



ANNAMALAINAGAR - 608002
(A State University Accredited with 'A' Grade by NAAC)

MYAS-AU DEPARTMENT OF SPORTS SCIENCES

DIVISION
of
EXERCISE PHYSIOLOGY AND
SPORTS BIOCHEMISTRY

MASTER OF SCIENCE
IN
EXERCISE PHYSIOLOGY

REGULATIONS AND SYLLABUS
(For students admitted from academic year 2019-20 onwards)
UNDER CHOICE BASED CREDIT SYSTEM

M.Sc. EXERCISE PHYSIOLOGY

REGULATIONS AND SYLLABUS

(For students admitted from academic year 2019-20 onwards)

1. Objectives:

The M.Sc. Exercise Physiology course is designed to provide an opportunity to students to apply theory to practice, which creates a highly valuable learning experience with clear vocational and professional significance. The content on M.Sc. Exercise Physiology has been carefully designed to provide quality assured professional training to meet the needs of the athletes and to foster life-long learning in participants.

This programme is designed to:

- Develop knowledge and understanding of the principles and applications of exercise physiology and their application to vocational/professional practice.
- Provide an opportunity to critically assess a broad range of theories, methodologies and research findings in exercise physiology.
- Develop a critical understanding of how to apply theories, strategies and methodologies in appropriate ways.
- Enable the student to develop empirical rigour in identifying solutions to complex problems.
- Develop the appreciation of inter-related scientific concepts that promote understanding of problems and issues in the study of exercise physiology.
- Provide a forum for the development of research skills and professional competencies in the field of exercise physiology.

2. Definition of key words:

- **Programme:** An educational program leading to the award of a Degree, diploma or certificate.
- **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.
- **Semester:** Each semester consists of 15-18 weeks of academic work equivalent to 90 days of actual teaching days. The odd semester may be scheduled from July to December and even Semester from January to June.
- **CBCS (Choice Based Credit System):** It provides choice for students to select from the prescribed courses.
- **Course:** It is usually referred to as “Papers”. All courses need not carry the same weight. A course may comprise lectures/tutorials/laboratory, work/field, work/outreach activities/project work/vocational training/viva/seminars etc or a combination of some of these.

- **Credit:** A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching or two hours of practical work.
- **Core course:** Are course that are basic to the subject of the degree. This is a course which is to be compulsorily studied by a student as a core requirement to the completion of the program.
- **Elective Courses:** This is a course that is supportive to the discipline of study, provides an expanded scope, enables exposure to some other domains or nurtures proficiency/skills. Elective papers can be of two types: Discipline Specific Elective (DSE) and Generic Elective (GE). Core / DS Electives will not be offered as Generic Electives. Elective papers can be taken from MOOC courses and credit transfer should be allowed.
- Each of the Core courses and Discipline Specific Elective (DSE) shall be of 4 credits. Credits under DSE may vary (16/12/8) depending upon the number of DSE courses offered across the semesters.
- **Discipline Specific Elective (DSE):** These courses are inter disciplinary in nature and considered similar to core course. And, the students have to choose one course from the option provided for them.
- **Generic Elective (GE):** These courses add generic proficiency to the students. Students have to choose generic elective courses in consultation with the head of the department from the Generic Elective courses offered by other Division of study in Sports Science or from other Departments in university.

3. Course Structure:

This M.Sc. Exercise Physiology is a programme consists of core courses, soft core courses, practical courses, internship and project work. The entire programme carries credit system. The number and distribution of credits for the programme will be decided by the respective faculties.

A programme is divided into two Semesters, Odd Semester and Even Semester. The normal Semester periods are:

Odd Semester: July to November (90 Working days)

Even Semester: December to April (90 Working days)

4. Credits:

The term credit is used to describe the quantum of syllabus for various courses in terms and hours of study. It indicates differential weight age given according to the contents and duration of the courses in the curriculum design. The minimum credit requirement for a two years Master's Programme shall be 90.

One credit of theory equals one lecture hour and

One credit of practical equals two laboratory hours.

5. Courses:

Each Programme may consist of Lectures / Tutorials / Laboratory Work / Seminar / Project Work / Practical Training Report / Viva-Voce etc. Normally, in each of the programmes, credits will be assigned on the basis of the Lectures/Tutorials/Laboratory Work and other form of learning in a 18 week schedule.

6. Eligibility for Admission:

Bachelor's Degree in Sports Science / Physical Education and Sports or equivalent thereto in 10+2+3 or 10+2+4 pattern from a recognized university with a minimum of 50% marks in aggregate. The candidate should have passed the HSC or equivalent examination with Physics, Chemistry and Biology.

7. Grading System:

The term grading system indicates a 10 point scale of evaluation of the performance of students in terms of marks, grade points, letter grade and class.

