0040059 K19P 1498

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (CBSS-Reg./Suppl./Imp.)
Examination, October - 2019
(2014 Admission Onwards)
PHYSICS
PHY 1C01- MATHEMATICAL PHYSICS - I

Time : 3 Hours Max. Marks : 60

SECTION-A

Answer both questions, either (a) or (b). Each question carries **12** marks. **(2×12=24)**

1. a) Explain Gauss elimination method to solve a system of linear equations. Using Gauss elimination method, solve the system of equations $2y+z=8, x-2y-3z=0, -x+y+2z=3$.

(OR)

b) Obtain the series solution to the Bessel's equation $x^2y''+xy'+(x^2-n^2)y=0$.

2. a) What do you mean by an analytic function? State and prove the necessary and sufficient condition for a complex function to be analytic.

(OR)

b) Derive Rodrigues' formula for Legendre polynomials. Deduce first two Legendre polynomials.

SECTION-B

Answer any Four (1 mark for part 'a', 3 marks for part 'b', 5 marks for part 'c') **(4×9=36)**

3. a) Define gradient of a scalar field.

b) Express the spherical polar unit vectors in terms of Cartesian unit vectors.

c) Prove that $\nabla.(r^n\vec{r}) = (n+2)r^{n-1}$ where $\vec{r}$ is the general vector and $r = |\vec{r}|$.

4. a) What do you mean by a symmetric tensor?
   b) Explain divergence of tensors.
   c) Prove that every square matrix A can be expressed as sum of two matrices of the form A=B + *i*c where B and *i*c are Hermitian matrices.

5. a) Give an example for a linear first order ordinary differential equation.
   b) Discuss the singular points of the Bessel's equation: $x^2y''+xy'+(x^2-n^2)y=0$.
   c) Explain Forbenius method to find the series solution of a linear second order homogeneous ordinary differential equation.

6. a) Check whether $f(z)=\overline{z}$ is analytic or not.
   b) Discuss the derivative of the logarithmic function $f(z)=\ln z$.
   c) Find the Laurent series expansion of $f(z)=\frac{ze^z}{z-1}$ about $z=1$. Also specify the region of convergence.

7. a) Define beta function.
   b) Express the coefficient of n^{th} term of the expansion of $(1+x)^{-\frac{1}{2}}$ in power of *x* in terms of the double factorial notation.
   c) Prove that $\beta(p,q)=\frac{\Gamma(p)\Gamma(q)}{\Gamma(p+q)}$.

8. a) Write the first three Hermite polynomials.
   b) Define spherical Bessel function. Obtain the expression for $j_1(x)$.
   c) Discuss the orthogonality property of Legendre polynomials.

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0040440

K19P 1499

I Semester M.Sc. Degree (CBSS-Reg./Suppl./Imp.)
Examination, October - 2019
(2014 ADMISSION ONWARDS)
PHYSICS
PHY1C02: CLASSICAL MECHANICS

Time : 3 Hours

Max. Marks : 60

SECTION-A

Answer both questions (either a or b) **(2×12=24)**

1. (a) Derive Lagrange's equation of motion from Hamiltonian principle

(OR)

(b) Obtain Lagrange's equation of motion for small oscillations.

2. (a) Derive Hamilton Jacobi differential equation. Work out Harmonic oscillator problem as an example of Hamilton Jacobi method.

(OR)

(b) Solve Kepler problem by Hamilton Jacobi method.

SECTION-B

Answer any **Four** questions (**1** mark for a , **3** marks for b, **5** marks for c) **(4×9=36)**

3. (a) What are cyclic coordinates?
   (b) Discuss the superiority of Lagrangean approach over Newtonian approach.
   (c) Show that generalized momentum conjugate to a cyclic coordinate is conserved.

4. (a) Define degrees of freedom.
   (b) Derive Hamilton's canonical equations of motion.
   (c) Find the Lagrangean of a spherical pendulum and obtain the equations of motion.

P.T.O.

5. (a) Define Poisson's bracket.
   (b) Give the fundamental Poisson bracket.
   (c) For what values of m and n, do the transformation equations $Q=q^m$ Cos np and $P = q^m$ Sin np represent a canonical transformation.

6. (a) Define moment of inertial tensor.
   (b) Derive Euler's equation of motion for a rigid body.
   (c) Solve Euler's equation for force free motion of a symmetric top.

7. (a) What are normal coordinates?
   (b) Explain conditions for stable and unstable equilibrium during small oscillations.
   (c) Account for the free vibrations of a linear triatomic molecule.

8. (a) State Hamiltons principle for a conservative system.
   (b) Explain principle of least action.
   (c) Derive Jacobi's identity.

