

# MAHATMA GANDHI UNIVERSITY, KOTTAYAM

## II SEMESTER B Sc. DEGREE (CBCS) EXAMINATION (model question paper)

### PH2CRT02: MECHANICS AND PROPERTIES OF MATTER

(Core Course – Common for B.Sc. Physics Model- I, Model- II and Model- III)

Time: 3 hours

Maximum Marks: 60

#### Part A (Very Short Answer Questions)

Answer any **ten** questions. Each question carries **one** mark.

1. Explain superposition of waves
2. Give two examples of harmonic oscillations.
3. Draw a neat curve showing all three damping cases of a damped harmonic oscillator.
4. Explain couple per unit twist.
5. What is meant by bending moment?
6. Distinguish between streamline and turbulent flow
7. What is Poisson's ratio?
8. The march past is prohibited on bridges, why?
9. Define flexural rigidity.
10. Explain I – section of girders
11. Find the dimension of Young's modulus.
12. What is meant by torque?

(10 x 1 = 10)

#### Part B (Short Essay/Problem Questions)

Answer any **SIX** questions. Each question carries **5** marks.

13. Derive the formula for Young's modulus when a beam is subjected to uniform bending.
14. Explain Parallel and perpendicular axes theorems
15. Discuss the theory of compound pendulum.
16. What are beats? Derive an equation for beat frequency? How are they produced?
17. Calculate the excess of pressure between inside and outside of a soap bubble of radius 0.5cm. Surface tension of soap solution is  $3.2 \times 10^{-2} \text{N/m}$
18. A tuning fork of unknown frequency gives 4 beats per second, when sounded with a fork of frequency 320 Hz. When loaded with a little wax it gives 3 beats per second. Find the unknown frequency?
19. What is the bulk modulus of water if an increase of pressure by 100atm changes the volume of 100 liters of water by 0.5 liters:
20. Three identical thin rods each of length L and mass M are joined together to form a letter H. What

is the moment of inertia of the system about one of the sides of H:

21. Find the work done in stretching a wire of 1sq mm cross section and 2m long through 0.1mm.  
(Young's modulus,  $Y = 2 \times 10^{11} \text{ N/m}^2$ )

**(6 x 5 = 30)**

### **Part C (Essay Questions)**

**Answer any TWO questions. Each question carries 10 marks**

22. Obtain the equation for forced oscillation. Explain the condition for resonance.
23. How to find the Young's modulus of the given material using it as a cantilever? Explain with the help of a neat diagram.
24. Obtain an expression for Moment of inertia of a sphere about one of its diameter.
25. Derive Poiseuille's formula for the rate of flow of a liquid through a capillary tube.

**(2x10 = 20)**

**MAHATMA GANDHI UNIVERSITY, KOTTAYAM**

**II SEMESTER B. Sc. DEGREE (CBCS) EXAMINATION MODEL**

**QUESTION PAPER**

**Complementary Physics Course: PH2CMT01 - Mechanics, Waves and  
Astrophysics**

**(For B. Sc. Programmes in Mathematics and Statistics)**

**Time: 3 hours**

**Maximum Marks: 60**

**Part A** (*Short answer type questions*)

*Answer any **ten** questions. Each question carries **1** mark.*

1. Explain the terms Inertia.
2. Define moment of inertia. What are its dimensions?
3. Define moment of inertia of a body about an axis. What are the factors on which moment of inertia of a body depends?
4. Moment of inertia is said to be analogue of mass in linear motion. Explain the statement.
5. What do you mean by radius of gyration?
6. Obtain an expression for the angular velocity of a particle executing simple harmonic motion.
7. What is a black hole?
8. What is Chandrasekhar limit?
9. What do you mean by resonance?
10. Explain phase and initial phase of a simple harmonic motion.
11. Distinguish between forced oscillations and natural oscillations.
12. State perpendicular axis theorem.

