Curriculum of Diploma Programme

in

Medical Laboratory Technology

Department of Science, Technology and Technical Education (DSTTE), Govt. of Bihar

State Board of Technical Education(SBTE), Biha

Semester – Third
Teaching & Learning Scheme

Course Codes	Category of course	CourseTitles	Teaching & Learning Scheme (Hours/Week)					
			Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+ SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
			L	T				
2476301	**PCC**	Human Anatomy & Physiology	3		4	2	9	6
2476302	**PCC**	Biophysics & Biochemistry	3		4	2	9	6
2476303	**PCC**	Clinical Pathology	2		4	2	8	5
2476304	**PCC**	Analog and Digital Electronics	2		4	2	8	5
2476305	**PCC**	Laboratory Management & Ethics	2		0	2	4	3
2476307	**PCC**	Computer application			4	0	4	2
2476306	**PSI**	Summer Internship – I*			4	2	6	3
			12	00	24	12	48	30

- **Note: Prefix will be added to Course Code if applicable (T for Theory Paper, P for Practical Paper and S for Term Work)**
- **Legend:**

CI: Classroom Instruction (Includes different instructional/implementation strategies i.e. Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning etc. to deliver theoretical concepts)
LI: Laboratory Instruction (Includes experiments/practical performances /problem-based experiences in laboratory, workshop, field or other locations using different instructional/Implementation strategies)
Notional Hours: Hours of engagement by learners, other than the contact hours for ensuring learning.
TW: Term work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.)
SL: Self Learning, MOOCs, spoken tutorials, online educational resources etc.
C: Credits = (1 x CI hours) + (0.5 x LI hours) + (0.5 x Notional hours)

Note: TW and SL have to be planned by the teacher and performed by the learner under the continuous guidance and feedback of teacher to ensu

Semester – Third

Assessment Scheme

Course Codes	Category of course	Course Titles	Assessment Scheme (Marks)						Total Marks (TA+TWA+LA)
			Theory Assessment (TA)		Term work & Self Learning Assessment (TWA)		Lab Assessment(LA)		
			Progressive Theory Assessment (PTA)	End Theory Assessment	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment	
2476301	PCC	Human Anatomy & Physiology	30	70	-	-	20	30	150
2476302	PCC	Biophysics & Biochemistry	30	70	20	30	20	30	200
2476303	PCC	Clinical Pathology	30	70	20	30	20	30	200
2476304	PCC	Analog and Digital Electronics	30	70	20	30	20	30	200
2476305	PCC	Laboratory Management & Ethics	30	70	-	-	-	-	100
2476307	PCC	Computer application	-	-	20	30	20	30	100
2476306	PSI	Summer Internship – I*	-	-	10	15	10	15	50
			150	**350**	**90**	**135**	**110**	**165**	**1000**

Note: Prefix will be added to Course Code if applicable (T for Theory Paper, P for Practical Paper and S for Term Work)

Legend:

PTA: Progressive Theory Assessment in class room (includes class test, mid-term test and quiz using online/offline modes)

PLA: Progressive Laboratory Assessment (includes process and product assessment using rating Scales and rubrics)

TWA: Term work & Self Learning Assessment (Includes assessment related to student performance in assignments, seminars, micro projects, industrial visits, self-learning, any other student activities etc.

Note: Separate passing is must for progressive and end semester assessment for both theory and practical.

- ETA & ELA are to be carried out at the end of the term/ semester.

Term Work is to be done by the students under the guidance of internal faculty but its assessment will be done **internally (40%)** as well as **externally (60%)**. Assessment related to planning and execution of Term Work activities like assignment, micro project, seminar and self-learning is to be done by internal faculty (Internal Assessment) whereas assessment of output/product/ presentation related to these activities will be carried out by external faculty/expert (External Assessment). However, criteria of internal as well as external assessment may vary as per the requirement of respective course. For valid and reliable assessment, the internal faculty should prepare checklist

A) Course Code : 2476301(T2476301/P2476301/S2476301)
B) Course Title : Human Anatomy & Physiology

C) Pre- requisite Course(s) : Fundamentals of Biology

D) Rationale

Human Anatomy and Physiology provides fundamental knowledge of the structure and functions of the human body systems. This course helps learners understand the organization of the body from cellular to system level and explains how various systems work together to maintain homeostasis. The subject builds a strong foundation for health sciences, engineering, and applied biological studies. Emphasis is given to practical understanding of body functions, common disorders, and health awareness. The course enhances analytical thinking related to human biological processes and promotes scientific understanding essential for professional practice.

E) Course Outcomes (COs): Upon successful completion of the course, learners are expected to achieve the prescribed course outcomes through active participation in learning activities encompassing the cognitive, psychomotor, and affective domains in classroom and experiential learning environments.

After completion of the course, the students will be able to-

CO1: Explain the basic concepts, terminology, and structural organization of the human body.

CO2: Describe the structure and functions of support, movement, and protective systems.

CO3: Explain the circulatory and respiratory systems and their role in transport of materials.

CO4: Describe the nervous and endocrine systems involved in control and coordination.

CO5: Explain nutrition, digestion, excretion, and reproductive processes in the human body.

F) Suggested Course Articulation Matrix (CAM):

PSO-1: Apply fundamental knowledge of human anatomy and physiology to understand the structure, functions, and interrelationships of body systems for health, biomedical, and applied life-science contexts.

PSO-2: Utilize basic analytical and observational skills to interpret physiological processes, health indicators, and common disorders, with an emphasis on wellness, preventive healthcare, and interdisciplinary applications.

Course Outcomes (COs)	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design / Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CO-1	3	-	-	-	-	-	1	-	-
CO-2	3	1	-	-	-	-	1	-	-
CO-3	3	2	3	2	1	1	2	-	-
CO-4	3	2	3	2	1	1	2	-	-
CO-5	3	2	3	2	1	1	2	-	-

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Studies (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+SL)	Total Hours (CI+LI+TW+SL)	Total Credits(C)
		L	T				
2476301	Human Anatomy & Physiology	03	-	04	02	09	06

Legend:

CI: Classroom Instruction (Includes different instructional/implementation strategies i.e. Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning etc. to deliver theoretical concepts)

LI: Laboratory Instruction (Includes experiments/practical performances in laboratory, workshop, field or other locations using different instructional/Implementation strategies)

Notional Hours: Hours of engagement by learners, other than the contact hours for ensuring learning.

TW: Term work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.)

SL: Self Learning, MOOCs, spoken tutorials, open educational resources (OERs)

C: Credits = (1 x CI hours) + (0.5 x LI hours) + (0.5 x Notional hours)

Note: TW and SL have to be planned by the teacher and performed by the learner under the continuous guidance and feedback of teacher to ensure outcome of learning.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2476301	Human Anatomy & Physiology	30	70	20	30	20	30	200

Legend:

PTA: Progressive Theory Assessment in class room (includes class test, mid-term test and quiz using online/offline modes)

PLA: Progressive Laboratory Assessment (includes process and product assessment using rating Scales and rubrics)

TWA: Term work & Self Learning Assessment (Includes assessment related to student performance in assignments, seminars, micro projects, industrial visits, self-learning, any other student activities etc.

Note:

- ETA & ELA are to be carried out at the end of the term/ semester.
- Term Work is to be done by the students under the guidance of internal faculty but its assessment will be done **internally (40%)** as well as **externally (60%)**. Assessment related to planning and execution of Term Work activities like assignment, micro project, seminar and self-learning is to be done by internal faculty (Internal Assessment) whereas assessment of output/product/ presentation related to these activities will be carried out by external faculty/expert (External Assessment). However, criteria of internal as well as external assessment may vary as per the requirement of respective course. For valid and reliable assessment, the internal faculty should prepare checklist & rubrics for these activities.

I) Course Curriculum Detailing: This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction

(LI), Term Work (TW) and Self Learning (SL). Students are expected to demonstrate the attainment of Theory Session Outcomes (TSOs) and Lab Session Outcomes (LSOs) leading to attainment of Course Outcomes (COs) upon the completion of the course. While curriculum detailing, NEP 2020 related reforms like Green skills, Sustainability, Multidisciplinary aspects, Society connect, Indian Knowledge System (IKS) and others must be integrated appropriately.

J) Theory Session Outcomes (TSOs) and Units: T2476301

Major Theory Session Outcomes (TSOs)	Units (with Expanded Title and Subtopics)	Relevant CO(s)
TSO 1.1 Explain the definition, scope, and importance of Anatomy and Physiology in understanding the human body. **TSO 1.2** Describe the hierarchical levels of organization and mechanisms of homeostasis in the human body. **TSO 1.3** Identify anatomical terminology, body planes, cavities, and explain basic cellular and tissue organization.	**Unit I – Introduction to Human Body & Structural Organization** 1.1 Definition of Anatomy and Physiology and their interrelationship 1.2 Scope and importance of studying human anatomy and physiology 1.3 Levels of organization: chemical, cellular, tissue, organ, system, organism 1.4 Concept of homeostasis and its role in maintaining internal balance 1.5 Anatomical terminology: position, directional terms, and regional terms 1.6 Body planes: sagittal, frontal, transverse 1.7 Body cavities: cranial, thoracic, abdominal, pelvic 1.8 Cell: structure, organelles, and functions 1.9 Tissues: epithelial, connective, muscular, and nervous tissues with functions	CO-1
TSO 2.1 Explain the structure and functions of the skeletal system and joints. **TSO 2.2** Describe the muscular system and basic mechanism of muscle contraction.	**Unit II – Support, Movement & Protection Systems** 2.1 Skeletal system: functions and significance 2.2 Classification of bones: long, short, flat, irregular, sesamoid 2.3 Major bones of axial and appendicular skeleton	CO-2

TSO 2.3 Explain the structure and protective role of the integumentary system.	2.4 Joints: definition, classification, and functions 2.5 Types of joints: fibrous, cartilaginous, synovial 2.6 Muscular system: functions and characteristics 2.7 Types of muscles: skeletal, smooth, cardiac 2.8 Basic concept of muscle contraction (sliding filament theory – overview) 2.9 Integumentary system: structure and functions of skin 2.10 Appendages of skin: hair, nails, sweat glands, sebaceous glands	
TSO 3.1 Explain the structure and functioning of the circulatory system and blood components. **TSO 3.2** Describe blood groups, blood pressure, and common circulatory disorders. **TSO 3.3** Explain the structure and function of the respiratory system and mechanism of breathing.	**Unit III – Circulatory & Respiratory Systems** 3.1 Circulatory system: components and functions 3.2 Structure and functioning of the heart 3.3 Blood composition: plasma and formed elements 3.4 Blood groups: ABO system and Rh factor 3.5 Blood pressure and pulse 3.6 Common disorders: hypertension and anemia (basic understanding) 3.7 Respiratory system: organs and their functions 3.8 Mechanism of breathing (inhalation and exhalation) 3.9 Exchange of gases at alveolar and tissue level	CO-3
TSO 4.1 Explain the structure and functions of the nervous system. **TSO 4.2** Describe neuron structure and functions of brain and spinal cord. **TSO 4.3** Explain the endocrine system, major hormones, and effects of hormonal imbalance.	**Unit IV – Control & Coordination Systems** 4.1 Nervous system: organization and functions 4.2 Neuron: structure and physiological functions 4.3 Central nervous system: brain and spinal cord 4.4 Parts and functions of the brain 4.5 Peripheral and autonomic nervous system (basic overview)	CO-4

	4.6 Endocrine system: role in coordination 4.7 Major endocrine glands and their hormones 4.8 Hormonal imbalance and related disorders (basic awareness)	
TSO 5.1 Explain the structure and functioning of the digestive system and role of nutrients. **TSO 5.2** Describe the excretory system, nephron structure, and urine formation. **TSO 5.3** Explain the human reproductive system and basic reproductive processes.	**Unit V – Nutrition, Excretion & Reproduction System** 5.1 Digestive system: organs and functions 5.2 Process of digestion and absorption of food 5.3 Nutrients: proteins, carbohydrates, fats, vitamins, and minerals 5.4 Excretory system: kidneys and associated organs 5.5 Nephron structure and urine formation 5.6 Reproductive system: male and female reproductive organs 5.7 Menstrual cycle 5.8 Fertilization and pregnancy (basic understanding)	CO-5

Note: One major TSO may require more than one Theory session/Period.

