DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.SU/B.Sc./08/2022

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies and Ad-hoc Boards with recommendation of the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted the **following syllabi of Bachelor of Science with Regulation under the scheme of Choice Based Credit & Grading System** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

Sr.No.	Courses	Semester
1.	B.Sc.Electronics(Optional)	Ist and IInd semester (First Year)
2.	B.A./B.Sc.Mathematics(Optional)	Ist and IInd semester (First Year)
3.	B.Sc.Chemistry(Optional)	Ist and IInd semester (First Year)
4.	B.Sc.Physics(Optional)	Ist and IInd semester (First Year)
5.	B.Sc.Analytical Chemistry	Ist and IInd semester (First Year)
6.	B.Sc.Geology (Optional)	Ist to VIth semester (First to Third)

This is effective from the Academic Year 2022-23 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
Ref.No.SU/2022/ 6852-62
Date:- 10.08.2022.

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Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] **The Director, Board of Examinations & Evaluation, Dr.BAMU,A'bad.**

2] The Section Officer,[B.Sc.Unit] Examination Branch,Dr.BAMU,A'bad.
3] The Programmer [Computer Unit-1] Examinations, Dr.BAMU,A'bad.
4] The Programmer [Computer Unit-2] Examinations, Dr.BAMU,A'bad.
5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.BAMU,A'bad.
6] The Public Relation Officer, Dr.BAMU,A'bad.
7] The Record Keeper, Dr.BAMU,A'bad.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

Physics Syllabus

Choice Based Credit & Grading System

B. Sc. F. Y.
Semester I & II

Effective from
Academic Year 2022-23

B.Sc. First Year Physics Syllabus
Choice Based Credit System Syllabus
To be implemented from Academic Year 2022-23

Title of the Course: B. Sc. Physics

Preamble:

The curriculum for the B. Sc. (Physics) programme is designed to cater to the requirement of Choice Based Credit System following the University Grants Commission (UGC) guidelines. In the proposed structure, due consideration is given to Core and Elective Courses (Discipline specific - Physics), along with Ability Enhancement (Compulsory and Skill based) Courses. Furthermore, continuous assessment is an integral part of the CBCS, which will facilitate systematic and thorough learning towards better understanding of the subject. The systematic and planned curricula from first year to the third year (comprised of six semesters) shall motivate the student for pursuing higher studies in Physics and inculcate enough skills for becoming an entrepreneur.

Objectives:

➢ To foster scientific attitude, provide in-depth knowledge of scientific and technological concepts of Physics.

➢ To enrich knowledge through problem solving, minor/major projects, seminars, tutorials, review of research articles/papers, participation in scientific events, study visits, etc.

➢ To familiarize with recent scientific and technological developments

➢ To create foundation for research and development in Physics.

➢ To help students to learn various experimental and computational tools thereby developing analytical abilities to address real world problems.

➢ To train students in skills related to research, education, industry, and market.

➢ To help students to build-up a progressive and successful career in Physics.

Structure of the Course

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Choice Based Credit System (CBCS) Curriculum For Physics Under Faculty of Science and Technology

