails: ssgc@kuvempuuniversity.org; info@kuvempuuniversitydde.org

**TOPICS FOR INTERNAL ASSESSMENT ASSIGNMENTS: 2015-16**  
**Course:M.Sc. PHYSICS (Previous Year)**

*Important Notes:(1) Students are advised to read the separate enclosed instructions before beginning the writing of assignments. (2) Out of 15 Internal Assignment marks per paper, 5 marks will be awarded for regularity (attendance) to Counseling/ Contact Programme classes pertaining to the paper. Therefore, the topics given below are only for 10 marks each paper.*

*Paper I: Mathematical Methods And Classical Mechanics Spectroscopy*

1. Solve in series the equation  $\frac{d^2y}{dx^2} + x^2y = 0$  **5 MARKS**
  
2. Two equal masses  $m$  connected by mass less rigid rod of length 'l' forming a dumb-bell is rotated in x-y plane. Find the lagrangian and obtain lagrange's equations of motion **5MARKS**

*Paper II: Quantum And Statistical Mechanics*

1. In the case of square potential well with finite walls, consider the limiting case  $V_0 \rightarrow \infty$  and obtain energy levels and energy Eigen functions? **5MARKS**
  
2. Show that at absolute temperature  $T$ , the quantity  $KT$  is roughly equal to the mean energy per degree of freedom **5MARKS**

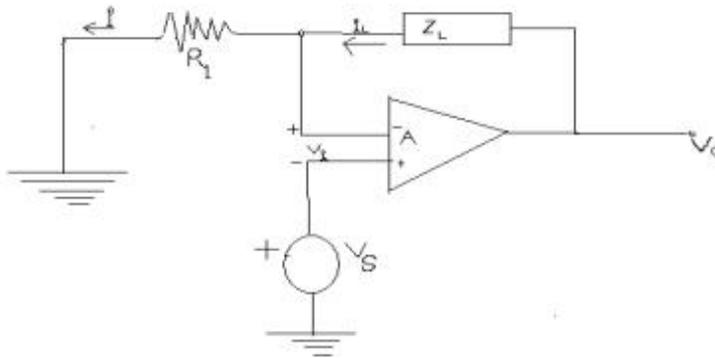
*Paper III: Solid State Physics*

1. Find the energies of six lowest energy levels of a particle in cubical box. Which of the levels are degenerate? **5MARKS**
  
2. A silicon material is subjected to a magnetic field of strength 1000A/m. If the magnetic susceptibility of silicon is  $-0.3 \times 10^{-5}$ , calculate its magnetization. Also evaluate the magnetic flux density of the field inside the material. **5MARKS**

Paper IV: Electronics

1. An alternative circuit for voltage-to-current converter is drawn in figure. Assuming that the opAmp has finite gain but is otherwise ideal. Derive an expression for load current  $i_L$  and show that as  $A \rightarrow \infty$ ,  $i_L = \frac{V_S}{R_1}$ ; independent of  $Z_L$ .

In the non ideal case, what would be the minimum value of gain A for the error in  $i_L$  to be within one percent of the above expression.



5MARKS

2. a) What is the feedback element in an Op-amp integrator?  
b) For a constant input voltage to an integrator, why is the voltage across the capacitor is linear?

5MARKS

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