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2476301

LSO No.	Laboratory Session Outcome (LSO)	Practical / Experiment Title	Relevant CO(s)
LSO 1.1	Use anatomical terminology and the concept of body planes concept, and body cavities for describing the human body structure.	1. Study of human body anatomical terms, body planes, and body cavities using charts/models.	CO-1
LSO 1.2	Identify major bones and joints of the human skeleton and relate them to support and movement functions.	2. Identification of major bones and joints of the human skeleton using skeletal model.	CO-2
LSO 1.3	Identify various human tissues based on their microscopic characteristics.	3. Identification of human tissues (epithelial, connective, muscular, nervous) under microscope using prepared slides.	CO-1
LSO 2.1	Explain the structure of the heart and major blood vessels	4. Study of the structure of the heart and circulatory system using charts/models and identification of major blood vessels.	CO-3

LSO No.	Laboratory Session Outcome (LSO)	Practical / Experiment Title	Relevant CO(s)
	and relate them to blood circulation.		
LSO 2.2	Perform blood grouping tests for interpretation of ABO and Rh blood groups.	5. Determination of blood group (ABO and Rh typing).	CO-3
LSO 2.3	Measure pulse rate and blood pressure under resting and post-activity conditions.	6. Measurement of pulse rate and blood pressure in resting and post-light activity condition.	CO-3
LSO 3.1	Demonstrate the structure of the respiratory system for assessing lung capacity using basic techniques.	7. Demonstration of respiratory system and measurement of lung capacity using spirometer or balloon technique.	CO-3
LSO 4.1	Identify major organs of the digestive system according to their functions in digestion and absorption.	8. Study of the digestive system: identification of major digestive organs using models/charts.	CO-5
LSO 4.2	Conduct basic physical examination of urine samples for interpretation of results related to excretory function.	9. Urine physical examination (color, appearance, pH, specific gravity using urinometer/strips).	CO-5
LSO 5.1	Demonstrate male and female reproductive organs and their roles in human reproduction.	10. Study of male and female reproductive systems using models/charts (identification of organs).	CO-5

L) Suggested Term Work and Self-Learning:S2476301 Some sample suggested assignments, micro project and other activities are mentioned here for reference.

a. **Assignments**

S. No.	Assignment Topic	Purpose / Expected Learning	Relevant CO(s)
1	Explain the importance of anatomy and physiology in understanding human health.	To develop conceptual understanding of the relevance of anatomy and physiology in maintaining health, diagnosing diseases, and promoting wellness.	CO-1
2	Describe the structure and functions of the skeletal and muscular systems.	To enhance understanding of support, movement, and protection systems and their coordinated functioning in the human body.	CO-2
3	Write short notes on blood groups and respiratory disorders.	To develop knowledge of circulatory and respiratory systems and create awareness	CO-3

S. No.	Assignment Topic	Purpose / Expected Learning	Relevant CO(s)
		about common health conditions and their implications.	
4	Explain the role of nervous and endocrine systems in coordination.	To identify control and coordination mechanisms in the human body and their role in maintaining internal balance.	CO-4
5	Discuss the importance of balanced nutrition and human reproductive health.	To promote awareness of nutrition, reproductive health, and their role in overall well-being and sustainable human health.	CO-5

b. **Micro Projects**

S. No.	Micro-Project Topic	Purpose / Expected Learning	Relevant CO(s)
1	Prepare charts/models showing levels of organization of the human body.	To develop clear understanding of structural organization from cellular to system level and enhance visual learning and presentation skills.	CO-1
2	Case study on common lifestyle disorders related to the circulatory system.	To analyze the causes, symptoms, and preventive measures of circulatory disorders and relate theoretical knowledge to real-life health issues.	CO-3
3	Survey on dietary habits and nutritional deficiencies.	To understand the relationship between diet, nutrition, and health and to develop data collection and interpretation skills.	CO-5
4	Model preparation of human heart or nephron.	To enhance practical understanding of circulatory or excretory system structures and improve hands-on and creative skills.	CO-3, CO-5
5	Awareness presentation on reproductive health and hygiene.	To promote health awareness, responsible behaviour, and understanding of reproductive health and hygiene practices.	CO-5

c. Other Activities

1. Seminar Topics:

S. No.	Seminar Topic	Purpose / Expected Learning	Relevant CO(s)
1	Importance of anatomy and physiology in healthcare and life sciences	To enhance conceptual understanding of the role of anatomy and physiology in health maintenance, disease prevention, and healthcare practices.	CO-1

S. No.	Seminar Topic	Purpose / Expected Learning	Relevant CO(s)
2	Lifestyle disorders and their impact on the circulatory system	To develop awareness about lifestyle-related diseases, their causes, and preventive measures related to the circulatory system.	CO-3
3	Role of nutrition in maintaining physiological balance and immunity	To understand the importance of balanced nutrition in supporting body functions, immunity, and overall health.	CO-5
4	Nervous and endocrine coordination in stress management	To analyze how nervous and endocrine systems regulate stress and maintain homeostasis.	CO-4
5	Reproductive health, hygiene, and awareness	To promote responsible attitudes, health awareness, and understanding of reproductive health and hygiene.	CO-5

2. Surveys:

S. No.	Survey Topic	Purpose / Expected Learning	Relevant CO(s)
1	Survey on lifestyle habits affecting cardiovascular health	To understand the impact of lifestyle factors such as diet, physical activity, and stress on circulatory health and promote preventive healthcare awareness.	CO-3
2	Survey on dietary patterns and nutritional deficiencies among students	To analyze common dietary habits and identify nutritional gaps, enhancing awareness of balanced nutrition and healthy eating practices.	CO-5
3	Survey on respiratory health and exposure to environmental pollutants	To study the effect of environmental factors on respiratory health and develop awareness about pollution-related disorders.	CO-3
4	Survey on stress levels and their effects on nervous and endocrine health	To assess the role of stress on control and coordination systems and understand stress management strategies.	CO-4
5	Survey on awareness of reproductive health and hygiene practices	To promote understanding of reproductive health, hygiene, and responsible behavior among individuals.	CO-5

3. Visit:

S. No.	Visit Place / Activity	Purpose / Expected Learning	Relevant CO(s)
1	Visit to a hospital / diagnostic laboratory	To observe basic clinical practices, understand human body systems in health and disease, and relate theoretical concepts to real-life medical applications.	CO-3, CO-4

S. No.	Visit Place / Activity	Purpose / Expected Learning	Relevant CO(s)
2	Visit to a blood bank	To understand blood grouping, blood storage, transfusion practices, and the importance of blood donation in healthcare.	CO-3
3	Visit to a public health center / wellness center	To gain awareness about preventive healthcare, nutrition, hygiene, and reproductive health services provided at community level.	CO-5

c. **Self-Learning Topics**

S. No.	Self-Learning Topic	Purpose / Expected Learning	Relevant CO(s)
1	Recent advances in learning of in human anatomy and physiology	To update learners with modern developments in understanding of human body systems and encourage continuous academic enrichment.	CO-1
2	Role of yoga, exercise, and lifestyle modification in physiological health	To understand how physical activity and healthy lifestyle choices influence circulatory, respiratory, and metabolic functions.	CO-3, CO-5
3	Impact of stress on nervous and endocrine systems	To analyze physiological stress responses and understand mechanisms of control and coordination.	CO-4
4	Nutrition, immunity, and disease prevention	To explore the relationship between balanced nutrition and immune system functioning for maintaining health.	CO-5
5	Use of digital health tools for monitoring physiological parameters	To develop awareness of basic digital tools used for monitoring heart rate, blood pressure, and respiratory parameters.	CO-3

M) Suggested Course Evaluation Matrix: The course teacher has to decide and use appropriate assessment strategy and its weightage in theory, laboratory and sessional work for ensuring CO attainment. The response/performance of each student in each of these designed activities is to be used to calculate **CO attainment**.

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Sessional Work Assessment (SWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid	End Theory Assessment (ETA)	Sessional Work & Self Learning Assessment			Progressive Lab Assessme	End Laboratory
			Assignments	Micro Projec	Other Activities		

	Sem Test			ts	*	nt (PLA)	Assessme nt (ELA)
CO-1	15%	15%	20%	20%	33%	20%	20%
CO-2	20%	25%	20%	20%	33%	25%	20%
CO-3	25%	25%	20%	20%	34%	20%	20%
CO-4	25%	20%	20%	20%	--	20%	20%
CO-5	15%	15%	20%	20%	--	15%	20%
Total Marks	30	70	20	20	10	20	30
			50				

Legend:

***:** Other Activities include self- learning, seminar, visits, surveys, product development, software development etc.

******: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

- The percentage given are approximate
- In case of Micro Projects and End Laboratory Assessment (ELA), the achieved marks will be equally divided in all those COs mapped with total experiments.
- For CO attainment calculation indirect assessment tools like course exit survey need to be used which comprises of questions related to achievement of each COs.

N) Suggested Specification Table for End Semester Theory Assessment:

Specification table represents the reflection of sample representation of assessment of cognitive domain of full course.

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit I – Introduction to Human Body & Structural Organization	6	CO1	9	4	4	1
Unit II – Support, Movement & Protection Systems	8	CO2	11	4	5	2
Unit III – Circulatory & Respiratory Systems	12	CO3	17	2	6	9
Unit IV – Control & Coordination Systems	12	CO4	18	2	6	10
Unit V – Nutrition, Excretion & Reproduction System	10	CO5	15	2	7	6

Total	**48**	**-**	**70**	**14**	**28**	**28**

Note: Similar table can also be used to design class/mid-term/ internal question paper for progressive assessment.

O) Suggested Assessment Table for Laboratory (Practical):

S. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA (%)	PDA (%)	
1	Study of human body anatomical terms, body planes, and body cavities using charts/models	CO-1	50	40	10
2	Identification of major bones and joints of the human skeleton using skeletal model	CO-2	50	40	10
3	Identification of human tissues (epithelial, connective, muscular, nervous) under microscope	CO-1	50	40	10
4	Study of structure of heart and circulatory system; identification of major blood vessels	CO-3	45	45	10
5	Determination of blood group (ABO and Rh typing)	CO-3	50	40	10
6	Measurement of pulse rate and blood pressure in resting and post-activity condition	CO-3	50	40	10
7	Demonstration of respiratory system and measurement of lung capacity	CO-3	50	40	10
8	Study of digestive system: identification of major digestive organs	CO-5	50	40	10
9	Urine physical examination (color, appearance, pH, specific gravity)	CO-5	50	40	10
10	Study of male and female reproductive systems using models/charts	CO-5	50	40	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

Note: This table can be used for both end semester as well as progressive assessment of practical. Rubrics need to be prepared by the course teacher for each experiment/practical to assess the student performance.

