D.Y. PATIL EDUCATION SOCIETY

INSTITUTION DEEMED TO BE UNIVERSITY,
KOLHAPUR

OUTCOME BASED EDUCATION (OBE) PLATFORM STANDARD OPERATING PROCEDURE (SOP)

MEASURING ATTAINMENT OF LEARNING OUTCOMES

Document Name:	SOP For Measuring Attainment of Learning Outcomes
Document No.:	
No. of Pages:	28
Date Created:	2019
Date of Implementation:	2019
Prepared By:	**Designation:** Professor and Medical Superintendent
	Name: Dr. Vaishali V. Gaikwad
	Signature: Gaikwad
	Designation: Biostatistician
	Name: Mr. Prasad V. Shinde
	Signature: P.V.Shinde
Reviewed and Updated By:	**Designation:** The Dean
	Name: Dr. R. K. Sharma
	Signature:
Approved By:	**Designation:** Registrar
	Name: Dr. V. V. Bhosale
	Signature: D. Y. PATIL EDUCATION SOCIETY DEEMED TO BE UNIVERSITY KOLHAPUR-416006

The Outcome Based Education (OBE) model devised focuses on student centric education in order to develop the personal, social, professional and knowledge requirements in a student's career and life. The research findings and principles of OBE derived out of the Competency Based Curriculum, Taylor's Model of Curriculum Development, and Blooms taxonomy are some of the principles are implemented in the design of OBE in the university programmes.

The OBE model in DYPES has been implemented by the way of different meetings, workshops and presentations by a committee exclusively appointed for this purpose. The old curriculum was transformed into the framework of OBE as guided by governing bodies with a continuous refinement process in order to enhance the competencies and employability of the students of the university department.

The programme outcomes and course outcomes are published in departmental publication/notice board and these are further disseminated during induction programme at the beginning of academic year. During consequent semester and the Course Outcome (CO)-Programme Outcome (PO)mapping and its meaning and context is further explained by each course faculty member during theory/practical work. OBE workshops are conducted for the design of learning and assessment tools and other processes involved in it.

The course outcome attainment is assessed in DYPES in order to track the student's performance with respect to the target level of performance. The CO-PO attainment is one of the tools used for continuous improvement in the students' abilities through appropriate learning and teaching strategies. In order to assess students' performance with respect to abilities the course outcome attainment is measured. The programme outcome attainment measurement is based on the course outcome attainment to facilitate the same course-programme outcome mapping is in place. The set target level is either decided by the department or course coordinator or it is set with respect to the passing percentage trend for the respective course. The set target level is decided for continuous improvement in the educational processes and thereby enhancement in the students' performance level. The POs and COs are listed on the website as well as maintained by the individual faculty in their course files.

Details of measuring the learning outcomes in the DYPES are elaborated here with following document.

Procedure for Defining Learning Outcomes and Measuring their Attainment

The following steps are being adopted for defining learning outcomes and measuring their attainment.

Step 1: Defining the vision and mission of the university.

Step 2: Defining Institutional Outcome and Programme Outcomes (POs)

Step 3: Defining Course Outcomes (COs) of each course in a programme.

Step 4: Defining relation between COs and POs for each course to obtain overall CO mapping with each POs (Course Articulation Matrix).

Step 5: Formulation of overall COs and POs mapping matrix for all courses (Programme Articulation Matrix).

Step 6: Defining the methodology for measuring the attainment of learning outcomes and setting up the target level.

Step 7: Measuring attainment levels of learning outcomes.

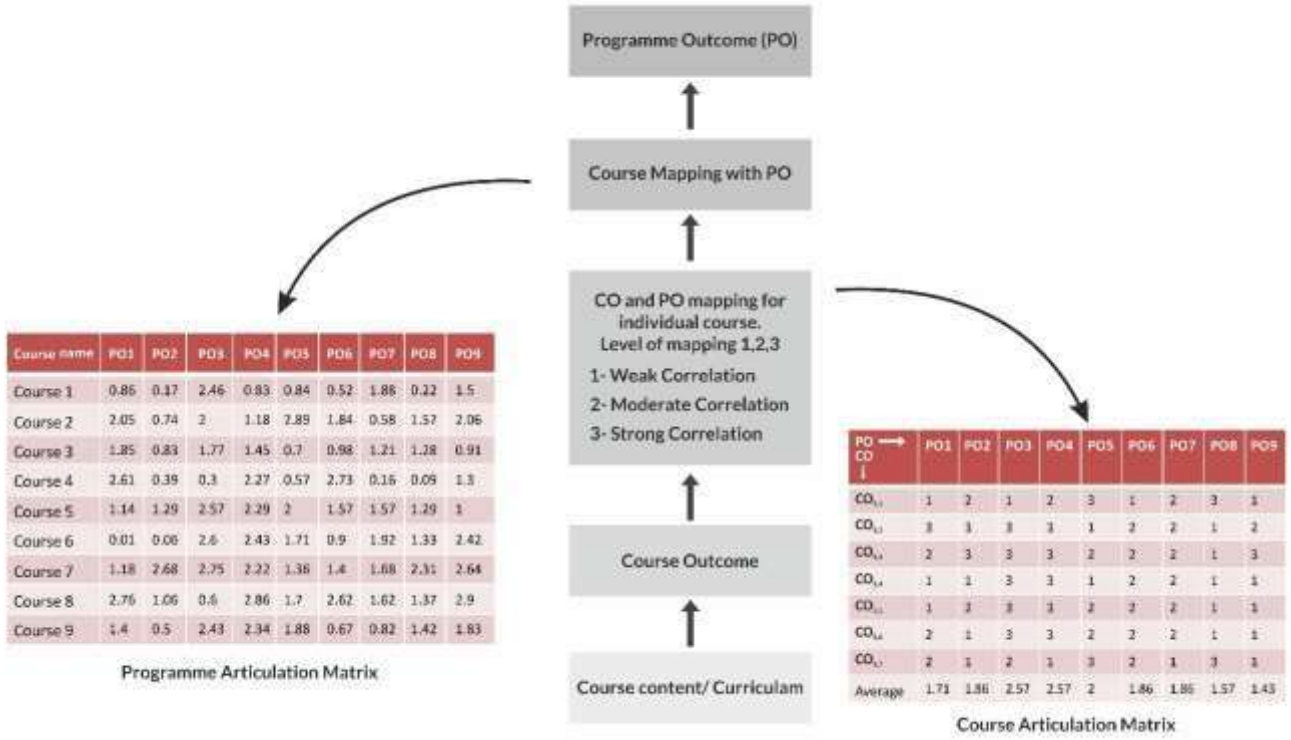
Step 8: Comparison of obtained attainment level with the target and action taken.