**(10 x 1 = 10)**

**Part B** (*Short Essays or Problems*)

*Answer any **six** questions. Each question carries **5** marks.*

13. Derive an expression for the moment of inertia of a rod about an axis passing through one of its end.
14. Write an account on evolution of stars.
15. Write a note on temperature and colour of a star.
16. A particle of mass  $m$  is executing simple harmonic motion of frequency  $n$ . Calculate its kinetic energy, potential energy and Total energy.
17. What are the conditions for the oscillation of a harmonic oscillator to be  
(a) over damped      (b) critically damped      (c) under damped.
18. What must be the relation between length  $l$  and radius  $R$  of a cylinder if the moment of inertia of the cylinder about its axis to be same as its MI about the equatorial axis.
19. A flywheel has a moment of inertia of  $1 \text{ kg m}^2$ . If it is rotating at a speed of  $2 \text{ rev/sec}$  find the constant torque required to stop the wheel in 5 rotations.

20. A block of mass 3kg is executing SHM of amplitude 0.6m and period 4sec. Find  
(a) maximum restoring force (b) the restoring force at a distance 0.2m from extreme position.
21. Of the two copper spheres, one is of twice the diameter of the other. What is the ratio of their moments of inertia about their diameters?

**(6 x 5 = 30)**

**Part C (Essay questions)**

*Answer any **two** questions. Each question carries **10** marks.*

22. What is conservation of angular momentum? What is a flywheel? Deduce an expression for the moment of inertia of a flywheel.
23. Derive an expression for the moment of inertia of  
(a) A sphere about its diameter.  
(b) A cylinder about its axis
24. Explain with theory the formation of beats.
25. Discuss HR Diagram. Discuss the different stages of the evolution of a star.

**(2 x 10 = 20)**

**MAHATMA GANDHI UNIVERSITY, KOTTAYAM**  
**II SEMESTER B. Sc. DEGREE (CBCS) EXAMINATION MODEL**  
**QUESTION PAPER**

**Complementary Physics Course: PH2CMT02 - Mechanics and  
Superconductivity**

**(For B. Sc. Programmes in Chemistry and Geology)**

**Time: 3 hours**

**Maximum Marks: 60**

**Part A** (*Short answer type questions*)

*Answer any **ten** questions. Each question carries **1** mark.*

1. Explain centrifugal force.
2. Define moment of inertia. What are its dimensions?
3. What is the radius of gyration for a solid sphere rotating about its diameter?
4. Explain Meissner effect.
5. Consider the oscillation of the pendulum of a quartz clock. Is it forced oscillation? Justify your answer.
6. Explain a Cooper pair.
7. Draw the graph connecting resistivity and temperature of a superconductor.
8. What is Doppler effect?
9. What do you mean by resonance?
10. Explain phase and initial phase of a simple harmonic motion.
11. What are the natures of acceleration in simple harmonic motion?
12. State perpendicular axis theorem.

**(10 x 1 = 10)**

**Part B** (*Short Essays or Problems*)

*Answer any **six** questions. Each question carries **5** marks.*

13. Derive an expression for the moment of inertia of a rod about an axis passing through one of its end.
14. Distinguish between ac and dc Josephson effects.
15. Explain the theory of beats.
16. A particle of mass  $m$  is executing simple harmonic motion of frequency  $n$ . Calculate its kinetic energy, potential energy and Total energy.
17. What are the conditions for the oscillation of a harmonic oscillator to be  
(a) over damped      (b) critically damped      (c) under damped.
18. What must be the relation between length  $l$  and radius  $R$  of a cylinder if the moment of inertia of the cylinder about its axis to be same as its MI about the equatorial axis.
19. A flywheel has a moment of inertia of  $1 \text{ kg m}^2$ . If it is rotating at a speed of  $2 \text{ rev/sec}$  find the constant torque required to stop the wheel in 5 rotations.

20. A block of mass 3kg is executing SHM of amplitude 0.6m and period 4sec. Find  
a) Maximum restoring force (b) the restoring force at a distance 0.2m from extreme position.
21. Of the two copper spheres, one is of twice the diameter of the other. What is the ratio of their moments of inertia about their diameters?