Course Structure and Scheme of Examination

B.Sc. Three Year Undergraduate Degree Program

	Course Code	Course Title	Total periods (Teaching periods / week)	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Semester I								
Optional I (DSC-1A) Core Courses	PHY-111	Mechanics and Properties of Matter (Theory Paper-I)	45(3/week)	2	50	10	40	20
	PHY-112	Heat and Thermodynamics (Theory Paper-II)	45(3/week)	2	50	10	40	20
	PHY-121	Lab course 1 (Based on PHY-111 and PHY-112)	45(3/week)	1.5	50	10	40	20
Ability Enhancement compulsory courses (AECC-1)	CLE-131	Communication skills in English-I	45(5/week)	3	50	10	40	20
	AECC-1	Marathi/Hindi/Urdu/Sanskrit A student can opt for any one of these languages (SL-I)	45(4/week)	3	50	10	40	20
			225	11.5	250	50	200	100
Total Credits for Semester I : 11.5 (Theory : 10 ; Laboratory : 1.5)								
Semester II								
Optional I (DSC-1B) Core Courses	PHY-211	Optics (Theory Paper-III)	45(3/week)	2	50	10	40	20
	PHY-212	Electricity and Magnetism (Theory Paper-IV)	45(3/week)	2	50	10	40	20
	PHY-221	Lab course 2 (based on PHY-211 and PHY-212)	45(3/week)	1.5	50	10	40	20
Ability Enhancement compulsory courses (AECC-2)	CLE-231	Communication skills in English-II	45(5/week)	3	50	10	40	20
	AECC-2	Marathi/Hindi/Urdu/Sanskrit A student can opt for any one of these languages (SL-II)	45(4/week)	3	50	10	40	20
Non-Credit Course / additional credits	COI-213	Constitution of India	45(3/week)	2 *				
Non-Credit Course /additional credits	CCC-214	Compulsory Computer Course	45(3/week)	2*				
			315	15.5	250	50	200	100
Total Credits for Semester II : 15.5 (Theory : 14 ; Laboratory : 1.5)								

	Course Code	Course Title	Total periods (Teaching periods / week)	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Semester III								
Optional I (DSC-1C) Core Courses	PHY-311	Core Course (Theory Paper-V)	45(3/week)	2	50	10	40	20
	PHY-312	Core Course (Theory Paper-VI)	45(3/week)	2	50	10	40	20
	PHY-321	Lab course 3 (Based on PHY-311)	45(3/week)	1.5	50	10	40	20
	PHY-322	Lab course 4 (Based on PHY-312)	45(3/week)	1.5	50	10	40	20
Skill Enhancement course (SEC-1)	SEC-313	SEC-1 Any one skill to be chosen out of two SEC-1(A), SEC-1(B)	45(3/week)	2	50	10	40	20
Ability Enhancement compulsory courses (AECC-3)	CLE-3	Communication skills in English-III	45(5/week)	3	50	10	40	20
	AECC-3	Marathi/Hindi/Urdu/Sanskrit A student can opt for any one of these languages (SL-III)	45(4/week)	3	50	10	40	20
			315	15	350	70	280	140
Total Credits for Semester III : 15 (Theory : 12 ; Laboratory : 3)								
Semester IV								
Optional I (DSC-1D) Core Courses	PHY-411	Core Course (Theory Paper-VII)	45(3/week)	2	50	10	40	20
	PHY-412	Core Course (Theory Paper-VIII)	45(3/week)	2	50	10	40	20
	PHY-421	Lab course 5 (Based on PHY- 411)	45(3/week)	1.5	50	10	40	20
	PHY-422	Lab course 6 (Based on PHY- 412)	45(3/week)	1.5	50	10	40	20
Skill Enhancement course (SEC-2)	SEC-413	SEC-2 Any one skill to be chosen out of two SEC-2(C):Physics Workshop Skills-II, SEC-2 (D): Computational Physics Skills-II	45(3/week)	2	50	10	40	20
Ability Enhancement compulsory courses (AECC-4)	CLE-4	Communication skills in English-IV	45(5/week)	3	50	10	40	20
	AECC-4	Marathi/Hindi/Urdu/Sanskrit A student can opt for any one of these languages (SL-IV)	45(4/week)	3	50	10	40	20
Additional credits		Environmental Studies	45(3/week)	2*				
			360	17	350	70	280	140
Total Credits for Semester IV : 17 (Theory : 12; Laboratory : 5)								

	Course Code	Course Title	Total periods (Teaching periods / week)	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Semester V								
Optional I (DSE-1 A) Discipline Specific Elective	PHY-511	DSE-1A(1) (Theory Paper-IX) (Select any one paper from A1/B1/C1/D1)	45(3/week)	2	50	10	40	20
	PHY-512	DSE-1A(2) (Theory Paper-X) (Select any one paper from A2/B2/C2/D2)	45(3/week)	2	50	10	40	20
	PHY-521	Lab course 7 (Based on PHY -511)	45(3/week)	1.5	50	10	40	20
	PHY-522	Lab course 8 (Based on PHY -512)	45(3/week)	1.5	50	10	40	20
Skill Enhancement course (SEC-3)	SEC-513	SEC-3 Any one skill to be chosen out of two SEC-3(E) , SEC-3 (F)	45(3/week)	2	50	10	40	20
			225	09	250	50	200	100