Steps 1, 2 and 3: Defining Institutional Outcome and Programme Outcomes (POs) and Defining Course Outcomes (COs) of each course in a Programme.

Overall process of OBE for mapping of COs with POs is shown in following diagram with formulation of Course Articulation matrix and Programme Articulation matrix. OBE Model is effectively realized by reviewing the Vision and Mission of the departments, defining PO, CO through stakeholders' participation, CO-PO mapping, designing attainment levels and target attainment level, calculating CO-PO attainments followed by developing teaching learning strategies at course level and programme level. Institutional outcomes provide guidance to programme directors or coordinators and departments for the development of programme outcomes.

Step 4: Defining relation between COs and POs for each course to obtain overall CO mapping with each POs (Course Articulation Matrix)

COs of each course are mapped with POs. The CO levels corresponding to each PO are averaged to obtain overall CO level for each PO and this is repeated for all courses. The Correlation between COs and POs is defined as 1 being the weak (low), 2 being moderate (medium) and 3 being substantial (high).



Course name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course 1	0.86	0.17	2.46	0.83	0.84	0.52	1.88	0.22	1.5
Course 2	2.05	0.74	2	1.18	2.89	1.84	0.58	1.57	2.06
Course 3	1.85	0.83	1.77	1.45	0.7	0.98	1.21	1.28	0.91
Course 4	2.61	0.39	0.3	2.27	0.57	2.73	0.16	0.09	1.3
Course 5	1.14	1.29	2.57	2.29	2	1.57	1.57	1.29	1
Course 6	0.01	0.06	2.6	2.43	1.71	0.9	1.92	1.33	2.42
Course 7	1.18	2.68	2.75	2.22	1.38	1.4	1.68	2.31	2.64
Course 8	2.76	1.06	0.6	2.86	1.7	2.62	1.62	1.37	2.9
Course 9	1.4	0.5	2.43	2.34	1.88	0.67	0.82	1.42	1.83

Programme Articulation Matrix

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
$CO_{1,1}$	1	2	1	2	3	1	2	3	1
$CO_{1,2}$	3	1	3	3	1	2	2	1	2
$CO_{1,3}$	2	3	3	3	2	2	2	1	3
$CO_{1,4}$	1	1	3	3	1	2	2	1	1
$CO_{1,5}$	1	2	3	3	2	2	2	1	1
$CO_{1,6}$	2	1	3	3	2	2	2	1	1
$CO_{1,7}$	2	1	2	1	3	2	1	3	1
Average	1.71	1.86	2.57	2.57	2	1.86	1.86	1.57	1.43

Course Articulation Matrix

For example,

Suppose programme say ABC has 9 POs Obtaining overall CO level with each PO for the course PQR.

Name of the Programme: ABC

- Programme has 9 POs, PO_1, $PO_{2,}$,…,PO_9
- For convenience, let us denote the POs PO_1, $PO_{2,}$,…,PO_9 by P_1, $P_{2,}$ …,P_9
- Programme has 20 courses, CO_1, $CO_{2,}$,…,CO_{20}
- Each course C_i has K_i course outcomes (CO_s) denotes s $CO_{i,1}$, $CO_{i,2}$,…. $CO_{i,ki}$, i = 1,2, … ,20.

Course Articulation Matrix:

Course- (C)**: PQR**

COs – POs mapping matrix (1-low, 2-medium, 3-high)

PO→ ↓ CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	1	2	1	2	3	1	2	3	1
CO2	3	3	3	3	1	2	2	1	2
CO3	2	3	3	3	2	2	2	1	3
CO4	1	1	3	3	1	2	2	1	1
CO5	1	2	3	3	2	2	2	1	1
CO6	2	1	3	3	2	2	2	1	1
CO7	2	1	2	1	3	2	1	3	1
Average	**1.71**	**1.86**	**2.57**	**2.57**	**2**	**1.86**	**1.86**	**1.57**	**1.43**

Step 5: Formulation of overall COs and POs mapping matrix for all courses (Programme Articulation Matrix).

Let $X_{i,j,l}$ be the level of correlation of CO, $CO_{i,j}$ with $P_l$where $i = 1,2,\dots,m, j = 1,2,\dots,k_i, l = 1,2,\dots,n$. Then, the overall CO levels with each PO of course C_i is computed as