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**Part C (Essay questions)**

*Answer any two questions. Each question carries 10 marks.*

22. Obtain an expression for the time- period of a compound pendulum and show that there are four points collinear with the centre of gravity about which the time period is the same. Also show that its time period remains unaffected by the fixing of a small additional mass to it at its centre of suspension.
23. Derive an expression for the moment of inertia of a sphere about its diameter.
24. What is a progressive wave? Find its energy.
25. (a) Discuss the features of type I and type II superconductors. (b) If superconducting tin has a critical temperature of 3.7K at zero magnetic field and the critical field is 0.0306 Tesla at 0K. Find the critical field at 2K

**(2 x 10 = 20)**

**MAHATMA GANDHI UNIVERSITY, KOTTAYAM**  
**II SEMESTER B. Sc. DEGREE (CBCS) EXAMINATION MODEL**  
**QUESTION PAPER**

**Vocational Course: AE2VOT03 - BASICS OF POWER**  
**ELECTRONICS**

**(For B. Sc. Physics Model II Applied Electronics Programme)**

**Time: 3 hours**

**Maximum Marks: 80**

**Part A** (*Short answer type questions*)

*Answer any **ten** questions. Each question carries **2** marks.*

1. Draw the trans-conductance characteristics and account for the shape of the curves.
2. What are the differences between a JFET and a bipolar transistor?
3. How do you set a Q-point in a self biased JFET?
4. Give a comparison between JFET and MOSFET.
5. Why FET is called a voltage controlled device.
6. Why MOSFET is sometimes an IGFET?
7. Why a MOSFET can be operated with positive and negative gate voltage, but not a JFET?
8. Write the definitions of four JFET parameters.
9. Why is the input impedance of a MOSFET much higher than a JFET?
10. Sketch the circuit symbols of enhancement and depletion type MOSFET.
11. Explain gate biasing for JFET.
12. Give comparison between N-channel MOSFETs over P-channel.

**(10x 2 = 20)**

**Part B** (*Short Essays or Problems*)

*Answer any **six** questions. Each question carries **5** marks.*

13. Draw the experimental setup to plot the drain characteristics for JFET. Explain the shape of the characteristics
14. Explain the following terms for a JFET:  
a)  $I_{DSS}$  b) Drain Resistance c) Trans-conductance d) Pinch off voltage
15. Briefly explain common drain JFET amplifier with circuit diagram.
16. with the help of connection diagrams explain how (i)E- MOSFET and (ii)D-MOSFET can be used as resistor

17. For an N-channel JFET  $I_{DSS} = 8.7\text{mA}$ ;  $V_p = -3\text{V}$ ;  $V_{GS} = -1\text{V}$ . Find the values of (i)  $I_D$  (ii)  $g_m$  (iii)  $g_m$  .
18. A gate biased JFET amplifier has  $R_D = 2.2\text{K}\Omega$ ,  $R_a = 1\text{M}\Omega$ ,  $V_{DD} = 15\text{V}$ ,  $V_{GG} = -2\text{V}$ ,  $I_{DSS} = 8\text{mA}$ ,  $V_p = -8\text{V}$ . Calculate: (i)  $I_D$  (ii)  $V_{DS}$  (iii)  $V_{GS}$ .
19. Sketch the transfer characteristics for an N- channel Depletion type MOSFET with  $I_{DSS} = 10\text{mA}$  and  $U_p = -4\text{V}$ .
20. In a JFET amplifier  $g_m = 4000\mu\text{ mho}$ ,  $R_L = 20\text{K}\Omega$   $R_D = 5\text{M}\Omega$ . Calculate the voltage gain.
21. A common drain JFET amplifier circuit has  $R_1 = 3\text{M}\Omega$ ,  $R_2 = 1.2\text{M}\Omega$ ,  $R_s = 2\text{K}\Omega$ ,  $R_4 = 20\text{K}\Omega$ ,  $G_m = 2.5\text{m mho}$ . Calculate its input resistance and output resistance.