8. Duration:

The duration for completion of Two Years Master's programme in any subject is four Semesters, but in any case not more than five years from the year of admission.

9. Attendance:

Every teaching faculty handling a course shall be responsible for the maintenance of Attendance Register for candidates who have registered for the course.

The teacher of the course must intimate the Head of the Department at least Seven Calendar Days before the last instruction day in the semester about the particulars of all students who have secured an attendance of less than 75%.

A candidate who has attendance less than 75% shall not be permitted to sit for the end-semester examination in the course in which the shortage exists.

However, it shall be open to the authorities to grant exemption to a candidate who has failed to obtain the prescribed 75% attendance for valid reasons on payment of a condonation fee and such exemptions should not under any circumstances be granted for attendance below 65%.

10. Examination:

There will be two sessional assessment tests and one End-Semester examination during each semester.

Sessional Test-I will be conducted after 35 working days and Sessional Test-II will be conducted after 70 working days.

Sessional Test-I will be a combination of a variety of tools such as class test, assignment and paper presentation that would be suitable to the course. This requires an element of openness. The students are to be informed in advance about the nature of assessment and the procedures. However, the tests are compulsory. Test-I may be for one hour duration. The pattern of question paper will be decided to the respective faculty. Sessional Test-I will carry 12.5% of marks of the entire course.

Sessional Test–II will be held after 70 working days for the syllabi covered between Seventh and Eleventh weeks.

Sessional Test–II will be conducted with a variety of assessment tools. It will also have an element of openness. The students are to be informed in advance about the nature of assessment and the procedures. However, the tests are compulsory. Test–II may be for two hours duration. The pattern of question paper will be decided by the respective Faculty. Sessional Test–II carries 12.5% of marks of the entire course.

There will be one End–Semester Examination of 3 Hours’ duration in each course. The end semester examination will cover all the syllabus of the course for 75% of marks.

Each course shall carry a maximum of 100 marks for the purpose of grading. The distribution of marks shall be as follows.

Theory Marks			Practical Marks		
Internal	External	Maximum	Internal	External	Maximum
25	75	100	40	60	100

11. Non-Credit Course

For the Non-Credit Courses offered in a Semester, a ‘Satisfactory Participation Certificate’ shall be issued to the Student from the concerned authorities, only after securing $\geq 65\%$ attendance in such a Course. No credits, marks or Letter Grade shall be allotted for the non-credit course.

12. Internship and Field visit:

The Internship / Practical Training shall carry 100 marks and shall be evaluated through internal assessment only. At the end of Internship / Practical training / Summer Project, the candidate shall submit a certificate from the organization where he /she has undergone training and a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Department. Certificates (issued by the training centre or Organization) submitted by the candidate shall be attached to the mark list sent by the Head of the Department.

Field visit carry 100 marks and shall be evaluated through internal assessment only. At the end of field visit students has to submit the field visit report. Similarly, like internship evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Department. Certificates (issued by the training centre or Organization) submitted by the candidate shall be attached to the mark list sent by the Head of the Department.

13. Evaluation:

Evaluation will be done on a continuous basis. Evaluation may be by Objective Type Questions, Quiz, Short Answers, Essays or a combination of these, but at the end semester it has to be a written examination.

The performance of students in each course is evaluated in terms of percentage of marks (PM) with a provision for conversion to Grade Point (GP). The sum total performance in each semester will be rated by GPA while the continuous performance from the 2nd Semester onwards will be marked by (OGPA).

14. Marks and Grading:

A student cannot repeat the Sessional Assessment Test–I and Sessional Test– II. However, if for any compulsive reason the student could not attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

A minimum of 50% marks in each course is prescribed for a pass. A student has to secure 50% minimum in the End Semester Examination.

If a candidate who has not secured a minimum of 50% of marks in a course shall be deemed to have failed in that course.

The student can repeat the End Semester Examination when it is offered next in the subsequent Odd/ Even semesters till the regulations are in force. However, a candidate cannot move to the next semester if he/she has more than six papers as arrears at any point of time.

A candidate who has secured a minimum of 50 marks in all courses prescribed in the programme and earned a minimum of the credits will be considered to have passed the Master's Degree Programme.

15. Grading:

A ten point rating is used for the evaluation of the performance of the student to provide a letter grade for each course and overall grade for the Master's Programme. The letter grade assigned is given below:

Marks	Grade Point	Letter Grade	Class
90+	10	S	Exemplary
85-89	9.0	D	Distinction
80-85	8.5	D	Distinction
75-79	8.0	D	Distinction
72-74	7.5	A	First class
65-69	7.0	A	First class
60-64	6.5	A	First class
55-59	6.0	B	Second class
50-54	5.5	C	Second class
49 or less	-	F	Fail

The successful candidates are classified as follows:

I – Class 60% marks and above in over all percentage of marks (OPM).