$$\boldsymbol{X_{i,j\,.k\,,l} = \frac{1}{k_i}\sum_{j=1}^{k_i} X_{i,j,l}\,.}$$

Programme Articulation Matrix

Course name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Course 1	0.86	0.17	2.46	0.83	0.84	0.52	1.88	0.22	1.5
Course 2	2.05	0.74	2	1.18	2.89	1.84	0.58	1.57	2.06
Course 3	1.85	0.83	1.77	1.45	0.7	0.98	1.21	1.28	0.91
Course 4	2.61	0.39	0.3	2.27	0.57	2.73	0.16	0.09	1.3
Course 5	1.14	1.29	2.57	2.29	2	1.57	1.57	1.29	1
Course 6	0.01	0.06	2.6	2.43	1.71	0.9	1.92	1.33	2.42
Course 7	1.18	2.68	2.75	2.22	1.36	1.4	1.68	2.31	2.64
Course 8	2.76	1.06	0.6	2.86	1.7	2.62	1.62	1.37	2.9
Course 9	1.4	0.5	2.43	2.34	1.88	0.67	0.82	1.42	1.83
Course 10	2.59	0.28	1.17	0.61	0.05	1.77	1.87	1.73	2.6
Course 11	2.86	1.24	0.48	2.73	1.42	1.51	0.07	2.53	0.45
Course 12	1.05	2.25	0.15	2.1	2.11	2.47	0.68	2.05	1.33
Course 13	2.51	0.81	0.34	2.07	1.81	0.68	0.38	2.98	1.17
Course 14	1.2	2.91	2.08	1.18	0.35	2.55	2.64	2.2	1.46
Course 15	1.07	0.31	1.29	1.65	1.13	0.9	1.13	1.99	1.64
Course 16	1.71	2.17	0.43	2.7	2.68	1.71	1.75	1.5	2.5
Course 17	1.83	2.89	0.92	0.02	1.38	2.04	2.69	1.09	1.82
Course 18	1.59	1.4	1.96	1.85	2.4	2.36	0.09	1.8	1.74
Course 19	2.86	0.5	2.09	2.37	2.84	1.94	1.53	0.27	2.02
Course 20	1.33	1.7	0.64	2.51	1.36	0.86	2.22	1.78	1.81

Step 6: Defining the methodology for measuring the attainment of learning outcomes and setting up the target level.

The CO attainment levels are measured based on the results of the internal assessment, external examination and practical assessment conducted by the university. The CO attainment level based on internal assessment, external examination and practical assessment are computed separately.

Attainment levels based on internal/external/Practical assessment method are defined as follows: -

Level 3: 50% of students scored more than class average for the assessment method

Level 2: 40% of students scored more than class average for the assessment method

Level 1: Less than 40% of students scored more than class average for the assessment method.

Let ALC_E, ALC_I and ALC_P be the CO attainment level of the course based on external assessment, internal assessment and practical assessment respectively. If some subject having need not the practical, then CO attainment level of the course based on external assessment and internal assessment.

Let ALC1, ALC2, ... ALCm be the CO attainment levels of the courses C1, C2,....,Cm respectively.

Name of Programme	CO attainment (ALC)
B.Sc. Nursing	$0.75*ALC_E + 0.25*ALC_I$
M.Sc. Nursing	$0.75* ALC_E + 0.25* ALC_I$
P.B.B.Sc. Nursing	$0.7* ALC_E + 0.3* ALC_I$
M.Sc. Stem Cell and Regenerative Medicine	$0.8* ALC_E + 0.2* ALC_I$
M.Sc. Medical Biotechnology	$0.8* ALC_E + 0.2* ALC_I$
B.Sc. Hospitality	$0.4* ALC_E + 0.3* ALC_I + 0.3*ALC_P$
M.Sc. Medical Physics	$0.8* ALC_E + 0.2* ALC_I$
Bachelor of Physiotherapy	$0.4* ALC_E + 0.1* ALC_I + 0.5* ALC_P$
MBBS	$0.4* ALC_E + 0.1* ALC_I + 0.3* ALC_P + 0.2*ALC_i$
MS/MD	$0.5* ALC_E + 0.5* ALC_I$

Let $ALC_1, ALC_2, \dots, ALC_m$ be the CO attainment levels of the courses $C_1, C_2, \dots, C_m$ respectively.

For example, 5 students have been appeared for the internal and external exam of the course PQR.

SEAT NO.	INTERNAL 30/10	THEORY 40/16	TOTAL 70/28	PRACTICAL 30/12	GRAND TOTAL 100/40
2409	14	30	**44**	14	**58**
2416	15	18	**33**	13	**46**
2427	13	25	**38**	13	**51**
2429	15	18	**33**	15	**48**
2437	16	27	**43**	13	**56**
Average	**14.6**	**23.6**		**13.6**	
Number of students above average	**3**	**3**		**2**	
% of above average students	**60**	**60**		**40**	
ALC_E, ALCI and ALC_P	**3**	**3**		**2**	
ALC	0.4* 3 + 0.3* 3+ 0.3* 2 = 2.7				

Attainment Level:

Level I: 0 to 1 -Poor

Level II: 1.0 to 1.5 -Average

Level III: 1.5 to 2.0 -Good

Level IV: 2.0 to 2.5 -Very Good

Level V: 2.5 to 3.0 –Excellent

Target Level: *Level IV (*Very Good)

If the attainment level is Level IV (Very Good) and Level V (Excellent) then the status of particular course or programme outcome is attained, the attainment level is Level III (Good) then the status of particular course or programme outcome is partially attained and if other attainment level is attained then the status of particular course or programme outcome is not attained.

Attainment level	Status
Level I (Poor)	Not Attained
Level II (Average)	Not Attained
Level III (Good)	Partially Attained
Level IV (Very Good)	Attained
Level V (Excellent)	Attained

Measuring course attainment levels of all the courses are as follows: -

Course Name	CO attainment score
Course 1	1.60
Course 2	2.70
Course 3	3.00
Course 4	1.60
Course 5	3.00
Course 6	1.30
Course 7	2.20
Course 8	2.40
Course 9	3.00
Course 10	2.80
Course 11	1.70
Course 12	3.00
Course 13	1.00

Course 14	2.70
Course 15	2.40
Course 16	2.70
Course 17	2.00
Course 18	2.70
Course 19	2.10
Course 20	1.70

Here Green cell denotes the course is fully attained. Yellow cell denotes the course is partially attained and red cell denotes the course is not attained.

Step 7: Measuring attainment levels of learning outcomes

Direct Assessment: Direct attainment level of the p^{th}, PO is calculated as follows.

$$\boldsymbol{DALP_p = \frac{\sum_{i=1}^{m} X_{i,p} * ALC_i}{\sum_{i=1}^{m} ALC_i}, p = 1, 2, \dots, n}$$

$\boldsymbol{X_{i,p}}$ is the value between i[th] course and p[th] program outcome assessment.