Total Credits for Semester V : 09 (Theory : 06 ; Laboratory : 03)

	Course Code	Course Title	Total periods	Credits	Max Marks	CIA	UA	Min Marks
Semester VI								
Optional I (DSE-1 B) Discipline Specific Elective	PHY-611	DSE-1B(1) (Theory Paper-XI) (Select any one paper from A1/B1/C1/D1)	45(3/week)	2	50	10	40	20
	PHY-612	DSE-1B(2) (Theory Paper-XII) (Select any one paper from A2/B2/C2/D2)	45(3/week)	2	50	10	40	20
	PHY-621	Lab course 8 (Based on PHY -611)	45(3/week)	1.5	50	10	40	20
	PHY-622	Lab course 9 (Based on PHY -612)	45(3/week)	1.5	50	10	40	20
Skill Enhancement course (SEC-4)	SEC-613	SEC-4 Any one skill to be chosen out of two SEC-4(G) , SEC-4 (H)	45(3/week)	2	50	10	40	20
			225	09	250	50	200	100

Total Credits for Semester VI : 09 (Theory : 06 ; Laboratory : 03)

Total Credits for three years: Sem. I (11.5) + Sem. II (15.5) + Sem. III (15) + Sem. IV (17) + Sem V (09) + Sem. VI (09) = 77 Credits

Important Notes:

i) **Nomenclature**: DSC- Discipline Specific Core course, SEC – Skill Enhancement Course, AECC- Ability Enhancement compulsory course, DSE- Discipline Specific Elective, UA- University Assessment (Semester End), CIA-Continuous Internal Assessment.

ii) **There shall be one skill enhancement course (SEC) IIIrd to VIth Semester (any one SEC course to be chosen (any one from three optional subjects) from the basket of SEC courses for the respective semester.**

iii) **Code description**: XXX code has to be decided by BoS of the respective subject while designing their respective curriculum (e.g. for Physics it will be PHY; for Electronics it will be ELE)

- The codes for first semester courses will start from XXX-111, Second-semester courses will start from XXX-211 and so on
- XXX-111 : The first digit indicate the Semester Number, the second two digits indicate paper numbers for the first-semester courses and the same analogy is for the remaining semesters
- The codes for theory courses will start from XXX-111 (for the first semester and the same analogy is for the remaining semesters)
- The codes for practical courses will start from XXX-121 (for the first semester and the same analogy is for the remaining semesters)
- The codes for Ability Enhancement compulsory courses will start from XXX-131 (for the first semester and the same analogy is for the remaining semesters)

iv) **Assessment**: 80% for University Assessment (Semester End Examination) and 20 % for Continuous Internal Assessment (CIA)

v) **Continuous Internal Assessment (CIA): Theory** (10 Marks): Internal Test 05 Marks (Two Internal Tests of 05 marks each and average of the two test will be considered) and 05 Marks for Assignment/tutorials.

vi) **Continuous Internal Assessment (CIA): Practical** (10 Marks): 07 Marks for Internal Practical Examination and 03 Marks for record book/submission of collection and field survey report and excursion report

vii) Practical examination : Annual examination

B. Sc. I Year Physics (Semester-I)
(Mechanics and Properties of Matter)
Course Code: PHY-111

Periods 45   **Credit 02**   **Marks 50 (CA=10, ESE 40)**

Course Outcome: On successful completion of this course students will be able to:
- Understand Newton's laws and apply them in calculations of the motion of simple systems.
- Use the free body diagrams to analyze the forces on the object.
- Understand the concepts of friction and the concepts of elasticity, fluid mechanics and be able to perform calculations using them.
- Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process. 5. Demonstrate quantitative problem solving skills in all the topics covered

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Unit – I Mechanics   **[13 L]**

Newton's law of Gravitation (Statement only), Gravitational Field Gravitational Potential, Gravitational Potential of mass, Gravitational potential and field due to spherical shell and solid sphere (at a point, outside, inside and on the surface). Compound Pendulum- expression of time period, Interchangeability of centre of suspension and oscillation, Kater's Pendulum, Problems.