II – Class 50–59% marks in over all percentage of marks.

Candidates who obtain 75% and above but below 91% of marks (OPM) shall be deemed to have passed the examination in First Class (Distinction) provided he/she passes all the course prescribed for the programme at the first appearance.

Candidates who obtain 90% and above (OPM) shall be deemed to have passed the examination in First Class (Exemplary) provided he/she passes the entire course prescribed for the programme at the first appearance.

For the Internal Assessment Evaluation the break up marks shall be as follows.

Test	10 marks
Assignment	05 marks
Case Study / Seminar / Short Answers etc.	05 marks
Attendance	05 marks
Total	25 Marks

Marks for Attendance Percentage

90% and above	5 Marks
80 – 89%	4 Marks
70 – 79%	3 Marks

16. Course–Wise Letter Grade:

The percentage of marks obtained by a candidate in a course will be indicated in a letter grade. A student is considered to have completed a course successfully and earned the credits if he/she secures over all grades other than F. A letter grade F in any course implies a failure in that course. A course successfully completed cannot be repeated for the purpose of improving the Grade point.

The F Grade once awarded stays in the grade card of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidates has appeared for clearance of the arrears.

A student secures F grade in any course which is listed as course as to repeat it compulsorily when the course is offered next. If it is an elective course, a student has the option to repeat it when it is offered next or to choose a new elective if he / she is chosen in the place of failed elective failed optional will be indicated as dropped in the subsequent grade card.

If a student secures F Grade in the Project Work/ Field Work/Practical Work/ Dissertation, either he/she shall improve it and resubmit it if it involves only rewriting incorporating the clarification of the evaluators of he/she can re–register and carry out the same in the subsequent semesters for evaluation.

17. Withdrawal from the course by the student:

Within two weeks from the date of commencement of the semester.

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Two-Year (4-Semester) CBCS Programme

Basic Structure: Distribution of Courses

1	Core (C)	13 Papers of 4 Credit each (Total Credit 11X4)	52
2	Elective (E) <ul style="list-style-type: none"> • Discipline Specific Elective • Generic Elective Courses • Value Added Courses 	2 Papers of 4 Credit each = 8 4 Papers of 3 Credit each = 12	20
3	Project Work Including Presentation, Comprehensive viva (D)	1 Activity of 3 credits (Total Credit 1x3)	03
4	Core Course Practical (P)	4 Activities of 2 credits each (Total Credit 4x2)	08
5	Core Course Internship (I)	1 Activity of 6 credits (Total Credit 1x2)	06
6	Core Course Field Visit (V)	1 Activity of 1 credit (Total Credit 1x1)	01
	Total Credit		90

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Two-Year (4-Semester) CBCS Programme

Programme Structure

Semester – I					
Course No.	Course Title	Course Type	No. of Credit		
			Theory	Practical	Total
MEPC101	Fundamentals of Exercise Physiology	C – 1	4	0	4
MEPC102	Principles of Sports Training	C – 2	4	0	4
MEPC103	Research Methodology in Exercise Physiology	C – 3	4	0	4
MEPE104	<i>Discipline Specific Elective (DSE -Select any one)</i>	E – 1	4	0	4
	a. Cardiorespiratory physiology				
	b. Neuromuscular physiology in sports				
	c. Science of Yoga				
	d. Fatigue, Injury and Rehabilitation				
MEPE105	<i>Generic Elective Course</i> Science of Exercise	E – 2	3	0	3
MEPP106	Practical – I : Fundamentals of Exercise Physiology	P – 1	0	2	2
TOTAL			19	2	21

Semester – II					
Course No.	Course Title	Course Type	No. of Credit		
			Theory	Practical	Total
MEPC201	Kinesiology and Motor Learning	C – 4	4	0	4
MEPC202	Applied Sports Physiology	C – 5	4	0	4
MEPC203	Statistical Methods in Exercise Physiology	C – 6	4	0	4
MEPC204	Exercise Biochemistry	C – 7	4	0	4
	<i>Generic Elective Course</i>	E – 3	3	0	3
MEPP206	Practical – II : Application of Sports Physiology	P – 2	0	2	2
TOTAL			19	2	21

Semester – III					
Course No.	Course Title	Course Type	No. of Credit		
			Theory	Practical	Total
MEPC301	Sports Nutrition	C – 8	4	0	4
MEPC302	Environmental Exercise Physiology	C – 9	4	0	4
MEPC303	Sports Biomechanics	C – 10	4	0	4
MEPE304	<i>Discipline Specific Elective (DSE -Select any one)</i>	E – 4	4	0	4
	a. Ergogenic aids and Doping				
	b. Exercise physiology and Gender				
	c. Physiological Aspects of Aging				
	d. Muscular Adaptations to exercise and training				
MEPE305	<i>Generic Elective Course</i> Exercise and Obesity	E – 5	3	0	3
MEPP306	Practical – III : Sports Biomechanics	P – 3	0	2	2
MEPI307	Internship:	I – 1	0	6	6
TOTAL			19	8	27