P) Suggested Instructional/Implementation Strategies:

Q) List of Major Laboratory Equipment, Tools and Software:

S. No.	Name of Equipment / Tools / Software	Broad Specifications	Relevant Experiment / Practical No.
1	Human skeletal model	Full-size articulated model showing major bones and joints	2
2	Anatomical charts (body planes & cavities)	Laminated charts depicting anatomical terminology, planes, and cavities	1
3	Compound microscope	Binocular microscope with 10× and 40× objectives	3
4	Prepared histology slides	Slides of epithelial, connective, muscular, and nervous tissues	3
5	Human heart model	Sectional model showing chambers, valves, and major vessels	4
6	Blood grouping kit	Antisera (A, B, D), lancet, slide, and reagents	5
7	Sphygmomanometer	Manual/digital BP apparatus with cuff and gauge	6
8	Stethoscope	Acoustic stethoscope for auscultation of heart sounds	6
9	Spirometer / Balloon set	Basic spirometer or balloon-based lung capacity measurement setup	7
10	Digestive system model	Model showing stomach, intestines, liver, pancreas, etc.	8
11	Urinometer / urine test strips	Device/strips for measuring specific gravity and pH of urine	9
12	Male reproductive system model	Anatomical model showing male reproductive organs	10
13	Female reproductive system model	Anatomical model showing female reproductive organs	10
14	Computer with multimedia software	System with presentation software and anatomy learning resources	1, 4, 8, 10
15	Personal Protective Equipment (PPE)	Gloves, lab coats, masks, and disinfectants	All Practicals

R) Suggested Learning Resources:

(a) Books:

S. No.	Title	Author(s)	Publisher and Edition with ISBN
1	Human Anatomy & Physiology	Elaine N. Marieb, Katja Hoehn	Pearson Education, 11th Edition, ISBN: 978-0134580999
2	Essentials of Human Anatomy & Physiology	Elaine N. Marieb	Pearson Education, 13th Edition, ISBN: 978-0135209295
3	Principles of Anatomy and Physiology	Gerard J. Tortora, Bryan H. Derrickson	Wiley India, 15th Edition, ISBN: 978-1119444460
4	Textbook of Human Anatomy	B. D. Chaurasia	CBS Publishers & Distributors, 8th Edition, ISBN: 978-9387964187
5	Textbook of Physiology	A. K. Jain	Avichal Publishing Company, 6th Edition, ISBN: 978-9386300832
6	Anatomy and Physiology for Nurses	Ross and Pinson	Jaypee Brothers Medical Publishers, 2nd Edition, ISBN: 978-9350903533
7	Human Physiology	C. C. Chatterjee	Medical Allied Agency, 13th Edition, ISBN: 978-8185425875
8	Textbook of Medical Physiology	Guyton & Hall	Elsevier, 14th Edition, ISBN: 978-8131258440

(b) Open Educational Resources (OER):

S. No.	Resource Type	Title / Description	Link / Reference	Relevant Practical / Module
1	National OER Platform	**DIKSHA Portal** – Concept videos, animations, worksheets on human body systems (multilingual)	DIKSHA, Ministry of Education, Govt. of India	All Units – concept clarity & revision
2	National OER Platform	**ePathshala** – Interactive digital learning resources (diagrams, animations) by NCERT	ePathshala (CIET–NCERT)	Units I–V – structure & functions
3	MOOC / Video Lectures	**NPTEL: Human Physiology** – Structured lectures by IIT faculty	NPTEL, SWAYAM	Units I–V – system-wise understanding
4	National OER Repository	**NROER** – Charts, diagrams, and animations on anatomy & physiology	National Repository of Open Educational Resources	Practical identification (organs, systems)

S. No.	Resource Type	Title / Description	Link / Reference	Relevant Practical / Module
5	MOOC Platform	**SWAYAM** – Introductory Biology / Human Body courses with self-assessment	SWAYAM, Govt. of India	All Units – self-learning & assessment
6	Educational Media	**PM eVidya / SWAYAM Prabha** – TV & video lectures on biology and health	PM eVidya, Govt. of India	Concept reinforcement & revision

A) Course Code : 2476302(T2476302/P2476302/S2476302)
B) Course Title : Biophysics & Biochemistry
C) Pre- requisite Course(s) : Fundamentals of Physics, Chemistry and Biology

D) Rationale

Biophysics introduces fundamental physical principles governing living systems, enabling learners to understand diffusion, osmosis, membrane transport, pressure, fluid flow, electricity, light, sound, and radiation in biological contexts. Biochemistry focuses on the chemical composition of living organisms, biomolecules, enzymes, and metabolism, linking molecular processes with health and disease. Together, this course strengthens scientific reasoning, laboratory awareness, hygiene consciousness, and prepares learners for advanced studies in health sciences and applied biology.

E) Course Outcomes (COs): Upon successful completion of the course, learners are expected to achieve the prescribed course outcomes through active participation in learning activities encompassing the cognitive, psychomotor, and affective domains in classroom and experiential learning environments.

After completion of the course, the students will be able to:

CO No.	Course Outcome
CO1	Explain fundamental physical principles such as diffusion, osmosis, pressure, and electricity and their relevance to biological systems.
CO2	Describe the structure, classification, and biological functions of major biomolecules including carbohydrates, proteins, lipids, and nucleic acids.
CO3	Explain the nature, mechanism, and regulation of enzymes and their role in metabolism and energy production.
CO4	Apply basic concepts of biophysics and biochemistry in laboratory experiments and simple health science applications.
CO5	Relate biochemical and biophysical principles to common clinical conditions such as anaemia and diabetes for basic health awareness.

F) Suggested Course Articulation Matrix (CAM):

PSO-1:

Apply fundamental principles of biophysics and biochemistry to understand biological processes, body functions, and health-related phenomena at molecular and system levels.

PSO-2:

Utilize basic laboratory, analytical, and observational skills to interpret biophysical and biochemical data for simple experiments, health awareness, and interdisciplinary applications.

Course Outcomes (COs)	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design / Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CO-1	3	-	1	-	-	-	1	-	-
CO-2	3	1	1	-	-	-	1	-	-
CO-3	3	2	3	2	1	1	2	-	-
CO-4	3	2	3	2	2	1	2	-	-
CO-5	3	2	3	2	2	1	2	-	-

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Studies (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+SL)	Total Hours (CI+LI+TW+SL)	Total Credits(C)
		L	T				
2476302	Biophysics & Biochemistry	03	-	04	02	09	06

Legend:

CI: Classroom Instruction (Includes different instructional/implementation strategies i.e. Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning etc. to deliver theoretical concepts)

LI: Laboratory Instruction (Includes experiments/practical performances in laboratory, workshop, field or other locations using different instructional/Implementation strategies)

Notional Hours: Hours of engagement by learners, other than the contact hours for ensuring learning.

TW: Term work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.)

SL: Self Learning, MOOCs, spoken tutorials, open educational resources (OERs)

C: Credits = (1 x CI hours) + (0.5 x LI hours) + (0.5 x Notional hours)

Note: TW and SL have to be planned by the teacher and performed by the learner under the continuous guidance and feedback of teacher to ensure outcome of learning.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2476302	Biophysics & Biochemistry	30	70	20	30	20	30	200

Legend:

PTA: Progressive Theory Assessment in class room (includes class test, mid-term test and quiz using online/offline modes)

PLA: Progressive Laboratory Assessment (includes process and product assessment using rating Scales and rubrics)

TWA: Term work & Self Learning Assessment (Includes assessment related to student performance in assignments, seminars, micro projects, industrial visits, self-learning, any other student activities etc.

Note:

a. ETA & ELA are to be carried out at the end of the term/ semester.

b. Term Work is to be done by the students under the guidance of internal faculty but its assessment will be done **internally (40%)** as well as **externally (60%)**. Assessment related to planning and execution of Term Work activities like assignment, micro project, seminar and self-learning is to be done by internal faculty (Internal Assessment) whereas assessment of output/product/ presentation related to these activities will be carried out by external faculty/expert (External Assessment). However, criteria of internal as well as external assessment may vary as per the requirement of respective course. For valid and reliable assessment, the internal faculty should prepare checklist & rubrics for these activities.

I) Course Curriculum Detailing: This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction

(LI), Term Work (TW) and Self Learning (SL). Students are expected to demonstrate the attainment of Theory Session Outcomes (TSOs) and Lab Session Outcomes (LSOs) leading to attainment of Course Outcomes (COs) upon the completion of the course. While curriculum detailing, NEP 2020 related reforms like Green skills, Sustainability, Multidisciplinary aspects, Society connect, Indian Knowledge System (IKS) and others must be integrated appropriately.

J) Theory Session Outcomes (TSOs) and Units: T2476302

Major Theory Session Outcomes (TSOs)	Units (with Expanded Title and Subtopics)	Relevant CO(s)
TSO 1.1 Explain the structure of atoms and molecules and their biological relevance. **TSO 1.2** Describe states of matter and their importance in biological systems. **TSO 1.3** Explain pH, buffers, and their role in maintaining body fluid balance. **TSO 1.4** Describe solution concentration and tonicity in biological contexts.	**Unit I – Fundamentals of Biophysics** 1.1 Structure of atoms and molecules (basic concept) 1.2 States of matter and biological relevance 1.3 pH and buffers; importance of pH in body fluids 1.4 Solutions: molarity, normality (basic idea) 1.5 Isotonic, hypertonic, hypotonic solutions	CO-1
TSO 2.1 Explain diffusion, osmosis, and membrane transport mechanisms. **TSO 2.2** Describe surface tension and viscosity with biological significance.	**Unit II – Transport Phenomena and Physical Properties of Biological Systems** 2.1 Diffusion and osmosis 2.2 Membrane transport (basic overview) 2.3 Surface tension and viscosity in biological systems	CO1
TSO 3.1 Explain pressure and fluid mechanics in human circulation. **TSO 3.2** Describe thermoregulation and heat transfer in the human body. **TSO 3.3** Explain the role of light, sound, electricity, and radiation in biology.	**Unit III – Biophysical Principles in Body Functions** 3.1 Pressure and its application in the human body 3.2 Fluid mechanics in circulation (basic) 3.3 Thermoregulation: body temperature and heat transfer 3.4 Light and sound in biology (visual system and hearing – basic)	CO1, CO4

	3.5 Electricity in biology: nerve impulse basics and ECG concept (introductory) 3.6 Radiation and radioisotopes in medicine (diagnostic and therapeutic overview)	
TSO 4.1 Describe the classification and functions of carbohydrates. **TSO 4.2** Explain amino acids, proteins, and their biological roles. **TSO 4.3** Describe lipids, nucleic acids, vitamins, and minerals in health.	**Unit IV – Biomolecules** 4.1 Carbohydrates: classification and functions 4.2 Amino acids and proteins: types and biological functions 4.3 Lipids: types and roles in the body 4.4 Nucleic acids: DNA and RNA – structure and functions 4.5 Vitamins and minerals: types, significance, and deficiency disorders (elementary)	CO-2
TSO 5.1 Explain the nature, mechanism, and regulation of enzymes. **TSO 5.2** Describe metabolism and major energy-yielding pathways. **TSO 5.3** Relate biochemical principles to common clinical conditions.	**Unit V – Enzymes, Metabolism, and Clinical Biochemistry** 5.1 Enzymes: nature, properties, mechanism of action 5.2 Factors affecting enzyme activity 5.3 Metabolism: anabolism and catabolism 5.4 Carbohydrate metabolism: glycolysis and ATP production (simplified) 5.5 Protein metabolism: protein synthesis (introductory) 5.6 Lipid metabolism: energy storage and breakdown 5.7 Clinical relevance: anemia and diabetes (basic awareness)	CO3, CO4, CO5

Note: One major TSO may require more than one Theory session/Period.