Unit – II Elasticity   **[10 L]**

Introduction, Stress and Strain, Hook's law and Coefficient of elasticity, Young's modulus, Bulk modulus, Modulus of rigidity, Twisting couple on a cylinder, Bending of Beam - Bending moment, cantilever loaded at free end- (a) When weight of beam is ineffective, (b) When weight of beam is effective, Depression of Beam supported at centre, Problems.

Unit – III Viscosity   **[12 L]**

Introduction, Concept of viscous force and viscosity, Coefficient of viscosity, Steady and Turbulent flow, Reynolds number, Equation of continuity, energy of liquid in motion, Bernoulli's Theorem, practical applications: (i) Law of hydrostatic pressure (ii) Filter pump, Problems.

Unit – IV Surface Tension   **[10 L]**

Introduction, Angle of contact, Factors affecting surface tension Difference of pressure across a curved surface, Determination of S.T. by Jaeger's method, Applications of surface tension, Problems.

Reference Books:
1) Elements of Properties of Matter - D. S. Mathur (S. Chand, 11 th edition, 1992)
2) Physics for Degree students-C. L. Arora and P.S.Heme (S. Chand, I st edition 2010)
3) Mechanics and Electrodynamics - Brijlal,N. Subrahmanyam, Jivan Seshan (S.Chand, 7 th edition)
4) Concepts of Physics: H. C. Verma, BharatiBhavan Publisher.
5) University Physics: Sears and Zeemansky, XIth/XIIth Edition, Pearson Education.

B.Sc. First Year Physics (Semester – I)
(Heat and Thermodynamics)
Course Code: PHY-112

| Periods 45 | Credit 02 | Marks 50 (CA=10, ESE 40) |

Course Outcome:
- Develop an understanding on the concepts of Heat and Thermodynamics.
- Describe and apply the physical concepts of heat, transport phenomena and laws of thermodynamics.
- Perform calculations of heat conduction in various geometries.
- To develop ability among the students to identify, remember and grasp the meanings, definitions and laws of heat and thermodynamics.
- To develop attitudes such as concern for accuracy and precision, objectivity and enquiry.

Unit – I: Thermometry and Thermal conductivity   [12 L]

Principal of thermometry, Celsius, Fahrenheit and Kelvin scale, types of thermometers (Mercury thermometer and platinum resistance thermometer), transference of heat, coefficient of thermal conductivity, rectilinear flow of heat along a metal bar, methods of radial flow of heat, (i) spherical shell method and (ii) flow of heat along the wall of a cylindrical tube, comparison of conductivities of different metals (Ingen-Housz experiment), Problems.

Unit – II: Real Gas: [10 L]

Introduction, change of state, behavior of gases at high pressure, reason for modification of a gas equation, Van-der Waal's Equation of state, comparison with experimental curves (Andrews Experiment), critical point and critical constants, estimation of critical constants, constants of Van-der Waal's equation, Problems.

Unit – III: Transport Phenomena: [10 L]

Introduction, Mean free path, sphere of influence, expression for mean free path, variation of mean free path with temperature and pressure, transport phenomena, viscosity, thermal conductivity, self diffusion (and their interrelationships, effect of temperature and pressure), Problems.

Unit - IV: Thermodynamics: [13 L]

Thermodynamic system, Zeroth law of thermodynamics, adiabatic process, adiabatic equation of a perfect gas, isothermal process, indicator diagram, first law of thermodynamics, work done during isothermal process and adiabatic process, reversible and irreversible process, second law of thermodynamics (Kelvin and Clausius statement), Heat engines, Carnot's ideal heat engine, Carnot's cycle (work done and efficiency).