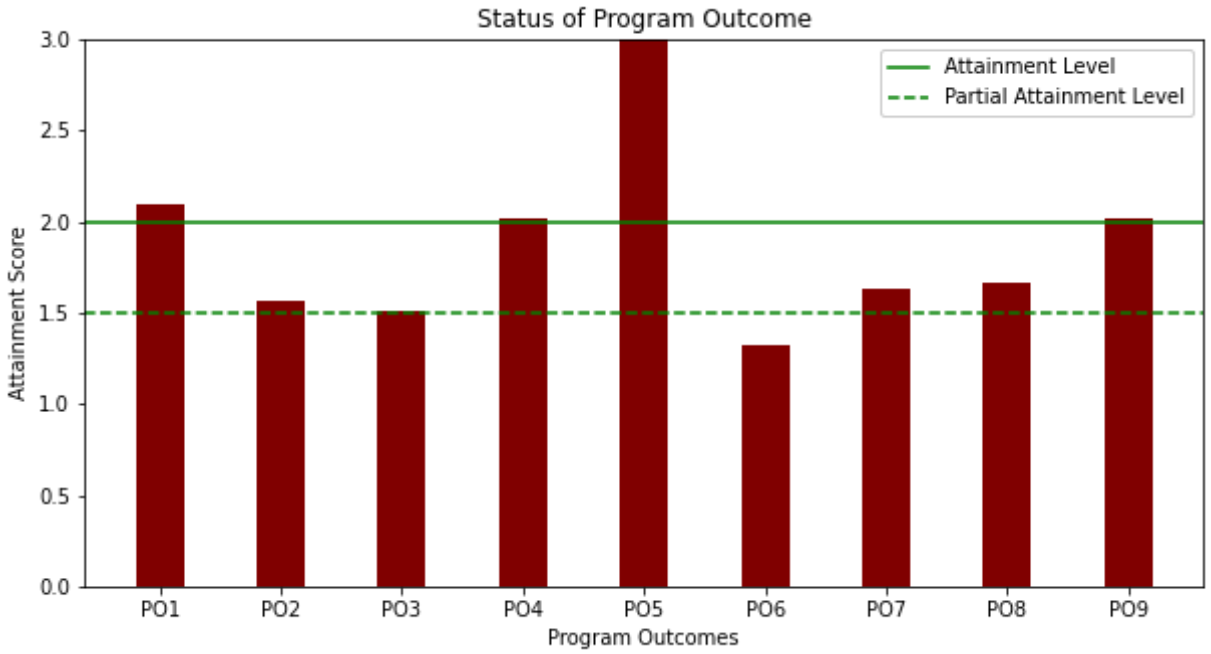
Indirect Assessment: Every year university IQAC conducts feedback survey from graduate exit students. This survey is conducted on different parameters which includes programme outcome. The rating of this survey is from 1 to 5. Average of the average response of all the students of that programme is considered as indirect attainment level of all POs.

$$\mathbf{PO_i = 0.8 \times} \boldsymbol{DALP_p} \mathbf{+ 0.2 \times} \boldsymbol{IALP}$$

Attainment level	Status
Level I (Poor)	Not Attained
Level II (Average)	Not Attained
Level III (Good)	Partially Attained
Level IV (Very Good)	Attained
Level V (Excellent)	Attained

PO	Total attainment
PO1	2.10
PO2	1.56
PO3	1.51
PO4	2.02
PO5	3.00
PO6	1.32
PO7	1.63
PO8	1.66
PO9	2.02

Here Green cell denotes the programme outcome is fully attained. Yellow cell denotes the programme outcome is partially attained and red cell denotes the programme outcome is not attained.



Example:

Vision and Mission of the University:

Vision

- To become a world class dynamic institution of education, research & training to develop globally competitive, professional and socially responsible human resource.

Mission

- To ensure globally relevant quality higher education and skill enhancement for providing required trained manpower to the nation & the world.
- To promote symbiotic relations with industry, academic and research institutions and community to meet the expectations of various stakeholders.
- To engage in interdisciplinary research and innovate for furtherance of knowledge, technology and growth.
- To put in place dynamic technocracy for effective use of emerging trends in curriculum development, andragogy, evaluation and system management.
- To provide an environment for holistic evolution of the learners as humane, socially responsible and conscious of sustainable ecosystem.

Goal

- University to be recognized as one of the top institutions of higher learning in the next decade and achieve global recognition.

Institutional outcome:

- Knowledge and Skills
- Planning and Problem-solving abilities
- Communication
- Research Aptitude
- Professionalism and Ethics
- Leadership
- Societal Responsibilities
- Environment and Sustainability
- Lifelong Learner

Case Study

Program Name: - Stem Cell and Regenerative Medicine

Vision and Mission of the University:

Vision

- To become a world class dynamic institution of education, research & training to develop globally competitive, professional and socially responsible human resource.

Mission

- To ensure globally relevant quality higher education and skill enhancement for providing required trained manpower to the nation & the world.
- To promote symbiotic relations with industry, academic and research institutions and community to meet the expectations of various stakeholders.
- To engage in interdisciplinary research and innovate for furtherance of knowledge, technology and growth.
- To put in place dynamic technocracy for effective use of emerging trends in curriculum development, andragogy, evaluation and system management.
- To provide an environment for holistic evolution of the learners as humane, socially responsible and conscious of sustainable ecosystem.

Programme Outcome

Upon completion of the M. Sc. SCRM programme, the student will be able to:

PO1: To get knowledge and skill of Stem Cell and Regenerative Medicine in Industry, Medical or hospital related organizations, Regulatory Agencies and Academia.

PO2: To develop Planning and Problem-solving abilities in Stem cell handling and preservation, molecular biology, disease diagnosis, handling and maintenance biological instrumentation, analytical methods, interpretation of experimental data.

PO3: To develop communication skills to communicate effectively in teaching, research project, interview, healthcare sectors, industries, academia for collaborative research by explaining ideas with good interpersonal and workplace-based skills.

PO4: To do research in Stem cryopreservation, transplantation, diagnosis and drug development for career as well as placement.

PO5: To develop understanding and implementation ethics in profession, research, society, animal experiment, biosafety, workplace, hospital, clinical research and human trial.

PO6: To develop leadership skills, logical reasoning, time management and values required for self-directed, lifelong learning, soft skills for professional development and execute their professional roles in society as stem cell professionals, employers and employees in various industries, academic institutions and research laboratories.