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2476302

Exp. No.	Laboratory Session Outcome	Practical / Experiment Title	Relevant CO
1	Measure pH using indicators and pH paper.	1. Determination of pH of given solutions	CO4

Exp. No.	Laboratory Session Outcome	Practical / Experiment Title	Relevant CO
2	Prepare buffer solutions of known pH.	2. Preparation of acidic and basic buffers	CO4
3	Demonstrate diffusion across a membrane.	3. Study of diffusion using agar or membrane model	CO4
4	Demonstrate osmosis using biological/semi-permeable membrane.	4. Osmosis experiment with hypotonic and hypertonic solutions	CO4
5	Determine viscosity of liquids.	5. Measurement of viscosity using simple viscometer	CO1
6	Identify carbohydrates qualitatively.	6. Tests for carbohydrates (Benedict's/Iodine)	CO2
7	Identify proteins qualitatively.	7. Tests for proteins (Biuret test)	CO2
8	Identify lipids qualitatively.	8. Tests for lipids (Sudan III / grease spot)	CO2
9	Demonstrate enzyme activity.	9. Effect of temperature and pH on enzyme action	CO3
10	Interpret biomedical relevance.	10. Case study discussion on anemia or diabetes	CO4 & CO5

L) Suggested Term Work and Self-Learning: S2476302 Some sample suggested assignments, micro project and other activities are mentioned here for reference.

d. **Assignments**

S. No.	Assignment Topic	Purpose / Expected Learning	Relevant CO(s)
1	Physical principles in biological systems	To understand diffusion, osmosis, pressure, electricity, and their relevance to living systems	CO1
2	pH, buffers, and solutions in body fluids	To explain the role of pH balance, buffer systems, and isotonic solutions in human physiology	CO1
3	Biomolecules and their biological significance	To describe structure, classification, and functions of carbohydrates, proteins, lipids, and nucleic acids	CO2
4	Enzymes and metabolic processes	To understand enzyme action, factors affecting enzyme activity, and basic metabolism	CO3
5	Laboratory applications of biophysics and biochemistry	To apply basic biophysical and biochemical concepts in laboratory practices and health-related applications	CO4

S. No.	Assignment Topic	Purpose / Expected Learning	Relevant CO(s)
6	Clinical relevance of biophysics and biochemistry	To relate biophysical and biochemical principles to common disorders such as anaemia and diabetes	CO5

e. **Micro Projects**

S. No.	Micro-Project Topic	Purpose / Expected Learning	Relevant CO(s)
1	Model or chart on diffusion and osmosis in biological systems	To visualize and explain basic transport mechanisms across biological membranes	CO1
2	Preparation of charts/models of major biomolecules	To demonstrate structure, classification, and functions of carbohydrates, proteins, lipids, and nucleic acids	CO2
3	Study of project on enzyme activity and factors affecting it	To analyse the effect of pH and temperature on enzyme action	CO3
4	Simple laboratory-based study using biophysical or biochemical techniques	To apply basic biophysics and biochemistry concepts in experimental or observational work	CO4
5	Case study of project on anaemia or diabetes	To relate biophysical and biochemical concepts to common clinical conditions and health awareness	CO5

c. Other Activities

1. Seminar Topics:

S. No.	Seminar Topic	Purpose / Expected Learning	Relevant CO(s)
1	Role of physical principles in biological systems	To understand and explain the application of diffusion, osmosis, pressure, and electricity in living organisms	CO1
2	Biomolecules and their importance in human health	To explain the structure and functions of carbohydrates, proteins, lipids, and nucleic acids	CO2
3	Enzymes and metabolism in living organisms	To understand enzyme action, metabolic pathways, and energy production	CO3
4	Applications of biophysics and biochemistry in healthcare	To apply basic biophysical and biochemical concepts to laboratory and health science practices	CO4
5	Biochemical basis of common clinical disorders	To relate biochemical and biophysical principles to disorders such as anaemia and diabetes	CO5

2. Surveys:

S. No.	Survey Topic	Purpose / Expected Learning	Relevant CO(s)
1	Awareness of pH balance, hydration, and electrolyte intake	To understand the importance of pH, buffers, and fluid balance in maintaining health	CO1
2	Dietary habits and intake of biomolecules	To analyze consumption of carbohydrates, proteins, fats, vitamins, and minerals	CO2
3	Awareness of enzymes and metabolism in daily life	To relate enzyme activity and metabolism with digestion and energy production	CO3
4	Use of basic diagnostic tools in healthcare	To understand application of biophysical and biochemical principles in health practices	CO4
5	Awareness of common biochemical disorders (anaemia, diabetes)	To relate biochemical principles with clinical conditions and preventive healthcare	CO5

3. Visit:

S. No.	Visit Place / Activity	Purpose / Expected Learning	Relevant CO(s)
1	Visit to a diagnostic laboratory	To observe applications of biophysics and biochemistry in routine medical testing	CO4
2	Visit to a hospital or health centre	To understand clinical relevance of biochemistry in diagnosis and patient care	CO4, CO5
3	Visit to a blood bank	To understand biochemical basis of blood components and disorders like anaemia	CO2, CO5

f. **Self-Learning Topics**

S. No.	Self-Learning Topic	Purpose / Expected Learning	Relevant CO(s)
1	Advanced concepts of diffusion, osmosis, and membrane transport	To deepen understanding of biophysical principles governing material transport in living systems	CO1
2	Emerging trends in biomolecules and functional nutrition	To explore the role of carbohydrates, proteins, lipids, vitamins, and minerals in health and disease	CO2
3	Enzymes and metabolic regulation in human physiology	To understand enzyme control mechanisms and metabolic balance in living organisms	CO3

S. No.	Self-Learning Topic	Purpose / Expected Learning	Relevant CO(s)
4	Applications of biophysics and biochemistry in modern diagnostics	To apply basic principles in healthcare technologies such as ECG, imaging, and laboratory diagnostics	CO4
5	Prevention and management of common biochemical disorders	To relate biophysical and biochemical concepts to health awareness, anemia, diabetes, and lifestyle management	CO5

M) Suggested Course Evaluation Matrix: The course teacher has to decide and use appropriate assessment strategy and its weightage in theory, laboratory and sessional work for ensuring CO attainment. The response/performance of each student in each of these designed activities is to be used to calculate **CO attainment**.

COs	Course Evaluation Matrix						
	Theory Assessment (TA)**		Sessional Work Assessment (SWA)			Lab Assessment (LA)#	
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Sessional Work & Self Learning Assessment			Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
			Assignments	Micro Projects	Other Activities *		
CO-1	15%	15%	20%	20%	33%	20%	20%
CO-2	20%	25%	20%	20%	33%	25%	20%
CO-3	25%	25%	20%	20%	34%	20%	20%
CO-4	25%	20%	20%	20%	--	20%	20%
CO-5	15%	15%	20%	20%	--	15%	20%
Total Marks	30	70	20	20	10	20	30
			50				

Legend:

***:** Other Activities include self- learning, seminar, visits, surveys, product development, software development etc.

******: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

a. The percentage given are approximate

b. In case of Micro Projects and End Laboratory Assessment (ELA), the achieved marks will be equally divided in all those COs mapped with total experiments.

c. For CO attainment calculation indirect assessment tools like course exit survey need to be used which comprises of questions related to achievement of each COs.

N) Suggested Specification Table for End Semester Theory Assessment: Specification table represents the reflection of sample representation of

assessment of cognitive domain of full course.

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit I – Fundamentals of Biophysics	6	CO1	9	4	4	1
Unit II – Transport Phenomena and Physical Properties of Biological Systems	8	CO2	11	4	5	2
Unit III – Biophysical Principles in Body Functions	12	CO3	17	2	6	9
Unit IV – Biomolecules	12	CO4	18	2	6	10
Unit V – Enzymes, Metabolism, and Clinical Biochemistry	10	CO5	15	2	7	6
Total	**48**	**-**	**70**	**14**	**28**	**28**

Note: Similar table can also be used to design class/mid-term/ internal question paper for progressive assessment.

O) Suggested Assessment Table for Laboratory (Practical):

Exp. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA (%)	PDA (%)	
1	Determination of pH of given solutions	CO4	50	40	10
2	Preparation of acidic and basic buffers	CO4	50	40	10
3	Study of diffusion using agar or membrane model	CO4	50	40	10
4	Osmosis experiment with hypotonic and hypertonic solutions	CO4	45	45	10
5	Measurement of viscosity using simple viscometer	CO1	50	40	10

6	Tests for carbohydrates (Benedict's/Iodine)	CO2	50	40	10
7	Tests for proteins (Biuret test)	CO2	50	40	10
8	Tests for lipids (Sudan III / grease spot)	CO2	50	40	10
9	Effect of temperature and pH on enzyme action	CO3	50	40	10
10	Case study discussion on anemia or diabetes	CO4 & CO5	50	40	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

Note: This table can be used for both end semester as well as progressive assessment of practical. Rubrics need to be prepared by the course teacher for each experiment/practical to assess the student performance.

P) Suggested Instructional/Implementation Strategies:

Q) List of Major Laboratory Equipment, Tools and Software:

S. No.	Name of Equipment / Tools / Software	Broad Specifications	Relevant Experiment / Practical No.
1	pH paper / pH indicator set	Universal pH paper (range 1–14) with standard color chart	1
2	Buffer preparation kit	Standard buffer salts, measuring cylinders, beakers	2
3	Semi-permeable membrane setup	Dialysis tubing / egg membrane with clamps	3, 4
4	Agar gel diffusion apparatus	Agar plates, petri dishes, droppers	3
5	Viscometer	Ostwald / simple viscometer with stopwatch	5
6	Water bath	Temperature-controlled (room temp to 100 °C)	9
7	Thermometer	Laboratory thermometer (0–100 °C)	9
8	Test tubes and test tube stand	Borosilicate glassware	6, 7, 8
9	Pipettes and droppers	Graduated glass / plastic pipettes	1, 2, 6–9
10	Benedict's reagent	Standard qualitative carbohydrate testing reagent	6
11	Iodine solution	Lugol's iodine solution	6

S. No.	Name of Equipment / Tools / Software	Broad Specifications	Relevant Experiment / Practical No.
12	Biuret reagent	Copper sulfate–based protein test reagent	7
13	Sudan III solution	Lipid-soluble dye for fat detection	8
14	Stopwatch	Digital stopwatch	5, 9
15	Case study charts / multimedia system	Printed charts / computer with projector	10
16	Personal Protective Equipment (PPE)	Lab coat, gloves, safety goggles	All Experiments

R) Suggested Learning Resources:

(c) Books:

S. No.	Title	Author(s)	Publisher and Edition with ISBN
1	Essentials of Medical Biophysics	K. S. G. Murthy	CBS Publishers & Distributors, 7th Edition, ISBN: 978-8123927164
2	Biophysics	Vasantha Pattabhi, N. Gautham	Narosa Publishing House, 2nd Edition, ISBN: 978-8184870096
3	Textbook of Biochemistry	U. Satyanarayana, U. Chakrapani	Elsevier India, 5th Edition, ISBN: 978-8131249257
4	Harper’s Illustrated Biochemistry	Rodwell, Bender, Botham et al.	McGraw-Hill Education, 31st Edition, ISBN: 978-1260455293
5	Medical Biochemistry	John W. Baynes, Marek H. Dominiczak	Elsevier, 5th Edition, ISBN: 978-0702063462
6	Fundamentals of Biochemistry: Life at the Molecular Level	Donald Voet, Judith G. Voet, Charlotte W. Pratt	Wiley India, 5th Edition, ISBN: 978-8126537360

(d) Open Educational Resources (OER):

S. No.	Resource Type	Title / Description	Link / Reference	Relevant Practical / Module
1	NPTEL Online Course	Biophysics – Physical principles in biological systems	https://nptel.ac.in	Unit I, II; Practicals 1–5
2	NPTEL Online Course	Biochemistry – Biomolecules and Metabolism	https://nptel.ac.in	Unit IV, V; Practicals 6–9

S. No.	Resource Type	Title / Description	Link / Reference	Relevant Practical / Module
3	Open Textbook	OpenStax Biology – Biomolecules & Enzymes	https://openstax.org/details/books/biology-2e	Unit IV; Practicals 6–8
4	Open Textbook	OpenStax Chemistry – pH, buffers, and solutions	https://openstax.org/details/books/chemistry-2e	Unit I; Practicals 1–2
5	Virtual Lab	Amrita Virtual Labs – Biochemistry Experiments	https://vlab.amrita.edu	Practicals 6–9
6	Virtual Lab	IIT Virtual Labs – Diffusion, Osmosis & Enzyme Kinetics	https://www.vlab.co.in	Unit II, V; Practicals 3, 4, 9
7	Educational Website	Khan Academy – Enzymes, Metabolism & Human Biology	https://www.khanacademy.org	Unit V; Practicals 9–10
8	WHO Resource	Nutrition, Vitamins & Mineral Deficiency Disorders	https://www.who.int	Unit IV; Practical 10
9	Online Learning Platform	Coursera / edX – Introduction to Biochemistry (audit mode)	https://www.coursera.org/ https://www.edx.org	Unit IV, V
10	Clinical Resource Portal	MedlinePlus – Anemia and Diabetes (basic awareness)	https://medlineplus.gov	Unit V; Practical 10

A) Course Code : 2476303(T2476303/P2476303/S2476303)
B) Course Title : Clinical Pathology
C) Pre- requisite Course(s) : Fundamentals of Biology / Basic Medical Laboratory Science

D) Rationale

Clinical Pathology deals with the laboratory investigation of body fluids for diagnosis, monitoring, and prevention of diseases. This course provides learners with fundamental knowledge of sample collection, laboratory safety, hematology, urine and stool examination, and basic clinical interpretation. Emphasis is placed on understanding routine diagnostic procedures, quality control, and report writing, thereby building a strong foundation for healthcare, laboratory technology, and allied health sciences.