Reference Books:
1) Heat, Thermodynamics and Statistical Physics – Brijlal, N. Subrahmanyan, P. S. Heme, (S. Chand, 2007 Edition)
2) Text Book of Heat and Thermodynamics – J. B. Rajam, C. L. Arora (S. Chand 9th Edition)
3) Heat and Thermodynamics – S. S. Singhal, J. P. Agarwala, S. Prakash (Pragati Prakashan)
4) Thermodynamics and Statistical Physics – S. L. Kakani

B.Sc. First Year Physics (Semester – I)

(Physics Practical)

Course Code: PHY-121

Credit 1.5

1. Determination of acceleration due to gravity by using Kater's Pendulum.
2. Y by bending loaded at center
3. Y by cantilever (Oscillation method)
4. Moment of inertial by using fly wheel.
5. η by Maxwell's needle
6. Determination of 'Y' and 'η' by flat spiral spring
7. Surface tension of a liquid by using Jaeger's method
8. Viscosity of a liquid by using Poiseuille's method
9. To find the co-efficient of thermal conductivity of copper using Searle's apparatus.
10. Thermal conductivity of a bad conductor by using Lee's disc method.

Note: Students should perform at least six experiments

Books:

1. B. Sc. Practical Physics – C. L. Arora (S. Chand Publications)
2. College Practical Physics – Khanna and Gulati (S. Chand Publication)
3. Practical Physics – Gupta and Kumar (Pragati Prakashan, Meerut)
4. A text book of Practical physics – Shrinivasan and Balsubramanyam.

B. Sc. F. Y. Physics (Semester –II)

(Optics)

Course Code-PHY-211

Periods 45   **Credit 02**   **Marks 50 (CA=10, ESE 40)**

Course Outcome: On successful completion of this course the student will able to

- Acquire the basic concept of optics and its applications.
- Explain how image formation takes place in lenses
- Understand the operations of many modern optical devices
- Understand the optical phenomenon such as interference and diffraction

Unit 1 - Geometrical Optics   [12 L]

Introduction to lenses, Location of the image, sign conversions, Thin Lens, Lens Equations, Lens Makers formula, Cardinal points of optical system (Six Points) and corresponding planes, Deviation by Lens, Coaxial Lens System (equivalent focal length and cardinal points), Problems

Unit 2 - Lens Aberrations   [08 L]

Introduction, Types of aberrations: Monochromatic and Chromatic aberration, methods to minimize Chromatic and spherical aberration, Problems

Unit 3 - Optical Instruments   [12 L]

Introduction, The Simple Magnifier, Field of View, stop and pupils, Objective and eyepiece, Need of multiple lens eye piece, Huygen's Eye-piece, Ramsden's Eye-piece, Comparison of Ramsden's eyepiece with Huygen's Eyepiece, Gauss Eye-piece, Problems

Unit 4 – Interference and Diffraction   [13 L]

Interference in thin film due to reflected and transmitted light, wedge shaped thin film, Newton's rings by reflected light, determination of wavelength, Michelson's Interferometer, type of fringes, determination of wavelength and difference in wavelength, Types of Diffraction, Plane diffraction grating, Rayleigh's Criterion for resolution, Resolving power of prism and grating, Problems

Reference Books:
1. Optics - A.R. Ganesan, 4th edition, Pearson Education.
2. A Textbook of Optics - N. Subhramanyam, Brijlal, M.N. Avadhanulu, S. Chand Publication.
3. Physical Optics - A.K. Ghatak, McMillan, New Delhi
4. Fundamental of Optics - F.A. Jenkins, H.E.White, Mc Graw-Hilll International edition
5. Principles of Optics - D.S. Mathur, Gopal Press, Kanpur.

B.Sc. First Year Physics (Semester – II)
(Electricity and Magnetism)
Course Code: PHY-212

Periods 45   **Credit 02**   **Marks 50 (CA=10, ESE 40)**

Course Outcome:
- Develop an understanding on the concepts of Electricity and magnetism.
- To understand the knowledge of various mathematical operations required for electrostatics and magnetostatics.
- Explain the fundamental concepts and operations of vector analysis.
- To increase the ability to perform calculations of various mathematical expressions and laws.
- To develop ability among the students to identify, remember and grasp the meanings, definitions and laws of electricity and magnetism.