PO7: To develop character with good moral values, human values, good social behavior, gratitude, honesty, ethics, safety, hygiene, responsibility, confidence, tolerance and critical thinking.

PO8: Able to Contribute in sustainable development to achieve the national sustainable development goal 3.

PO9: Well Prepared for lifelong learning in Medical Science Stream.

Course Outcomes

Paper 1: Biochemistry

CO1: To describe the structure and properties of biomolecules like nucleic acids, proteins amino acids, estimation of biomolecules, carbohydrates and proteins and their role in metabolic and cellular pathways.

CO2: To describe the classification and functional properties of enzymes, enzyme kinetics and enzyme inhibition.

CO3: To explain about the role of vitamins and cofactors in enzyme activity.

CO4: To describe the metabolism of carbohydrates.

CO5: To describe the metabolism of lipids.

CO6: To describe the metabolic disorders in human.

Paper 2: Cell Biology and Developmental Biology

CO1: To know the basic concepts of cell biology including structure and function of different organelles.

CO2: To understand the transport mechanisms and Mechanism of cellular recognition and communication.

CO3: To develop the basic understanding of receptor, ligand and different types of cell signalling and their mechanisms.

CO4: To explain the importance of development and development process.

CO5: To explain the Growth, Morphogenesis and Genetic assimilation.

CO6: To understand of role of stem cells in development of organisms and developmental anomalies.

Paper 3: Genetics and Molecular Biology

CO1: To explain the mechanisms of DNA replication and repair, RNA synthesis and processing, and protein synthesis.

CO2: Contribute to the education of peers by actively engaging in small group sessions, and by clearly communicating information in an oral presentation based on a personal literature search on a specific genetic disease.

CO3: Critically evaluate one's performance in the course to identify strengths and personal limitations in either knowledge of molecular cell biology and genetics or study methods, develop learning goals to address any deficiencies and actively seek out assistance from appropriate sources to successfully remediate these deficiencies.

CO4: To explain the mechanisms of gene transcription and its regulation.

CO5: To explain the Gene mutations and human genetic disorders consequences of mutation, causes and occurrences.

Paper 4: Immunology and Virology

CO1: The role and importance of innate and adaptive immunity to host defense against micro-organisms and the processes involved in immune cell development.

CO2: Concepts of regulation of Immune responses.

CO3: Understanding of Immunologic basis of graft rejection and immunotherapies.

CO4: Knowledge of viral diseases.

CO5: Understanding of development of vaccines.

Paper 5: Clinical Biochemistry and Disease Metabolism

CO1: To understand the concepts of protein metabolism and understand the importance of clinically important enzymes and related pathophysiology.

CO2: To know about the cause of metabolic diseases.

CO3: Biochemical methods for diagnosis of metabolic diseases.

CO4: The knowledge of Metabolic disorders and organ system function test.

CO5: To get the knowledge of Metabolic disorders due to errors in metabolism.

CO6: To understand about clinically important Enzymes.

Paper 6: Biostatistics and Bioinformatics

CO1: To understand the basic concepts of bioinformatics and databases available for Bioinformatics study.

CO2: Apply the knowledge of bioinformatics for getting DNA sequence and protein sequence for desired gene.

CO3: To study the comparison of nucleotides, aminoacids sequences between various organisms.

CO4: Recognize the definition of statistics and its relation with biological sciences.

CO5: Apply the knowledge of sampling techniques, probability distributions.

CO6: Apply the knowledge of sampling correlation and regression in problem solving.

Paper 7: Biomedical Instrumentation and Nano biotechnology

CO1: To understand the fundamental principles of chromatography, electrophoresis, spectrophotometry etc.

CO2: To development of technical Skills involved in chromatography, electrophoresis, spectrophotometry etc.

CO3: To understand principle and Instrumentation involved in PCR and Flow cytometry techniques.

CO4: To understand basic principles in nanobiotechnology.

CO5: To acquire knowledge about techniques used in nanobiotechnology.

CO6: To understand the applications of nanobiotechnology in Tissue engineering.

Paper 8: Stem Cell Biology

CO1: To explain basic concepts of stem cells, and different types of stem cells.

CO2: To understand the pluripotent stem cell and molecular mechanism of Self renewal and differentiation.

CO3: Demonstrate methods of isolation of stem cell types.

CO4: To understand the hematopoietic stem cell, their characterization, and differentiation of hematopoietic stem cell lineages.

CO5: To explain basic concepts of endothelial progenitor cells, multipotent adult progenitor cells.

CO6: To understand the Cancer stem cells and their regulation.

Paper 9: Stem Cell, Disease and applications.

CO1: To understand the concepts of stem cell therapy in degenerative neuronal disease and spinal cord regeneration.

CO2: To explain the Role of stem cells in acute myocardial infarction and dilated cardiomyopathy.

CO3: To understand the Role of stem cells in diabetes and muscular dystrophies.

CO4: To understand the Role of stem cells in treatment of hereditary hemolytic anemias.

CO5: To understand the CART cell therapy, NK & dendritic cell therapy for solid tumors.

CO6: To explain Role of Hematopoietic stem cell transplantation for malignancies, lymphoma, leukemia and myeloma.

Paper 10: Biomaterials, Tissue engineering and 3 D bioprinting.

CO1: To understand the properties of materials, classes of materials used in Tissue engineering.

CO2: Concepts of biomaterials used in medicine and their reactions with biological systems.

CO3: To demonstrate the Tissue engineering of organs like bone, cartilage, liver, cornea.

CO4: To explain Tissue engineering of organs and their clinical application.

CO5: To understand the advances of 3D Printing Technology and its clinical applications.

CO6: To explain the concepts of Bio ink for 3D printing of Bone, cartilage, skin, arteries and heart.

Paper 11: Clinical Research, Bioethics and Regulatory Affairs

CO1: To understand and Explain Clinical Research, Terminologies and definition in Clinical Research.

CO2: To know origin and History of Clinical Research, Difference between Clinical Research and Clinical Practice.

CO3: To understand and explain the Biosafety in laboratory institution: laboratory associated infection and other hazards, assessment of biological hazards and level of biosafety.