E) Course Outcomes (COs): Upon successful completion of the course, learners are expected to achieve the prescribed course outcomes through active participation in learning activities encompassing the cognitive, psychomotor, and affective domains in classroom and experiential learning environments.

After completion of the course, the students will be able to:

CO No.	Course Outcome
CO1	Explain the basic principles of clinical pathology, laboratory safety, and sample handling procedures.
CO2	Describe the composition of blood and perform basic hematological investigations and result interpretation.
CO3	Explain physical, chemical, and microscopic examination of urine and interpret findings in common conditions.
CO4	Describe stool examination procedures and basic analysis of other body fluids for clinical relevance.
CO5	Apply principles of quality control, safety, and report writing in routine clinical pathology practice.

F) Suggested Course Articulation Matrix (CAM):

PSO-1

Apply fundamental principles of clinical pathology, hematology, and body fluid analysis to assist in the diagnosis and monitoring of common diseases.

PSO-2

Perform basic clinical pathology laboratory procedures safely using standard equipment, following quality control, infection control, and proper reporting practices.

Course Outcomes (COs)	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design / Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CO-1	3	-	-	-	-	-	1	-	-
CO-2	3	1	-	-	-	-	1	-	-
CO-3	3	2	3	2	1	1	2	-	-
CO-4	3	2	3	2	1	1	2	-	-
CO-5	3	2	3	2	1	1	2	-	-

Legend: High (3), Medium (2), Low (1) and No mapping (-)
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2476303	Clinical Pathology	03	-	04	02	09	06

Legend:

CI: Classroom Instruction (Includes different instructional/implementation strategies i.e. Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning etc. to deliver theoretical concepts)

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C: Credits = (1 x CI hours) + (0.5 x LI hours) + (0.5 x Notional hours)

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Legend:

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(LI), Term Work (TW) and Self Learning (SL). Students are expected to demonstrate the attainment of Theory Session Outcomes (TSOs) and Lab Session Outcomes (LSOs) leading to attainment of Course Outcomes (COs) upon the completion of the course. While curriculum detailing, NEP 2020 related reforms like Green skills, Sustainability, Multidisciplinary aspects, Society connect, Indian Knowledge System (IKS) and others must be integrated appropriately.

J) Theory Session Outcomes (TSOs) and Units: T2476303

Major Theory Session Outcomes (TSOs)	Units (with Expanded Title and Subtopics)	Relevant CO(s)
TSO 1.1 Explain the scope and importance of clinical pathology. **TSO 1.2** Describe principles of sample collection, labeling, transportation, and storage. **TSO 1.3** Explain types and uses of anticoagulants. **TSO 1.4** Describe basic laboratory glassware, equipment, and safety measures.	**Unit I –Introduction to Clinical Pathology and Laboratory Practices** 1.1 Introduction and scope of clinical pathology 1.2 Sample collection, labeling, transportation, and storage 1.3 Anticoagulants: types and uses 1.4 Laboratory glassware and equipment: microscope, centrifuge, water bath, incubator (introductory) 1.5 Safety in pathology laboratory: PPE, biomedical waste disposal, infection control	CO-1
TSO 2.1 Describe composition and functions of blood. **TSO 2.2** Explain methods of blood sample collection. **TSO 2.3** Explain routine hematological investigations and their significance.	**Unit II – Hematology: Blood and Routine Investigations** 2.1 Blood composition and functions 2.2 Collection of blood samples: venous and capillary 2.3 Hemoglobin estimation 2.4 Total RBC count, Total WBC count, Platelet count 2.5 Differential Leukocyte Count (DLC) 2.6 ESR and PCV – concept 2.7 Blood indices 2.8 Interpretation of common hematology results	CO2
TSO 3.1 Explain collection and preservation of urine samples.	**Unit III – Urine Examination** 3.1 Collection and preservation of urine samples	CO3

TSO 3.2 Describe physical, chemical, and microscopic examination of urine. **TSO 3.3** Interpret urine findings in common clinical conditions.	3.2 Physical examination: color, appearance, odor, volume, pH, specific gravity 3.3 Chemical tests: glucose, protein, ketone bodies, bile salts and pigments, albumin, urobilinogen 3.4 Microscopic examination: RBCs, WBCs, pus cells, epithelial cells, casts, crystals, bacteria, yeasts, parasites 3.5 Interpretation of urine examination findings	
TSO 4.1 Describe stool sample collection and examination procedures. **TSO 4.2** Explain examination of other body fluids for basic clinical awareness.	**Unit IV – Stool Examination and Other Body Fluids** 4.1 Stool sample collection and preservation 4.2 Physical and chemical examination of stool 4.3 Detection of blood, fat, mucus 4.4 Identification of ova, cysts, and parasites 4.5 Stool examination in common diseases 4.6 Introduction to examination of other body fluids: a) CSF: protein, glucose, cells (general awareness) b) Sputum examination: AFB smear (concept only) c) Semen analysis (basic parameters)	CO-2
TSO 5.1 Explain the role of quality control in clinical pathology laboratories. **TSO 5.2** Describe principles of laboratory report writing and result communication.	**Unit V – Quality Control and Clinical Reporting** 5.1 Importance of quality control in laboratory investigations 5.2 Sources of laboratory errors and their prevention 5.3 Standard operating procedures (SOPs) 5.4 Basics of laboratory records and documentation 5.5 Principles of report writing and ethical considerations	CO5

Note: One major TSO may require more than one Theory session/Period.

K) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2476303

Exp. No.	Practical / Experiment Title	Laboratory Session Outcome	Relevant CO(s)
1	Identification of laboratory glassware and equipment	Identify basic pathology lab equipment and their uses	CO1
2	Demonstration of PPE and biomedical waste disposal	Practice laboratory safety and infection control	CO1, CO5
3	Collection of venous and capillary blood samples (demo)	Demonstrate correct blood collection techniques	CO2
4	Hemoglobin estimation	Estimate hemoglobin and interpret results	CO2
5	Total RBC and WBC count	Perform cell counting using hemocytometer	CO2
6	Differential Leukocyte Count (DLC)	Identify and differentiate leukocytes	CO2
7	ESR and PCV (demonstration)	Explain ESR and PCV and their clinical significance	CO2
8	Physical and chemical examination of urine	Perform routine urine analysis	CO3
9	Microscopic examination of urine sediment	Identify cells, casts, and crystals	CO3
10	Stool examination (demo)	Identify ova, cysts, blood, and mucus	CO4
11	Case study interpretation and report writing	Interpret lab findings and prepare reports	CO5

L) Suggested Term Work and Self-Learning: S2476303 Some sample suggested assignments, micro project and other activities are mentioned here for reference.

g. **Assignments**

S. No.	Assignment Topic	Purpose / Expected Learning	Relevant CO(s)
1	Principles of sample collection and anticoagulants	Understand correct sample handling, labeling, storage and use of anticoagulants	CO1
2	Laboratory safety and biomedical waste management	Learn infection control practices and safe laboratory behavior	CO1, CO5
3	Hematological investigations and their clinical significance	Correlate blood parameters with common hematological disorders	CO2
4	Routine urine examination and interpretation	Interpret physical, chemical and microscopic urine findings	CO3
5	Stool examination in parasitic and gastrointestinal diseases	Understand diagnostic importance of stool analysis	CO4

S. No.	Assignment Topic	Purpose / Expected Learning	Relevant CO(s)
6	Importance of quality control and report writing in pathology	Develop awareness of laboratory quality assurance and ethical reporting	CO5

h. **Micro Projects**

S. No.	Micro-Project Topic	Purpose / Expected Learning	Relevant CO(s)
1	Model of hematology laboratory workflow	Understand lab process flow	CO1, CO2
2	Case study on anemia	Interpret hematology reports	CO2, CO5
3	Survey on urinary tract infections	Relate urine analysis with disease	CO3
4	Stool parasites chart preparation	Identify parasites visually	CO4
5	SOP preparation for pathology lab	Learn quality control documentation	CO5

c. Other Activities

1. Seminar Topics:

S. No.	Seminar Topic	Purpose / Expected Learning	Relevant CO(s)
1	Role of clinical pathology in disease diagnosis	Understand importance of lab investigations	CO1
2	Hematological disorders and lab diagnosis	Correlate blood tests with diseases	CO2
3	Urine examination in renal disorders	Interpret urine findings	CO3
4	Parasitic infections and stool examination	Understand stool-based diagnosis	CO4
5	Quality control and ethical reporting	Appreciate lab quality and ethics	CO5

2. Surveys:

S. No.	Survey Topic	Purpose / Expected Learning	Relevant CO(s)
1	Awareness of blood disorders	Understand public health relevance	CO2
2	Hygiene and infection control practices	Relate safety to lab practice	CO1, CO5

S. No.	Survey Topic	Purpose / Expected Learning	Relevant CO(s)
3	Prevalence of diabetes (urine sugar)	Correlate urine findings	CO3
4	Parasitic infections awareness	Link stool exam with disease	CO4
5	Lab report understanding by patients	Improve communication skills	CO5

3. Visit:

S. No.	Visit Place	Purpose / Expected Learning	Relevant CO(s)
1	Hospital pathology laboratory	Observe routine diagnostic work	CO1–CO5
2	Blood bank	Understand blood testing and safety	CO2, CO5
3	Diagnostic center	Learn lab workflow and reporting	CO1, CO5

1

i. **Self-Learning Topics**

S. No.	Self-Learning Topic	Purpose / Expected Learning	Relevant CO(s)
1	Advances in clinical pathology diagnostics	Gain awareness of modern laboratory diagnostic techniques	CO1
2	Automated hematology analyzers	Understand basic principles of automation in hematology	CO2
3	Urine abnormalities and their clinical correlation	Relate urine findings with renal and metabolic disorders	CO3
4	Emerging parasitic and gastrointestinal infections	Enhance understanding of stool-based disease diagnosis	CO4
5	Laboratory accreditation and quality assurance systems	Learn importance of NABL/ISO standards in pathology labs	CO5

M) Suggested Course Evaluation Matrix: The course teacher has to decide and use appropriate assessment strategy and its weightage in theory, laboratory and sessional work for ensuring CO attainment. The response/performance of each student in each of these designed activities is to be used to calculate CO attainment.

	Course Evaluation Matrix				
	Theory Assessment (TA)**		Sessional Work Assessment (SWA)	Lab Assessment (LA)#	
COs	Progressive Theory	End Theory Assessment	Sessional Work & Self Learning Assessment	Progressi	End

	Assessment (PTA) Class/Mid Sem Test	(ETA)	Assignments	Micro Projects	Other Activities *	ve Lab Assessment (PLA)	Laboratory Assessment (ELA)
CO-1	15%	15%	20%	20%	33%	20%	20%
CO-2	20%	25%	20%	20%	33%	25%	20%
CO-3	25%	25%	20%	20%	34%	20%	20%
CO-4	25%	20%	20%	20%	--	20%	20%
CO-5	15%	15%	20%	20%	--	15%	20%
Total Marks	30	70	20	20	10	20	30
			50				

Legend:

***:** Other Activities include self- learning, seminar, visits, surveys, product development, software development etc.

******: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

a. The percentage given are approximate

b. In case of Micro Projects and End Laboratory Assessment (ELA), the achieved marks will be equally divided in all those COs mapped with total experiments.

c. For CO attainment calculation indirect assessment tools like course exit survey need to be used which comprises of questions related to achievement of each COs.