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0041258

K19P 1501

I Semester M.Sc. Degree (CBSS-Reg./Suppl./Imp.)
Examination, October - 2019
(2014 Admission Onwards)
PHYSICS
PHY1C04:ELECTRONICS

Time : 3 Hours

Max. Marks : 60

SECTION-A

Answer both questions (either a or b) **(2×12=24)**

1. a) Explain with circuit diagram the different types of open loop op-amp configurations.

(OR)

b) Explain with circuit diagram the summing and averaging amplifiers using

i) inverting op-amp configuration

ii) non inverting op-amp configuration.

2. a) Draw the circuit diagram and output waveforms of a square wave generator and explain its working. Also deduce the expression for its frequency.

(OR)

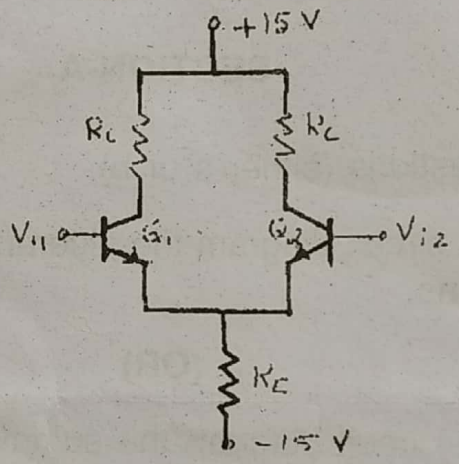
b) Explain synchronous counter with its advantages and disadvantages. Write the design steps of synchronous counter with excitation of various flip-flops.

SECTION-B

Answer any **Four** (1 mark for part a, 3 marks for part b, 5 marks for part c) **(4×9=36)**

3. a) What is the difference between common mode and double ended operations.

   b) Calculate the dc bias values of I_c and V_c for an amplifier using R_c=4.7$k\Omega$, R_E=4.7$k\Omega$, V_{BE}=0.7V and V_{cc} =+15 V and V_{EE}= –15 V.



   c) Draw the circuit diagram and hence derive the expression for AC voltage of a single ended unbalanced output differential amplifier.

4. a) What is CMRR?

   b) An op-amp has a slew rate of $2V/\mu s$. If the peak output is 15V. What is the maximum value of input frequency for which the output is undistorted?

   c) Explain with circuit diagram the working of a closed loop op-amp with voltage series feedback.

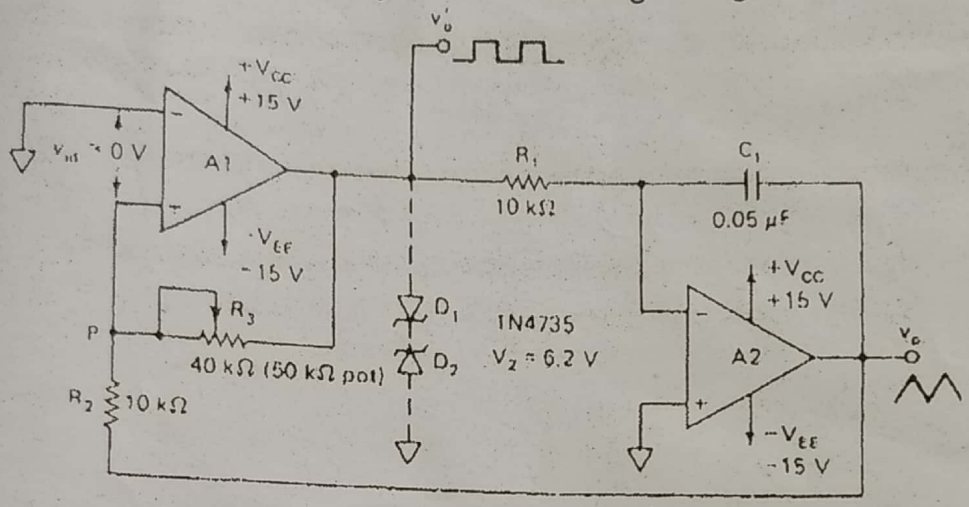
5. a) What do you mean by frequency scaling?

   b) A first order low pass Butterworth filter has cutoff frequency 1kHz, passband gain 2 and capacitance 0.01 μF. Find the value of resistance to be connected.

   c) Explain with circuit diagram the working of a schmitt trigger.

6. a) What is a sample and hold circuit?

b) Calculate the frequency of the following triangular wave generator.



c) Draw and briefly explain 8085 microprocessor.

7. a) What is ROM?

b) Why does the conversion time increase with the value of the analog input voltage in a counter type ADC.

c) Explain with logic diagram serial-in serial-out shift registers using

i) JK flip flop

ii) SR flip flop

8. a) What is a latch?

b) Calculate the time period of 555 Astable multivibrator for $C_1 = 0.01\,\mu F$, $R_A = 10K\Omega$, $R_B = 50\Omega$

c) With the help of logic diagram and truth table, explain a one line to eight line demultiplexer.