CO4: To understand and explain the rules and regulations involved in Clinical research.

CO5: To understand and explain concepts of Bioethics.

CO6: To understand and explain Intellectual property rights.

Paper 12: Cell and Tissue Banking and Cryopreservation

CO1: To understand the concepts of Cell and Tissue banking.

CO2: To know instrumentation for setting up of cell and organ tissue bank.

CO3: To understand the applications of cord blood banking.

CO4: To know advantages and disadvantages of transplantation.

CO5: To understand and apply the knowledge of cryopreservation and cryoprotectants for cryopreservation.

Paper 13: Research Methodology

CO1: To understand basic concept of Research, Types of Research methodology.

CO2: To know about selection of research problem and Hypothesis.

CO3: To write research project and thesis.

CO4: To use application of computer for research.

CO5: To use Power point presentation, Excel, Word to compilation and analysis of data.

CO6: To use of search engine for searching of literature.

Paper 14: Entrepreneurship and Management

CO1: To understand the nature of management, Roles of Management and Levels of Management.

CO2: To understand the Nature and purpose of planning and Organization.

CO3: To know the Nature and importance of staffing–Process of Recruitment and Selection.

CO4: To understand the Meaning and nature of directing.

CO5: To understand the Structure of a Biotechnology Company.

CO6: To know the function of entrepreneur in successful, commercial application of innovations.

SCRM	CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Biochemistry	CO1	3	3	1	3	2	3	3	2	2
	CO2	3	3	2	2	1	1	2	1	1
	CO3	3	2	3	2	1	1	1	1	2
	CO4	3	2	2	1	1	1	2	3	1
	CO5	3	2	1	3	1	1	1	2	3
	CO6	3	2	2	3	2	2	1	1	3
	Total	**18**	**14**	**11**	**14**	**8**	**9**	**10**	**10**	**12**
	Average	3.00	2.33	1.83	2.33	1.33	1.50	1.67	1.67	2.00
Cell Biology and Developmental Biology	CO1	3	3	1	3	2	3	3	2	2
	CO2	3	3	2	2	1	1	2	1	1
	CO3	3	1	3	2	1	1	1	1	2
	CO4	3	2	1	1	1	1	2	3	1
	CO5	3	3	1	3	2	3	1	2	3
	CO6	3	1	1	1	3	2	1	1	2
	Total	**18**	**13**	**9**	**12**	**10**	**11**	**10**	**10**	**11**
	Average	3.00	2.17	1.50	2.00	1.67	1.83	1.67	1.67	1.83
Genetics and Molecular Biology	CO1	3	3	1	1	1	1	3	2	2
	CO2	3	3	2	2	2	2	2	1	1
	CO3	2	3	2	2	2	2	1	1	2
	CO4	2	2	2	3	3	3	2	3	1
	CO5	2	2	2	3	3	3	1	2	3
	Total	**12**	**13**	**9**	**11**	**11**	**11**	**9**	**9**	**9**
	Average	2.4	2.6	1.8	2.2	2.2	2.2	1.8	1.8	1.8
Immunology and Virology	CO1	3	3	1	1	1	1	3	2	2
	CO2	3	3	2	2	1	2	2	1	1
	CO3	3	3	2	2	2	1	1	1	2
	CO4	3	2	2	1	1	1	2	3	1
	CO5	3	2	2	1	1	2	1	2	3
	Total	**15**	**13**	**9**	**7**	**6**	**7**	**9**	**9**	**9**
	Average	3	2.6	1.8	1.4	1.2	1.4	1.8	1.8	1.8

Clinical Biochemistry and Disease Metabolism	**CO1**	3	3	1	1	1	1	3	2	2
	CO2	3	3	2	2	1	2	2	1	1
	CO3	3	3	2	2	2	1	1	1	2
	CO4	3	2	2	1	1	1	2	3	1
	CO5	3	3	2	2	1	2	1	2	3
	CO6	3	3	2	2	2	1	1	1	2
	Total	**18**	**17**	**11**	**10**	**8**	**8**	**10**	**10**	**11**
	Average	3.00	2.83	1.83	1.67	1.33	1.33	1.67	1.67	1.83
Biostatistics and Bioinformatics	**CO1**	2	3	1	2	3	2	3	2	2
	CO2	3	3	2	2	1	1	2	1	1
	CO3	3	3	2	2	2	1	1	1	2
	CO4	3	2	2	1	2	2	2	3	1
	CO5	3	3	2	2	2	2	1	2	3
	CO6	2	3	2	2	2	1	1	1	2
	Total	**16**	**17**	**11**	**11**	**12**	**9**	**10**	**10**	**11**
	Average	2.67	2.83	1.83	1.83	2.00	1.50	1.67	1.67	1.83
Biomedical Instrumentation and Nanobiotechnology	**CO1**	3	3	1	1	1	1	3	2	2
	CO2	3	3	3	2	2	2	2	1	1
	CO3	3	3	2	2	2	2	1	1	2
	CO4	3	2	2	1	1	1	2	3	1
	CO5	3	2	2	2	1	1	1	2	3
	CO6	3	2	2	1	1	1	1	1	2
	Total	**18**	**15**	**12**	**9**	**8**	**8**	**10**	**10**	**11**
	Average	3.00	2.50	2.00	1.50	1.33	1.33	1.67	1.67	1.83
Stem Cell Biology	**CO1**	3	2	2	2	3	1	3	2	2
	CO2	3	3	2	2	1	1	2	1	1
	CO3	3	3	2	2	2	2	1	1	2
	CO4	3	2	1	1	1	1	2	3	1
	CO5	3	3	2	2	1	2	1	2	3
	CO6	3	3	2	2	2	1	1	1	2
	Total	**18**	**16**	**11**	**11**	**10**	**8**	**10**	**10**	**11**
	Average	3.00	2.67	1.83	1.83	1.67	1.33	1.67	1.67	1.83