N) Suggested Specification Table for End Semester Theory Assessment:

Specification table represents the reflection of sample representation of assessment of cognitive domain of full course.

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit I – Introduction to Clinical Pathology and Laboratory Practices	6	CO1	9	4	4	1
Unit II – Hematology: Blood and Routine Investigations	8	CO2	11	4	5	2
Unit III – Urine Examination	12	CO3	17	2	6	9
Unit IV – Stool Examination and Other Body Fluids	12	CO4	18	2	6	10
Unit V – Quality Control and Clinical Reporting	10	CO5	15	2	7	6

Total	**48**	**-**	**70**	**14**	**28**	**28**

Note: Similar table can also be used to design class/mid-term/ internal question paper for progressive assessment.

O) Suggested Assessment Table for Laboratory (Practical):

Exp. No.	Practical / Experiment Title	Relevant CO(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA (%)	PDA (%)	
1	Identification of laboratory glassware and equipment	CO1	50	40	10
2	Demonstration of PPE and biomedical waste disposal	CO1, CO5	50	40	10
3	Collection of venous and capillary blood samples (demo)	CO2	50	40	10
4	Hemoglobin estimation	CO2	45	45	10
5	Total RBC and WBC count	CO2	50	40	10
6	Differential Leukocyte Count (DLC)	CO2	50	40	10
7	ESR and PCV (demonstration)	CO2	50	40	10
8	Physical and chemical examination of urine	CO3	50	40	10
9	Microscopic examination of urine sediment	CO3	50	40	10
10	Stool examination (demo)	CO4	50	40	10
11	Case study interpretation and report writing	CO5	50	40	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

Note: This table can be used for both end semester as well as progressive assessment of practical. Rubrics need to be prepared by the course teacher for each experiment/practical to assess the student performance.

P) Suggested Instructional/Implementation Strategies:

Q) List of Major Laboratory Equipment, Tools and Software:

S. No.	Name of Equipment / Tools / Software	Broad Specifications	Relevant Experiment / Practical No.
1	Compound Microscope	Binocular, 10× and 40× objectives	6, 9, 10
2	Centrifuge	Bench-top, variable speed	8, 9
3	Hemocytometer (Neubauer chamber)	Glass counting chamber with cover slip	5
4	Hemoglobinometer	Sahli's / digital type	4
5	ESR apparatus	Westergren / Wintrobe type	7
6	Microhematocrit centrifuge	Capillary tube centrifuge	7
7	Water bath	Temperature controlled (room temp–100°C)	4
8	Incubator	Temperature range 25–37°C	10
9	Test tubes and racks	Borosilicate glassware	4–10
10	Pipettes and droppers	Graduated glass / plastic	4–9
11	Personal Protective Equipment (PPE)	Lab coat, gloves, masks, goggles	2, All
12	Biomedical waste bins	Color-coded disposal system	2
13	Slides and cover slips	Standard microscopy slides	6, 9, 10
14	Computer / multimedia system	Basic data entry and presentation	11

R) Suggested Learning Resources:

(a) Books:

S. No.	Title	Author(s)	Publisher and Edition with ISBN
1	Essentials of Clinical Pathology	Shirish M. Kawthalkar	Jaypee Brothers Medical Publishers, 3rd Edition (Reprint) – ISBN: **9789356961616** (AIBH)
2	Textbook of Clinical Pathology for MLT Students	Ramnik Sood	CBS Publishers & Distributors, 1st Edition – ISBN: **9789354661785** (AIBH)
3	Laboratory Manual of Clinical Pathology and Hematology	Santosh Kumar Mondal	CBS Publishers & Distributors, 1st Edition – ISBN: **9789354660580** (AIBH)
4	Biochemistry and Clinical Pathology Theory and Practical	S. P. Singh	CBS Publishers & Distributors, 1st Edition – ISBN: **9789354660481** (AIBH)

(b) Open Educational Resources (OER):

S. No.	Resource Type	Title / Description	Link / Reference	Relevant Practical / Module
1	NPTEL	Clinical Pathology basics	https://nptel.ac.in	Unit I–V
2	Virtual Lab	Hematology & urine analysis	https://www.vlab.co.in	Practicals 4–9
3	Open Textbook	OpenStax Anatomy & Physiology	https://openstax.org	Units II–IV
4	WHO Resource	Laboratory safety & quality	https://www.who.int	Unit I, V
5	MedlinePlus	Blood, urine & stool tests	https://medlineplus.gov	Case studies

A) Course Code : 2476305(T2476305/P2476305/S2476305)
B) Course Title : Laboratory Management & Ethics
C) Pre- requisite Course(s) : None (Introductory / Foundation Course)
D) Rationale

Laboratory Management & Ethics equips learners with essential knowledge of laboratory organization, safety, quality systems, documentation, and ethical responsibilities in medical laboratories. As laboratory professionals play a crucial role in patient care and public health, this course emphasizes managerial efficiency, quality assurance, safety culture, ethical conduct, and effective communication. The course does not include laboratory practicals and focuses on professional readiness, compliance, and ethical decision-making.

E) Course Outcomes (COs): Upon successful completion of the course, learners are expected to achieve the prescribed course outcomes through active participation in learning activities encompassing the cognitive, psychomotor, and affective domains in classroom and experiential learning environments.

After completion of the course, the students will be able to:

CO No.	Course Outcome
CO1	Explain the organization, management, and documentation practices of different types of medical laboratories.
CO2	Describe laboratory safety measures, quality management systems, and corrective actions for error prevention.
CO3	Apply principles of professional ethics, communication, and medico-legal responsibilities in laboratory practice.

F) Suggested Course Articulation Matrix (CAM):

PSO-1

Apply fundamental principles of clinical pathology, hematology, and body fluid analysis to assist in the diagnosis and monitoring of common diseases.

PSO-2

Perform basic clinical pathology laboratory procedures safely using standard equipment, following quality control, infection control, and proper reporting practices.

Course Outcomes (COs)	**PO-1** Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design / Development of Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	3	-	-	-	-	-	1	-	-

CO-2	3	1	-	-	-	-	1	-	-
CO-3	3	2	3	2	1	1	2	-	-
CO-4	3	2	3	2	1	1	2	-	-
CO-5	3	2	3	2	1	1	2	-	-

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	**Course Title**	**Scheme of Studies (Hours/Week)**					
		Classroom Instruction (CI)		**Lab Instruction (LI)**	**Notional Hours (TW+ SL)**	**Total Hours (CI+LI+TW+ SL)**	**Total Credits(C)**
		L	**T**				
2476305	Laboratory Management & Ethics	02	-	-	02	04	03

Legend:

CI: Classroom Instruction (Includes different instructional/implementation strategies i.e. Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning etc. to deliver theoretical concepts)

LI: Laboratory Instruction (Includes experiments/practical performances in laboratory, workshop, field or other locations using different instructional/Implementation strategies)

Notional Hours: Hours of engagement by learners, other than the contact hours for ensuring learning.

TW: Term work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.)

SL: Self Learning, MOOCs, spoken tutorials, open educational resources (OERs)

C: Credits = (1 x CI hours) + (0.5 x LI hours) + (0.5 x Notional hours)

Note: TW and SL have to be planned by the teacher and performed by the learner under the continuous guidance and feedback of teacher to ensure outcome of learning.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2476305	Laboratory Management & Ethics	30	70	-	-	-	-	100

Legend:

PTA: Progressive Theory Assessment in class room (includes class test, mid-term test and quiz using online/offline modes)

PLA: Progressive Laboratory Assessment (includes process and product assessment using rating Scales and rubrics)

TWA:Term work & Self Learning Assessment (Includes assessment related to student performance in assignments, seminars, micro projects, industrial visits, self-learning, any other student activities etc.

Note:

a. ETA & ELA are to be carried out at the end of the term/ semester.

b. Term Work is to be done by the students under the guidance of internal faculty but its assessment will be done **internally (40%)** as well as **externally (60%)**. Assessment related to planning and execution of Term Work activities like assignment, micro project, seminar and self-learning is to be done by internal faculty (Internal Assessment) whereas assessment of output/product/ presentation related to these activities will be carried out by external faculty/expert (External Assessment). However, criteria of internal as well as external assessment may vary as per the requirement of respective course. For valid and reliable assessment, the internal faculty should prepare checklist & rubrics for these activities.

I) Course Curriculum Detailing: This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Term Work (TW) and Self Learning (SL). Students are expected to demonstrate the attainment of Theory Session Outcomes (TSOs) and Lab

Session Outcomes (LSOs) leading to attainment of Course Outcomes (COs) upon the completion of the course. While curriculum detailing, NEP 2020 related reforms like Green skills, Sustainability, Multidisciplinary aspects, Society connect, Indian Knowledge System (IKS) and others must be integrated appropriately.

J) Theory Session Outcomes (TSOs) and Units: T2476305

Major Theory Session Outcomes (TSOs)	Units (with Expanded Title and Subtopics)	Relevant CO(s)
TSO 1.1 Describe types and organization of medical laboratories. **TSO 1.2** Explain equipment and inventory management systems. **TSO 1.3** Describe documentation and record-keeping practices.	**Unit I –Introduction to Laboratory Management** 1.1 Types of laboratories: hospital laboratories, public health laboratories, private laboratories 1.2 Organization of clinical laboratory: sections, roles and responsibilities of laboratory staff 1.3 Equipment management: installation, calibration, preventive maintenance, equipment logbooks 1.4 Inventory management: reagents, consumables, procurement and supply ordering 1.5 Documentation and record keeping: sample registers, test reports, storage and retrieval of records	CO-1
TSO 2.1 Explain safety practices and infection control in laboratories. **TSO 2.2** Describe biomedical waste management and biosafety concepts. **TSO 2.3** Explain quality management systems and error control mechanisms.	**Unit II – Laboratory Safety and Quality Management** 2.1 Safety in medical laboratories: PPE, safety signs, emergency protocols 2.2 Infection control: universal precautions, hand hygiene, vaccination (HBV), needle stick injury protocols 2.3 Biosafety levels (concept only) 2.4 Biomedical waste management 2.5 Quality in laboratory testing: Internal Quality Control (IQC), External Quality Assurance Scheme (EQAS)	CO2

	2.6 Good Laboratory Practices (GLP) 2.7 Reporting errors and corrective actions	
TSO 3.1 Explain principles of medical ethics and professional conduct. **TSO 3.2** Describe patient rights, confidentiality, and ethical handling of samples. **TSO 3.3** Apply ethical decision-making and communication skills in laboratory settings.	**Unit III – Professional Ethics and Communication in Medical Laboratories** 3.1 Introduction to medical ethics and professional conduct 3.2 Patient privacy and confidentiality 3.3 Informed consent and patient rights 3.4 Ethical handling of laboratory samples and results 3.5 Professionalism and communication skills 3.6 Receiving samples and conveying results respectfully 3.7 Medico-legal issues in laboratory practice: fraud, misreporting 3.8 Ethical decision-making and case discussions	CO3

Note: One major TSO may require more than one Theory session/Period.