(6 x 5 = 30)

**Part C (Essay questions)**

*Answer any two questions. Each question carries 15 marks.*

22. With neat cross-sectional diagram, explain the working of a JFET? Sketch its drain and trans-conductance characteristics and explain their shapes.
23. Discuss the construction and working of the depletion type and enhancement type MOSFETs.
24. Explain with circuit diagram and small signal model common source JFET amplifier and derive expression for voltage gain.
25. Explain the need for biasing JFET. Draw and explain voltage divider bias and source bias of JFET.

(2 x 15 = 30)

**MAHATMA GANDHI UNIVERSITY, KOTTAYAM**

**II SEMESTER B. Sc. DEGREE (CBCS) EXAMINATION MODEL  
QUESTION PAPER**

**Vocational Course: AE2VOT04 - POWER ELECTRONICS**

**(For B. Sc. Physics Model II Applied Electronics Programme)**

**Time: 3 hours**

**Maximum Marks: 60**

**Part A** (*Short answer type questions*)

*Answer any **ten** questions. Each question carries **1** mark.*

1. Distinguish between holding current and latching current.
2. Why SCR can be fabricated of using only Silicon, but not Germanium?
3. Draw the diode model of a thyristor and mention what is the necessity of gate.
4. List the various applications of SCR.
5. Distinguish between SCR and TRIAC.
6. What is intrinsic stand-off ratio?
7. What is SBS? Why it is preferred over DIAC for triggering SCR?
8. What is SCS? How it is different from SCR?
9. What is firing angle?
10. What is false triggering?
11. What is meant by forward current rating of an SCR?
12. How power control is achieved by SCR?

**(10 x1 = 10)**

**Part B** (*Short Essays or Problems*)

*Answer any **six** questions. Each question carries **5** marks.*

13. Explain the different methods to turn-ON an SCR.
14. Draw the two transistor model of an SCR. Derive an equation for anode current.
15. How SCR is used as a half-wave rectifier?
16. Explain the working of a 180° variable half wave rectifier.
17. A d.c. power supply of 110V feeds an inductance of 10H through a thyristor. Calculate the minimum width of the gate pulse so that the thyristor is triggered. The latching current of the thyristor is 70mA.
18. The intrinsic stand-off ratio for an UJT is 0.65. Its interbase resistance is 10KΩ. Calculate the values of the interbase resistances.

19. A UJT relaxation oscillator has  $R=60\text{K}\Omega$  and  $C=0.25\mu\text{F}$ . Determine the pulse repetition frequency. Take intrinsic stand-off ratio to be 0.65.
20. A single-phase half wave rectifier circuit using a thyristor is fed by a transformer whose secondary voltage is  $200\sin\omega t$ . Calculate the average load current if the load resistance is  $50\Omega$ .
21. The forward break down voltage of an SCR is 150V when a gate current of 1mA flows in the gate circuit. Calculate the firing angle, average output voltage and current for a load resistor of 200 ohms when a sinusoidal voltage of 400V peak is applied to it.

**(6 x 5 = 30)**

**Part C (Essay questions)**

*Answer any two questions. Each question carries 10 marks.*

22. With a neat constructional cross-sectional diagram, describe the working of a TRIAC. Sketch and explain its V-I characteristics.
23. With neat constructional details, explain the working of UJT. Explain the V-I characteristics.
24. Explain the forward and reverse characteristics of an SCR. How does the forward break over voltage change with gate current? What are the methods to turn off an SCR?
25. With necessary circuit diagram and waveforms, explain the operation of a single-phase fully controlled bridge rectifier using SCR. Derive an expression for the average output voltage assuming continuous conduction mode.