	CO1	3	2	3	3	3	3	3	2	2
Stem Cell, Disease and applications	**CO2**	2	2	2	3	3	2	2	1	1
	CO3	3	2	3	3	1	1	1	1	2
	CO4	3	2	3	2	3	1	2	3	1
	CO5	3	2	3	3	2	2	1	2	3
	CO6	3	2	3	3	3	2	1	1	2
	Total	**17**	**12**	**17**	**17**	**15**	**11**	**10**	**10**	**11**
	Average	2.83	2.00	2.83	2.83	2.50	1.83	1.67	1.67	1.83
Biomaterials, Tissue engineering and 3 D bioprinting	**CO1**	3	2	2	2	2	1	3	2	2
	CO2	2	2	2	3	3	1	2	1	1
	CO3	3	2	3	3	2	1	1	1	2
	CO4	3	2	3	2	3	2	2	3	1
	CO5	3	2	3	3	2	2	1	2	3
	CO6	3	2	3	3	3	2	1	1	2
	Total	**17**	**12**	**16**	**16**	**15**	**9**	**10**	**10**	**11**
	Average	2.83	2.00	2.67	2.67	2.50	1.50	1.67	1.67	1.83
Clinical Research, Bioethics and Regulatory Affairs	**CO1**	3	2	3	3	3	3	3	2	2
	CO2	2	2	2	3	3	3	2	1	1
	CO3	3	2	3	3	3	3	1	1	2
	CO4	3	2	3	2	3	2	2	3	1
	CO5	3	2	3	3	2	3	1	2	3
	CO6	3	2	3	3	3	2	1	1	2
	Total	**17**	**12**	**17**	**17**	**17**	**16**	**10**	**10**	**11**
	Average	2.83	2.00	2.83	2.83	2.83	2.67	1.67	1.67	1.83
Cell and Tissue Banking and Cryopreservation	**CO1**	3	2	3	1	1	2	3	2	2
	CO2	3	2	3	3	3	2	2	1	1
	CO3	3	2	2	2	2	1	1	1	2
	CO4	3	1	1	1	1	1	2	3	1
	CO5	3	2	2	2	1	1	1	2	3
	Total	**15**	**9**	**11**	**9**	**8**	**7**	**9**	**9**	**9**
	Average	3	1.8	2.2	1.8	1.6	1.4	1.8	1.8	1.8
Research	**CO1**	3	2	3	1	3	2	3	2	2

Methodology	**CO2**	3	2	2	3	3	2	2	1	1
	CO3	3	2	2	3	3	2	1	1	2
	CO4	3	2	2	1	1	2	2	3	1
	CO5	3	2	2	2	1	2	1	2	3
	CO6	3	2	2	1	1	2	1	1	2
	Total	**18**	**12**	**13**	**11**	**12**	**12**	**10**	**10**	**11**
	Average	3.00	2.00	2.17	1.83	2.00	2.00	1.67	1.67	1.83
Entrepreneurship And Management	**CO1**	3	2	3	3	3	3	3	2	2
	CO2	2	2	2	3	3	3	2	1	1
	CO3	3	2	3	3	3	3	1	1	2
	CO4	3	2	3	2	3	2	2	3	1
	CO5	3	2	3	3	2	3	1	2	3
	CO6	3	2	3	3	3	2	1	1	2
	Total	**17**	**12**	**17**	**17**	**17**	**16**	**10**	**10**	**11**
	Average	2.83	2.00	2.83	2.83	2.83	2.67	1.67	1.67	1.83

No colour (1) shows the weak relation between CO and PO. A blank show there is no relation between CO and PO. Faint green colour (2) shows the moderate relation between the CO and PO. Green colour (3) shows the strong relation between CO and PO.

Programme Articulation Matrix:

SCRM	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Biochemistry	3.00	2.33	1.83	2.33	1.33	1.50	1.67	1.67	2.00
Cell Biology and Developmental Biology	3.00	2.17	1.50	2.00	1.67	1.83	1.67	1.67	1.83
Genetics and Molecular Biology	2.4	2.6	1.8	2.2	2.2	2.2	1.8	1.8	1.8
Immunology and Virology	3	2.6	1.8	1.4	1.2	1.4	1.8	1.8	1.8
Clinical Biochemistry and Disease Metabolism	3.00	2.83	1.83	1.67	1.33	1.33	1.67	1.67	1.83
Biostatistics and Bioinformatics	2.67	2.83	1.83	1.83	2.00	1.50	1.67	1.67	1.83
Biomedical Instrumentation and Nanobiotechnology	3.00	2.50	2.00	1.50	1.33	1.33	1.67	1.67	1.83
Stem Cell Biology	3.00	2.67	1.83	1.83	1.67	1.33	1.67	1.67	1.83
Stem Cell , Disease and applications	2.83	2.00	2.83	2.83	2.50	1.83	1.67	1.67	1.83
Biomaterials, Tissue engineering and 3 D bio-printing	2.83	2.00	2.67	2.67	2.50	1.50	1.67	1.67	1.83
Clinical Research, Bioethics and Regulatory Affairs	2.83	2.00	2.83	2.83	2.83	2.67	1.67	1.67	1.83
Cell and Tissue Banking and Cryopreservation	3	1.8	2.2	1.8	1.6	1.4	1.8	1.8	1.8
Research Methodology	3.00	2.00	2.17	1.83	2.00	2.00	1.67	1.67	1.83
Entrepreneurship and Management	2.83	2.00	2.83	2.83	2.83	2.67	1.67	1.67	1.83

Measuring the attainment of learning outcomes:

The CO attainment levels are measured based on the results of the internal assessment, external examination and practical assessment conducted by the university. The CO attainment level based on internal assessment, external examination and practical assessment are computed separately. 80% weight for external assessment and 20% weight for internal assessment for this programme.