Unit – I: Mathematic foundation (Vector Algebra)   [15 L]

Introduction, scalar (dot) and vector (cross) product, scalar triple product and its geometrical interpretation, vector triple product, scalar and vector field, differentiation of vector with respect to scalar, partial differentiation and gradient of a scalar field, divergence and curl of a vector field and their physical significance, vector integrations (line, surface and volume integrals), Gauss divergence theorem, Stoke's theorem, Problems.

Unit – II: Electrostatics   [10 L]

Coulomb's law, electric field, field due to point charge, electric flux, Gauss law (with proof), differential form of gauss law, electric potential, potential due to a point charge, field and potential due to a point charge, Problems.

Unit – III: Dielectrics   [08 L]

Introduction, polar and non-polar molecules, fundamental definitions of dielectrics (dielectric constant, dielectric polarization, polarizability, polarization vector, and dielectric displacement), Relation between D, E and P, molecular field in a dielectric (Clausius – Mossotti relation), Problems.

Unit – IV: Magnetostatics   [12 L]

Introduction, magnetic field, magnetic flux, magnetic induction, Biot and Savart law, magnetic induction at a point due to straight conductor carrying current, magnetic field at the center of circular coil carrying current, magnetic induction on the axis of solenoid, Ampere's law, differential form of Ampere's law, torque on a current loop in uniform magnetic field, moving coil ballistic galvanometer – expression for charge, Problems.

References:
1. Mathematical Methods in Physics – D. Biswas (New Central book agency, 2009 edition)
2. Electricity and Magnetism – R Murugeshan (S. Chand, 2008 edition)
3. Electrodynamics – Gupta, Kumar, Singh (Pragati Prakashan, Merrut, 18th Edition, 2005)
4. Foundation of Electromagnetic theory – Reitz, Milford, Chirstey IIIrd Edition)
5. Fundamentals of Physics – Halliday Rensik and Walkar, 8th Edition
6. Electromagnetic – B. B. Laud
7. Electricity and Magnetism – Brijlal, Subramanyan (Ratan Prakashan (Revised edition, 1997)
8. Electricity and Magnetism – Edward M. Purcell, 1986, McGraw – Hill Education
9. Electricity and Magnetism – D. C. Tayal, 1988, Himalaya Publishing house.

1. Use of multimeter for measuring voltage, current and resistance.

2. Determination of dielectric constant of liquid/solid.

3. I-H curve.

4. Field along the axis of circular coil.

5. Determination of wavelength of light by Newton's rings.

6. Resolving power of telescope.

7. Specific rotation by Laurent's half shade polarimeter.

8. λ by grating (normal incidence)

9. Determination of frequency of AC mains by sonometer

10. Comparison of capacitor using De'Sauty's method

11. Measurement of constants of B. G.

Note: - At least six experiments should be performed.

Books:

1. B. Sc. Practical Physics – C. L. Arora (S. Chand Publications)
2. College Practical Physics – Khanna and Gulati (S. Chand Publication)
3. Practical Physics – Gupta and Kumar (Pragati Prakashan, Meerut)
4. A text book of Practical physics – Shrinivasan and Balsubramanyam.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Nature of Question Paper for choice based credit system (CBCS) semester pattern.

Subject: Physics

Time: 2 hours   Max. Marks: 40

Instructions:

1. All questions are compulsory.
2. All questions carry equal marks.
3. Draw neat diagrams and give equations wherever necessary.
4. Figures to the right indicate full marks.
5. Use of logarithmic table and calculator is allowed.

Q. 1)   Long answer questions (Solve any one)   10
      A. Question from Unit – I
      2. Question from Unit – III

Q. 2)   Long answer questions (Solve any one)   10
      1. Question from Unit – II
      2. Question from Unit – IV

Q. 3)   Short answer questions / problems   10
      a. Short answer question / problem from Unit – I
      b. Short answer question / problem from Unit – III
<div align="center">OR</div>

      a. Short answer question / problem from Unit – II
      b. Short answer question / problem from Unit – IV

Q. 4)   Multiple Choice Questions   (MCQ)   10

Note: Ten MCQ's having four alternatives based on theory and numerical.
(Minimum two MCQ's from each chapter)