K) Suggested Term Work and Self-Learning:S2476305 Some sample suggested assignments, micro project and other activities are mentioned here for reference.

j. **Assignments**

S. No.	Assignment Topic	Purpose / Expected Learning	Relevant CO(s)
1	Types and organization of medical laboratories	Understand structure, sections, and functions of different laboratories	CO1
2	Equipment and inventory management in laboratories	Learn importance of calibration, maintenance, and inventory control	CO1

S. No.	Assignment Topic	Purpose / Expected Learning	Relevant CO(s)
3	Laboratory safety and infection control measures	Develop awareness of PPE, safety signs, and emergency protocols	CO2
4	Quality management systems in medical laboratories	Understand IQC, EQAS, and GLP concepts	CO2
5	Ethics and professionalism in laboratory practice	Appreciate ethical responsibilities and professional behavior	CO3

k. **Micro Projects**

S. No.	Micro-Project Topic	Purpose / Expected Learning	Relevant CO(s)
1	Design of a basic clinical laboratory layout	Understand laboratory organization and workflow	CO1
2	Preparation of equipment maintenance and logbook formats	Learn documentation and preventive maintenance practices	CO1
3	Safety audit checklist for medical laboratories	Apply safety and infection control principles	CO2
4	Quality control flowchart for a diagnostic test	Understand implementation of IQC and EQAS	CO2
5	Case study on ethical dilemma in laboratory reporting	Develop ethical decision-making skills	CO3

c. Other Activities

1. Seminar Topics:

S. No.	Seminar Topic	Purpose / Expected Learning	Relevant CO(s)
1	Role of laboratory management in healthcare delivery	Understand managerial importance in diagnostics	CO1
2	Biomedical waste management in medical laboratories	Learn safe waste handling and disposal practices	CO2
3	Quality assurance and accreditation in laboratories	Understand quality standards and compliance	CO2
4	Patient confidentiality and informed consent	Appreciate ethical and legal responsibilities	CO3
5	Medico-legal issues and ethical challenges in laboratories	Develop awareness of legal and ethical implications	CO3

2. Surveys:

S. No.	Survey Topic	Purpose / Expected Learning	Relevant CO(s)
1	Awareness of laboratory safety practices among staff	Assess safety culture and compliance	CO2
2	Inventory management practices in diagnostic labs	Understand real-world inventory control	CO1
3	Awareness of patient confidentiality	Evaluate ethical awareness in healthcare settings	CO3
4	Implementation of quality control measures	Study QC practices in laboratories	CO2

3. Visit:

S. No.	Visit Place	Purpose / Expected Learning	Relevant CO(s)
1	Hospital clinical laboratory	Observe laboratory organization and management	CO1
2	Diagnostic center / private laboratory	Understand equipment management and quality systems	CO1, CO2
3	Biomedical waste treatment facility	Learn waste segregation and disposal methods	CO2

l. **Self-Learning Topics**

S. No.	Self-Learning Topic	Purpose / Expected Learning	Relevant CO(s)
1	Laboratory accreditation standards (NABL/ISO)	Gain awareness of laboratory accreditation systems	CO2
2	Advances in laboratory information systems (LIS)	Understand digital record keeping and reporting	CO1
3	Ethical case studies in healthcare laboratories	Improve ethical reasoning and professionalism	CO3
4	Risk management in medical laboratories	Learn prevention and control of laboratory errors	CO2
5	Effective communication skills in healthcare	Develop professional communication abilities	CO3

L) Suggested Course Evaluation Matrix: The course teacher has to decide and use appropriate assessment strategy and its weightage in theory, laboratory and sessional work for ensuring CO attainment. The response/performance of each student in each of these designed activities is to be used to calculate **CO**

attainment.

COs	Course Evaluation Matrix				
	Theory Assessment (TA)**		Sessional Work Assessment (SWA)		
	Progressive Theory Assessment (PTA) Class/Mid Sem Test	End Theory Assessment (ETA)	Sessional Work & Self Learning Assessment		
			Assignments	Micro Projects	Other Activities*
CO-1	15%	15%	20%	20%	33%
CO-2	20%	25%	20%	20%	33%
CO-3	25%	25%	20%	20%	34%
CO-4	25%	20%	20%	20%	--
CO-5	15%	15%	20%	20%	--
Total Marks	30	70	20	20	10
			50		

Legend:

***:** Other Activities include self- learning, seminar, visits, surveys, product development, software development etc.

******: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

a. The percentage given are approximate

b. In case of Micro Projects and End Laboratory Assessment (ELA), the achieved marks will be equally divided in all those COs mapped with total experiments.

c. For CO attainment calculation indirect assessment tools like course exit survey need to be used which comprises of questions related to achievement of each COs.

M) Suggested Specification Table for End Semester Theory Assessment:

Specification table represents the reflection of sample representation of assessment of cognitive domain of full course.

Unit Title and Number	Total Classroom Instruction (CI) Hours	Relevant COs Number(s)	Total Marks	ETA (Marks)		
				Remember (R)	Understanding (U)	Application & above (A)
Unit I – Introduction to Laboratory Management	10	CO1	20	4	8	8
Unit II – Laboratory Safety and Quality Management	12	CO2	30	6	12	12

Unit III – Professional Ethics and Communication in Medical Laboratories	10	CO3	20	4	8	8
Total	**32**	**-**	**70**	**14**	**28**	**28**

Note: Similar table can also be used to design class/mid-term/ internal question paper for progressive assessment.

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

Note: This table can be used for both end semester as well as progressive assessment of practical. Rubrics need to be prepared by the course teacher for each experiment/practical to assess the student performance.

N) Suggested Instructional/Implementation Strategies:

O) Suggested Learning Resources:

(a) Books:

S. No.	Title	Author(s)	Publisher and Edition with ISBN
1	Laboratory Management	S. K. Sharma	CBS Publishers & Distributors, 1st Edition, ISBN: **978-8123922954**
2	Laboratory Management and Quality Assurance	R. Ananthanarayan, C. K. Jayaram Paniker (Indian editions/editorial adaptation)	Universities Press (India), 2nd Edition, ISBN: **978-8173719049**
3	Medical Ethics, Principles and Practice	V. N. Shukla	Jaypee Brothers Medical Publishers, 2nd Edition, ISBN: **978-9352701032**
4	Biomedical Waste Management	S. S. Bhatia	CBS Publishers & Distributors, 1st Edition, ISBN: **978-8123914737**
5	Hospital and Health Care Administration	K. V. Ramani	PHI Learning Pvt. Ltd., 1st Edition, ISBN: **978-8120346357**

(b) Open Educational Resources (OER):

S. No.	Resource Type	Title / Description	Link / Reference	Relevant Practical / Module
1	NPTEL Online Course	Laboratory Management and Quality Systems	https://nptel.ac.in	Unit I, II
2	WHO Guidelines	Laboratory Quality Management System (LQMS)	https://www.who.int	Unit II
3	WHO Manual	Laboratory Biosafety Manual	https://www.who.int	Unit II
4	Government of India Resource	Biomedical Waste Management Rules	https://www.moef.gov.in	Unit II
5	Open Learning Platform	Ethics and Professionalism in Healthcare	https://www.coursera.org	Unit III
6	Open Textbook	OpenWHO – Infection Prevention and Control	https://openwho.org	Unit II
7	Educational Website	NABL Standards and Accreditation Awareness	https://nabl-india.org	Unit II
8	Open Educational Portal	Communication Skills for Healthcare Professionals	https://www.swayam.gov.in	Unit III

A) Course Code : 2476307(P2476307/S2476307)

B) Course Title : Computer Applications (Laboratory)

C) Pre- requisite Course(s) : Basic knowledge of computers

D) Rationale

The Computer Applications Laboratory aims to develop fundamental practical skills in computer usage and application software. It provides hands-on exposure to computer systems, operating systems, and file management for effective digital literacy. The course enables students to use office automation tools for document preparation, data analysis, and presentations. It also introduces basic programming concepts using Python to enhance logical thinking and problem-solving abilities. Overall, the laboratory supports skill-based learning and prepares students for academic and professional computing needs.

E) Course Outcomes (COs): Upon successful completion of the course, learners are expected to achieve the prescribed course outcomes through active participation in learning activities encompassing the cognitive, psychomotor, and affective domains in classroom and experiential learning environments.

After completion of the course, the students will be able to:

CO No.	Course Outcome
CO1	Identify computer hardware, software, operating systems, and perform basic file management tasks
CO2	Use office automation tools effectively for document preparation, data analysis, and presentations
CO3	Develop basic algorithms and flowcharts for problem-solving
CO4	Write, execute, and debug simple Python programs using fundamental programming concepts
CO5	Apply programming fundamentals such as data types, operators, and input/output operations

F) Suggested Course Articulation Matrix (CAM):

PSO-1: Apply fundamental computer application skills, office automation tools, and operating systems to solve academic and workplace-related tasks effectively.

PSO-2: Develop basic programming and logical problem-solving skills using algorithms, flowcharts, and Python programming for simple computational problems.

Course Outcomes (COs)	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design / Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CO-1	3	-	-	-	-	-	1	-	-
CO-2	3	1	-	-	-	-	1	-	-
CO-3	3	2	3	2	1	1	2	-	-
CO-4	3	2	3	2	1	1	2	-	-
CO-5	3	2	3	2	1	1	2	-	-

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional

G) Teaching & Learning Scheme:

Course Code	Course Title	Scheme of Studies (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+SL)	Total Hours (CI+LI+TW+SL)	Total Credits(C)
		L	T				
2476307	Computer Applications (Laboratory)	**00**	-	04	00	04	03

Legend:

CI: Classroom Instruction (Includes different instructional/implementation strategies i.e. Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning etc. to deliver theoretical concepts)

LI: Laboratory Instruction (Includes experiments/practical performances in laboratory, workshop, field or other locations using different instructional/Implementation strategies)

Notional Hours: Hours of engagement by learners, other than the contact hours for ensuring learning.

TW: Term work (includes assignments, seminars, micro projects, industrial visits, any other student activities etc.)

SL: Self Learning, MOOCs, spoken tutorials, open educational resources (OERs)

C: Credits = (1 x CI hours) + (0.5 x LI hours) + (0.5 x Notional hours)

Note: TW and SL have to be planned by the teacher and performed by the learner under the continuous guidance and feedback of teacher to ensure outcome of learning.

H) Assessment Scheme:

Course Code	Course Title	Assessment Scheme (Marks)						
		Theory Assessment (TA)		Term Work & Self-Learning Assessment (TWA)		Lab Assessment (LA)		
		Progressive Theory Assessment (PTA)	End Theory Assessment (ETA)	Internal	External	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)	
2476307	Computer Applications (Laboratory)	-	-	20	30	20	30	100

Legend:

PTA: Progressive Theory Assessment in class room (includes class test, mid-term test and quiz using online/offline modes)

PLA: Progressive Laboratory Assessment (includes process and product assessment using rating Scales and rubrics)

TWA: Term work & Self Learning Assessment (Includes assessment related to student performance in assignments, seminars, micro projects, industrial visits, self-learning, any other student activities etc.

Note:

a. ETA & ELA are to be carried out at the end of the term/ semester.

b. Term Work is to be done by the students under the guidance of internal faculty but its assessment will be done **internally (40%)** as well as **externally (60%)**. Assessment related to planning and execution of Term Work activities like assignment, micro project, seminar and self-learning is to be done by internal faculty (Internal Assessment) whereas assessment of output/product/ presentation related to these activities will be carried out by external faculty/expert (External Assessment). However, criteria of internal as well as external assessment may vary as per the requirement of respective course. For valid and reliable assessment, the internal faculty should prepare checklist & rubrics for these activities.

I) Course Curriculum Detailing: This course curriculum detailing depicts learning outcomes at course level and session level and their attainment

by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Term Work (TW) and Self Learning (SL). Students are expected to demonstrate the attainment of Theory Session Outcomes (TSOs) and Lab Session Outcomes (LSOs) leading to attainment of Course Outcomes (COs) upon the completion of the course. While curriculum detailing, NEP 2020 related reforms like Green skills, Sustainability, Multidisciplinary aspects, Society connect, Indian Knowledge System (IKS) and others must be integrated appropriately.

Note: One major TSO may require more than one Theory session/Period.