Measuring course attainment levels of all the courses:

Course Name	CO attainment score	Level	Status
Biochemistry	3.00	Excellent	Attained
Cell Biology and Developmental Biology	3.00	Excellent	Attained
Genetics and Molecular Biology	3.00	Excellent	Attained
Immunology and Virology	3.00	Excellent	Attained
Cell Physilogy & Metabolism	1.00	Average	Not Attained
Bio -Medical Instrumentation	3.00	Excellent	Attained
Biomaterials, Medical Nanobiotechnology and Tissue Engineering	1.40	Average	Not Attained
Animal Models, Biostatistics & Bioinformatics	1.40	Average	Not Attained
Stem Cell Biology	3.00	Excellent	Attained
Stem Cell , Disease and applications	3.00	Excellent	Attained
Clinical Research, Bioethics and Regulatory Affairs	3.00	Excellent	Attained
Cell and Tissue Banking and Cryopreservation	3.00	Excellent	Attained
Entrepreneurship and Management	2.80	Excellent	Attained
Research Methodology	2.80	Excellent	Attained

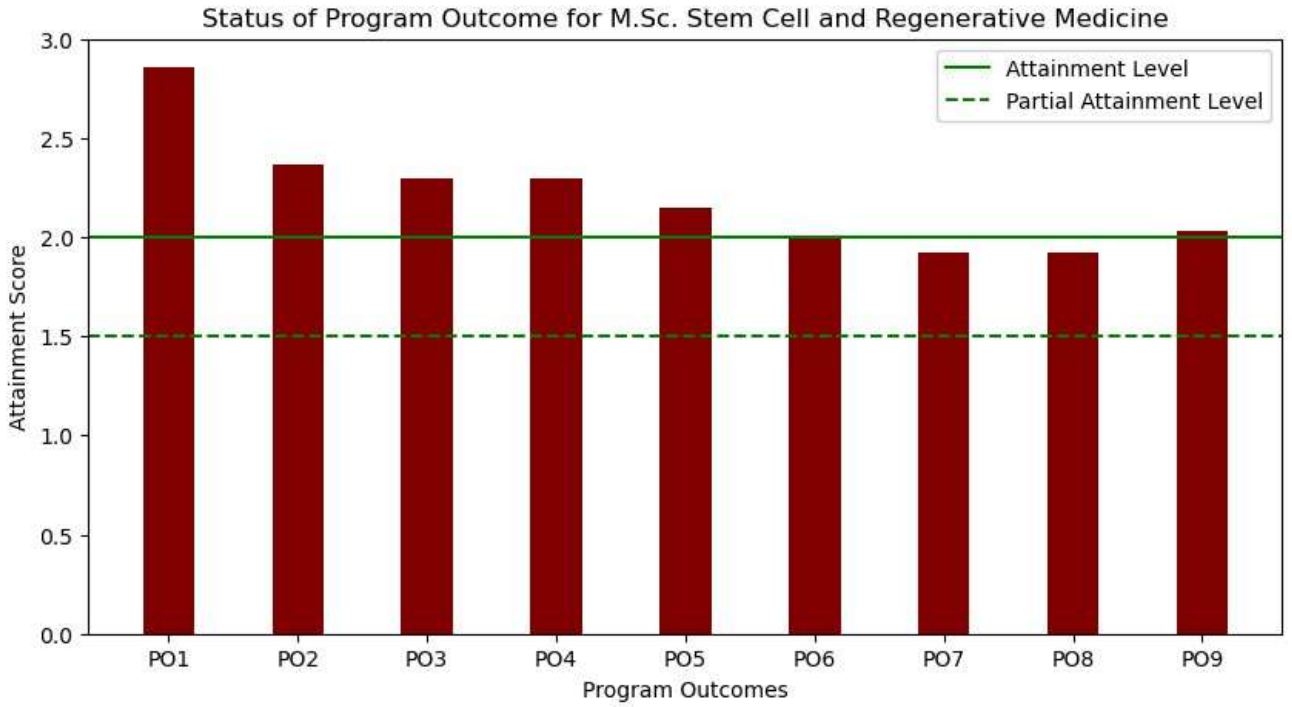
Here Green cell denotes the course is fully attained. Yellow cell denotes the course is partially attained and red cell denotes the course is not attained.

IALP=2.8

Measuring attainment levels of learning/ programme outcomes:

Programme Outcome	Total attainment
PO1	2.86
PO2	2.37
PO3	2.30
PO4	2.30
PO5	2.15
PO6	2.00
PO7	1.92
PO8	1.92
PO9	2.03

Here Green cell denotes the programme outcome is fully attained. Yellow cell denotes the programme outcome is partially attained.



Name of the Programme Coordinator: Prof. Dr. M. G. Joshi

Name of the Programme: M.Sc. Stem Cell and Regenerative Medicine

Year: 2018-19

Outcome: The details of the Course Attainment Score and Programme Attainment Score

PO	Level	Remark
PO1	Excellent	Attained
PO2	Very Good	Attained
PO3	Very Good	Attained
PO4	Very Good	Attained
PO5	Very Good	Attained
PO6	Very Good	Attained
PO7	Good	Partially Attained
PO8	Good	Partially Attained
PO9	Very Good	Attained

Course Name	Level	Status
Molecular Cell Biology	Excellent	Attained
Immunology	Excellent	Attained
Biochemistry	Excellent	Attained
Developmental Biology and Histology	Excellent	Attained
Cell Physiology& Metabolism	Average	Not Attained
Bio -Medical Instrumentation	Excellent	Attained
Biomaterials, Medical Nanobiotechnology and Tissue Engineering	Average	Not Attained
Animal Models, Biostatistics & Bioinformatics	Average	Not Attained
Stem Cell Biology	Excellent	Attained
Disease & Applications of Stem Cells	Excellent	Attained
Cell & Tissue Banking and Cryopreservation	Excellent	Attained
Clinical Research, Bioethics and Regulatory Affairs	Excellent	Attained
Molecular Diagnostics and Therapeutics	Excellent	Attained
Research Methodology	Excellent	Attained
Entrepreneurship and Management	Excellent	Attained

Subsequently a further presentation was made in the presence of the Dean (Centre for Interdisciplinary Research, Kolhapur), members of MEU and faculty members in Centre for Interdisciplinary Research, Kolhapur, Kolhapur.

Some of the suggestions made during the deliberations are as follows:

1. Take activity related to social responsibility and Sustainable Development Goal.
2. Take workshop and conferences to fulfil our Programme Outcome.

Dean

Centre for Interdisciplinary Research, Kolhapur