**(2 x 10 = 20)**

**MAHATMA GANDHI UNIVERSITY, KOTTAYAM**

**II SEMESTER B. Sc. DEGREE (CBCS) EXAMINATION MODEL**

**QUESTION PAPER Vocational Course: CA2VOT03 - WORD AND**

**DATA PROCESSING PACKAGES**

**(For B. Sc. Physics Model II Computer Applications Programme)**

**Time: 3 hours**

**Maximum Marks: 80**

**Part A** (*Short answer type questions*)

*Answer any **ten** questions. Each question carries 2 marks.*

1. Define record.
2. Define file.
3. What is the use of Print Preview option?
4. Define workbook and spreadsheet.
5. What is Control Palette?
6. What is a word processor?
7. What are the steps to print a document?
8. What are the different ways to select the entire document?
9. How to insert clip art in word?
10. What are the steps to add Header and Footer toolbar method?
11. Explain the process of finding a text in Excel?
12. What is the need of page break? **(10 x 2 = 20)**

**Part B** (*Short Essays or Problems*)

*Answer any **six** questions. Each question carries 5marks.*

13. Describe Master pages in Page Maker?
14. What are the steps to create a chart?
15. Explain the use of computers for business applications.
16. How will you insert a Word Art in Word?
17. What is a spreadsheet? Give important features of the spreadsheet.
18. Write a note on fill and stroke options in Page Maker?
19. Explain the various methods of paragraph formatting in Page Maker.
20. Explain the various options available for bulleting in MS-Word.
21. Describe the various file formats supported by MS-Word.

**(6 x 5 = 30)**

**Part C (Essay questions)**

*Answer any **two** questions. Each question carries **15** marks.*

22. What is Control Palette? Explain its functions and applications with respect to characters in Page Maker.
23. Explain Indenting text, Tab stops, Line spacing, Paragraph spacing, borders and shading
24. Explain mail merge facility of MS-Word with example.
25. Describe the types of charts available in MS-Excel.

**(2 x 15 = 30)**

**MAHATMA GANDHI UNIVERSITY, KOTTAYAM**  
**II SEMESTER B. Sc. DEGREE (CBCS) EXAMINATION MODEL**  
**QUESTION PAPER**

**Vocational Course: CA2VOT04 -**  
**PROGRAMMING IN ANSI C (For B. Sc. Physics**  
**Model II Computer Applications Programme)**

**Time: 3 hours**

**Maximum Marks: 60**

**Part A** (*Short answer type questions*)

*Answer any **ten** questions. Each question carries 1 mark.*

1. How to execute a C program?
2. What is an identifier?
3. What is the relationship between an assignment statement and an expression?
4. What are C tokens? Give examples.
5. From what parts of a program can a function be called?
6. When do you need a variable?
7. What is meant by recursion?
8. What is a unary operator?
9. What is the minimum number of times that a “do-while” loop can be executed?
10. What is a pre-processor directive?
11. What is a global variable?
12. What is the range of integer data type in C?

**(10 x 1 = 10)**

**Part B** (*Short Essays or Problems*)

*Answer any **six** questions. Each question carries 5 marks.*

13. Describe the two different ways that floating point constants can be written, with the help of examples.
14. What happens when the value of the expression in the “switch” statement matches the value of one of the case labels? What happens when the value of this expression does not match

any of the case labels?

15. Write a program to find the solutions of a quadratic equation
16. Write a program to calculate the factorial of a given number.
17. How can we classify C functions?
18. Write a function in C to check whether a given integer is prime or not.
19. Give the general form of “switch” and explain it using an example.
20. Write a C program to find the sum of all even numbers between 1 and 100.
21. Show the storage of two dimensional array in memory with the help of a diagram.

**(6 x 5 = 30)**

### **Part C (Essay questions)**

*Answer any **two** questions. Each question carries **10** marks.*

22. Explain precedence and associativity with examples. What is their importance?
23. Discuss the scope and lifetime of variables in functions. Explain with examples.
24. Explain in detail need and elements of ‘user defined function’? Also explain multifunction program.
25. Given are two one dimensional arrays A and B which are sorted in ascending order. Write a program to merge them into a single sorted array D that contains every item from arrays A and B, in ascending order.