J) Suggested Laboratory (Practical) Session Outcomes (LSOs) and List of Practical: P2476307

Exp. No.	Practical / Experiment Title	Laboratory Session Outcome	Relevant CO(s)
1	Familiarization with computer system and peripherals	Identify hardware components and understand system startup/shutdown	CO1
2	Operating System basics (Windows/Linux)	Perform basic OS operations and navigation	CO1
3	File and folder management	Create, organize, copy, move, rename, and delete files/folders	CO1
4	Word processing – document creation	Create and format documents using word processing software	CO2
5	Word processing – advanced formatting	Apply styles, tables, headers, footers, page setup, and spell check	CO2
6	Spreadsheet – data entry and formatting	Enter data, apply formatting, and use basic formulas	CO2
7	Spreadsheet – functions and charts	Use functions (SUM, AVERAGE, IF) and generate charts	CO2
8	Presentation software – slide creation	Create slides with text, images, and layouts	CO2
9	Presentation software – animations and transitions	Apply animations, transitions, and slide show features	CO2
10	Algorithm development	Design algorithms for simple problems	CO3
11	Flowchart design	Draw flowcharts using standard symbols	CO3
12	Introduction to Python environment	Write and execute basic Python programs	CO4
13	Python data types and variables	Use numeric, string, and Boolean data types	CO5
14	Operators and expressions in Python	Implement arithmetic, relational, and logical operators	CO5

Exp. No.	Practical / Experiment Title	Laboratory Session Outcome	Relevant CO(s)
15	Input and output operations in Python	Use input() and print() functions effectively	CO5

K) Suggested Term Work and Self-Learning: S2476307 Some sample suggested assignments, micro project and other activities are mentioned here for reference.

m. **Assignments**

S. No.	Assignment Topic	Purpose / Expected Learning	Relevant CO(s)
1	Basics of Computer Systems (Hardware & Software)	Understand the components of a computer system and differentiate between hardware and software	CO1
2	Operating Systems and File Management	Learn basic OS operations and effective file and folder organization	CO1
3	Document Preparation Using Word Processor	Develop skills in creating, formatting, and editing professional documents	CO2
4	Data Analysis Using Spreadsheets	Apply formulas, functions, and charts for data organization and analysis	CO2
5	Algorithm and Flowchart Design	Enhance logical thinking and problem-solving skills using algorithms and flowcharts	CO3
6	Basic Python Programming	Write and execute simple Python programs using variables, operators, and input/output	CO4, CO5

n. **Micro Projects**

S. No.	Micro Project Topic	Expected Learning	Relevant CO(s)
1	Resume creation using word processor	Professional document preparation	CO2
2	Student marks analysis using spreadsheet	Data handling and visualization	CO2
3	Algorithm and flowchart for ATM transaction	Logical thinking	CO3
4	Python program for calculator / grading system	Programming fundamentals	CO4, CO5

c. Other Activities

a. **Self-Learning Topics**

S. No.	Self-Learning Topic	Purpose / Expected Learning	Relevant CO(s)
1	Basics of Digital Literacy and Cyber Safety	Develop awareness of safe and responsible use of computers and the internet	CO1
2	Advanced Features of Word Processing Tools	Enhance document formatting, templates, and collaboration skills	CO2
3	Spreadsheet Functions for Data Analysis	Learn advanced formulas and chart-based data interpretation	CO2
4	Introduction to Problem Solving Using Algorithms	Improve logical thinking and structured problem-solving skills	CO3
5	Basics of Python Programming through Online Tutorials	Strengthen programming fundamentals and self-paced learning ability	CO4, CO5

L) Suggested Course Evaluation Matrix: The course teacher has to decide and use appropriate assessment strategy and its weightage in theory, laboratory and sessional work for ensuring CO attainment. The response/performance of each student in each of these designed activities is to be used to calculate **CO attainment**.

COs	Course Evaluation Matrix	
	Lab Assessment (LA)#	
	Progressive Lab Assessment (PLA)	End Laboratory Assessment (ELA)
CO-1	20%	20%
CO-2	25%	20%
CO-3	20%	20%
CO-4	20%	20%
CO-5	15%	20%
Total Marks	20	30

Legend:

***:** Other Activities include self- learning, seminar, visits, surveys, product development, software development etc.

******: Mentioned under point- (N)

#: Mentioned under point-(O)

Note:

a. The percentage given are approximate

b. In case of Micro Projects and End Laboratory Assessment (ELA), the achieved marks will be equally divided in all those COs mapped with total experiments.

c. For CO attainment calculation indirect assessment tools like course exit survey need to be used which comprises of questions

related to achievement of each COs.

M) Suggested Assessment Table for Laboratory (Practical):

Exp. No.	Laboratory Practical Titles	Relevant COs Number(s)	PLA/ELA		
			Performance		Viva-Voce (%)
			PRA (%)	PDA (%)	
1	Identification of computer hardware and peripherals	CO1	50	40	10
2	Familiarization with operating systems (Windows/Linux)	CO1	50	40	10
3	File and folder management	CO1	50	40	10
4	Word processing – document creation and formatting	CO2	45	45	10
5	Spreadsheet – data entry and basic formulas	CO2	50	40	10
6	Spreadsheet – functions and chart creation	CO2	50	40	10
7	Presentation software – slide creation	CO2	50	40	10
8	Presentation software – animations and transitions	CO2	50	40	10
9	Algorithm design for simple problems	CO3	50	40	10
10	Flowchart representation	CO3	50	40	10
11	Introduction to Python programming	CO4	50	40	10
12	Python programming using data types and I/O	CO4, CO5	50	40	10

Legend:

PRA*: Process Assessment

PDA**: Product Assessment

Note: This table can be used for both end semester as well as progressive assessment of practical. Rubrics need to be prepared by the course teacher for each experiment/practical to assess the student performance.

N) Suggested Instructional/Implementation Strategies:

O) List of Major Laboratory Equipment, Tools and Software:

S. No.	Tool / Software	Purpose
1	Desktop / Laptop Computer	Practical execution
2	Windows / Linux OS	Operating system practice
3	MS Word / LibreOffice Writer	Word processing
4	MS Excel / LibreOffice Calc	Spreadsheet operations
5	MS PowerPoint / LibreOffice Impress	Presentations
6	Python Interpreter / IDE	Programming practice
7	Flowchart Software (optional)	Algorithm representation

P) Suggested Learning Resources:

(a) Books:

S. No.	Title	Author(s)	Publisher and Edition with ISBN
1	Computer Fundamentals and Programming in C	Reema Thareja	Oxford University Press, 2nd Edition, ISBN: 9780199487166
2	Fundamentals of Computers	V. Rajaraman	PHI Learning Pvt. Ltd., 6th Edition, ISBN: 9788120348989
3	Introduction to Computers	Alexis Leon & Mathews Leon	Vikas Publishing House, 1st Edition, ISBN: 9788125925727
4	Programming with Python	T. Budd (Indian Edition adapted)	McGraw Hill Education (India), 1st Edition, ISBN: 9789353162344

(b) Open Educational Resources (OER):

S. No.	Resource Type	Title / Description	Link / Reference	Relevant Practical / Module
1	NPTEL	Computer Fundamentals and Programming Basics	https://nptel.ac.in	Basics of Computer Systems, Programming Fundamentals
2	Open Educational Resource (OER)	Computer Basics and Office Applications	https://spoken-tutorial.org	Office Automation Tools
3	Virtual Lab	Programming and Problem Solving Labs	https://www.vlab.co.in	Algorithms, Flowcharts, Python Programming
4	Online Tutorial	Python Programming for Beginners	https://docs.python.org/3/tutorial/	Introduction to Programming, Python

S. No.	Resource Type	Title / Description	Link / Reference	Relevant Practical / Module
5	Open Courseware	Digital Literacy and Computer Applications	https://www.swayam.gov.in	Operating Systems, File Management, Office Tools

A) Course Code : 2476306(P2476306/S2476306)

B) Course Title : SUMMER INTERNSHIP – I

C) Pre- requisite Course(s) :

D) Rationale

Summer Internship – I is designed to provide diploma students with structured exposure to real-world industry environments. It bridges the gap between theoretical knowledge and practical application through hands-on experience. The internship helps students develop technical, professional, and ethical competencies while enabling informed career choices. It also enhances employability by fostering workplace readiness, discipline, and industry-relevant skills.

E) Course Outcomes (COs): Upon successful completion of the course, learners are expected to achieve the prescribed course outcomes through active participation in learning activities encompassing the cognitive, psychomotor, and affective domains in classroom and experiential learning environments.

After successful completion of Summer Internship – I, the students will be able to:

CO No.	Course Outcome
CO1	Understand organizational structure, workplace culture, safety norms, and professional expectations
CO2	Apply technical knowledge and skills to assigned project tasks or work activities
CO3	Demonstrate effective communication, teamwork, problem-solving, and time management skills
CO4	Prepare technical reports, presentations, and internship documentation
CO5	Practice ethical behavior, professionalism, self-assessment, and continuous improvement

F) Suggested Course Articulation Matrix (CAM):

PSO-1: Apply domain-specific technical knowledge and practical skills in real industry or organizational settings.

PSO-2: Demonstrate professional behavior, communication, teamwork, ethical responsibility, and lifelong learning skills in the workplace.

Course Outcomes (COs)	**PO-1** Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design / Development of Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**PO-7** Life Long Learning	**PSO-1**	**PSO-2**
CO-1	3	-	-	-	-	-	1	-	-
CO-2	3	1	-	-	-	-	1	-	-
CO-3	3	2	3	2	1	1	2	-	-
CO-4	3	2	3	2	1	1	2	-	-
CO-5	3	2	3	2	1	1	2	-	-

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2476306	Summer Internship	-	-	10	15	10	15	50

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Note: One major TSO may require more than one Theory session/Period.

J) Detailed Course Contents (Unit-wise Mapping with COs): P2476306

Unit No.	Unit Title	Key Topics	Relevant CO(s)
I	Orientation	Organization overview, policies, safety, team structure	CO1
II	Project-Based Learning	Project description, objectives, tools, methodologies	CO2
III	Technical & Skill Development	Technical training, software/tools, soft skills	CO2, CO3
IV	Mentorship & Supervision	Mentor meetings, feedback, guidance	CO3, CO5
V	Professional Development	Etiquette, networking, resume & interview skills	CO3
VI	Industry & Field Knowledge	Industry trends, guest lectures, emerging technologies	CO2
VII	Reporting & Documentation	Report writing, presentations, documentation	CO4
VIII	Ethics & Professionalism	Ethical practices, case studies	CO5
IX	Feedback & Evaluation	Performance review, self-assessment	CO5
X	Networking & Industry Exposure	Conferences, webinars, professional connections	CO3, CO5

K) Suggested Internship Activities: S2476306

Sr. No.	Activity / Practical Title	Expected Learning Outcome	Relevant CO(s)
1	Workplace orientation and safety training	Understand organizational culture and safety practices	CO1
2	Assignment of project/task	Understand project scope and objectives	CO2
3	Hands-on technical work	Apply technical skills to real tasks	CO2
4	Participation in team meetings	Develop communication and teamwork skills	CO3

Sr. No.	Activity / Practical Title	Expected Learning Outcome	Relevant CO(s)
5	Mid-internship progress review	Improve performance through feedback	CO3, CO5
6	Preparation of internship report	Document work and learning outcomes	CO4
7	Final presentation and evaluation	Demonstrate learning and professional competence	CO4, CO5

L) Suggested Assignments

S. No.	Assignment Topic	Purpose / Expected Learning	Relevant CO(s)
1	Organization profile study	Understand organizational structure and functions	CO1
2	Project planning and objectives	Learn task planning and goal setting	CO2
3	Weekly work diary	Track learning progress and self-reflection	CO4, CO5
4	Soft skills reflection report	Improve communication and teamwork skills	CO3
5	Ethical issues case study	Understand professional ethics	CO5

c. Other Activities

b. **Self-Learning Topics**

S. No.	Self-Learning Topic	Purpose / Expected Learning	Relevant CO(s)
1	Workplace ethics and professional conduct	Build ethical and professional awareness	CO5
2	Industry-specific tools or software	Enhance technical competency	CO2
3	Communication and interpersonal skills	Improve workplace communication	CO3
4	Resume and interview preparation	Enhance employability skills	CO3
5	Emerging trends in the industry	Promote lifelong learning	CO2, CO5