**(2 x 10 = 20)**

**MAHATMA GANDHI UNIVERSITY, KOTTAYAM**

**II SEMESTER B. Sc. DEGREE (CBCS) EXAMINATION MODEL**

**QUESTION PAPER**

**Core Course 2: EM2CRT03 - POWER ELECTRONICS**

**(For B. Sc. Physics -Model III – Electronic Equipment Maintenance)**

**Time: 3hours**

**Maximum Marks: 80**

**Part A** (*Short answer type questions*)

*Answer any 10 questions. Each question carries 2 marks.*

1. What is mean by triggering of an SCR?
2. What are the advantages of TRIAC over SCR?
3. Explain the natural commutation.
4. What is a controlled rectifier?
5. Explain current and voltage ratings of a Power Diode.
6. Explain the soft starting of Induction Motor.
7. Why is Diac preferred to trigger a Triac?
8. Why is power electronics so important?
9. What are the Merits and demerits of Buck Boost converters
10. What is a switched mode regulator?
11. List the methods of voltage control of inverters.
12. What are the symptoms of an *open* Diac or Triac?

**(10x2= 20)**

**Part B** (*Short Essay/Problem*)

*Answer any six questions. Each question carries 5 marks.*

13. What are the applications of cycloconverters?
14. Sketch the V-I Characteristics of a Triac.
15. Explain the resonant pulse commutation circuit of a Thyristor.
16. Give a brief note on Solid state relays.
17. Explain the construction and working of an SCR.
18. Explain the working principle of power MOSFET.
19. Explain the operation principle of a single phase bridge inverter.
20. Why is SCR always turned on by gate current?
21. Explain about power semiconductor devices.

**(6 × 5 = 30)**

**Part C (Essay questions)**

*Answer any **two** questions. Each question carries **15** marks.*

22. Discuss the various power electronics converter. Give the advantages and disadvantages of power electronics converter.
23. What is meant by Commutation? Explain the various commutation methods of SCR. Give the circuit diagram of any one method and explain.
24. Describe the reverse recovery characteristics of power diode and its effects. Draw and explain any base drive circuit of a power transistor switch.
25. Write brief notes on Buck, Boost and Buck Boost regulators. What is their application?

**(2 × 15 = 30)**

**MAHATMA GANDHI UNIVERSITY, KOTTAYAM**  
**II SEMESTER B. Sc. DEGREE (CBCS) EXAMINATION MODEL**  
**QUESTION PAPER**

**Core Course 2: EM2CRT04 - ANALOGUE INTEGRATED**  
**CIRCUITS**

**(For B. Sc. Physics -Model III – Electronic Equipment Maintenance)**

**Time: 3hours**

**Maximum Marks: 60**

**Part A** (*Short answer type questions*)

*Answer any 10 questions. Each question carries 1 mark.*

1. What is the function of OP-AMP?
2. What are the applications of op-amp?
3. What is the schematic symbol for an op-amp?
4. Explain the basic difference between digital and linear ICs.
5. What is the difference between monolithic and Hybrid ICs?
6. List the advantages of first generation OP-amp.
7. What are the characteristics of an ideal op-amp?
8. What is the voltage transfer curve of an op-amp?
9. List three open loop op-amp configurations.
10. Define CMRR.
11. Define input offset voltage.
12. What do you mean by offset minimizing resistors?

**(10x 1 = 10)**

**Part B** (*Short Essay/Problem*)

*Answer any six questions. Each question carries 5 marks.*

13. Explain the equivalent circuit of an op-amp with circuit.
14. Explain different types of open loop op-amp configurations.
15. Explain integrator circuit with different waveforms?
16. Explain the difference between dc and ac voltage followers.
17. What is comparator? Explain its function.
18. What is a window detector?
19. What is a voltage limit and why it is needed?
20. What are the applications of 555 timer?
21. Write a note on band reject filter.

**(6 x 5 = 30)**

**Part C (Essay Questions)**

(Answer any 2 questions. Each carries 10 marks.)

22. With block diagram explain the instrumentation amplifier.
23. Explain different types of sine wave generators.
24. With neat sketch explain VCO.
25. Explain astable multivibrator using IC 555 and derive the expression for frequency.  
**(2 x 10 =20)**