Semester – IV					
Course No.	Course Title	Course Type	No. of Credit		
			Theory	Practical	Total
MEPC401	Exercise Immunology	C – 11	4	0	4
MEPC402	Behavioural Physiology	C – 12	4	0	4
MEPC403	Physiological Support of Athletes	C – 13	4	0	4
MEPD404	Project Work including Presentation, Comprehensive Viva <i>(Related to their Specialization selected)</i>	D – 1	0	3	3
	Generic Elective Course	E – 6	3	0	3
	Value Added Course				
MEPP406	Practical – IV : Physiological Support of Athletes	P – 4	0	2	2
MEPV407	Field Visit	FV	0	1	1
TOTAL			15	6	21

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Scheme of Examination Marks Distribution

Semester – I				
Course No.	Course Title	Internal Marks	External Marks	Maximum Marks
MEPC101	Fundamentals of Exercise Physiology	25	75	100
MEPC102	Principles of Sports Training	25	75	100
MEPC103	Research Methodology in Exercise Physiology	25	75	100
MEPE104	<i>Discipline Specific Elective (DSE -Select any one)</i>	25	75	100
	a. Cardiorespiratory physiology			
	b. Neuromuscular physiology in sports			
	c. Science of Yoga			
	d. Fatigue, Injury and Rehabilitation			
MEPE105	<i>Generic Elective Course</i> Science of Exercise	25	75	100
MEPP106	Practical – I : Fundamentals of Exercise Physiology	40	60	100
TOTAL		165	435	600

Semester – II				
Course No.	Course Title	Internal Marks	External Marks	Maximum Marks
MEPC201	Kinesiology and Motor Learning	25	75	100
MEPC202	Applied Sports Physiology	25	75	100
MEPC203	Statistical Methods in Exercise Physiology	25	75	100
MEPC204	Exercise Biochemistry	25	75	100
	<i>Generic Elective Course</i>	25	75	100
MEPP206	Practical – II : Application of Sports Physiology	40	60	100
TOTAL		165	435	600

Semester – III				
Course No.	Course Title	Internal Marks	External Marks	Maximum Marks
MEPC301	Sports Nutrition	25	75	100
MEPC302	Environmental Exercise Physiology	25	75	100
MEPC303	Sports Biomechanics	25	75	100
MEPE304	<i>Discipline Specific Elective (DSE -Select any one)</i>	25	75	100
	a. Ergogenic aids and Doping			
	b. Exercise physiology and Gender			
	c. Physiological Aspects of Aging			
	d. Muscular Adaptations to exercise and training			
MEPE305	<i>Generic Elective Course</i> Exercise and Obesity	25	75	100
MEPP306	Practical – III : Sports Biomechanics	40	60	100
MEPI307	Internship:	100	---	100
TOTAL		265	435	700

Semester – IV				
Course No.	Course Title	Internal Marks	External Marks	Maximum Marks
MEPC401	Exercise Immunology	25	75	100
MEPC402	Behavioural Physiology	25	75	100
MEPC403	Physiological Support of Athletes	25	75	100
MEPD404	Project Work including Presentation, Comprehensive Viva <i>(Related to their Specialization selected)</i>	40	60	100
	Generic Elective Course	25	75	100
	Value Added Course			
MEPP406	Practical – IV : Physiological Support of Athletes	40	60	100
MEPV407	Field Visit	100	---	100
TOTAL		280	420	700

Cumulative Allotment of Marks for Semesters

Semester	Internal	External	Total
Semester I	165	435	600
Semester II	165	435	600
Semester III	265	435	700
Semester IV	280	420	700
Total	875	1725	2600

MEPC101 (Theory): Fundamentals of Exercise Physiology

Learning objectives	To learn the changes in human body systems due to exercise and sporting activities in an integrated manner.
Learning outcome	Students will be ready to study effect of exercise in detail and in application perspective.

Unit 1

Origins of Exercise Physiology; Scope, Importance; Application in Competitive sports, Recreation sports, Medical rehabilitation; Human energy transfer in rest and exercise; Concept of Aerobic and anaerobic energy production; Energy expenditure in different activities.

Unit 2

Physiology of body systems in relation to sports; Cardiovascular system, respiratory system, Neuromuscular system, Endocrine system, and Nervous system; Regulation of physiological responses.

Unit 3

Physiological Adaptations to exercise and training; measurement of exercise and training related changes

Unit 4

Environment and exercise, Body Temperature Regulation in rest and exercise; Response to exercise in the Hot and Humid environments; heat stress and its manifestation; acclimatization and adaptation in heat; Exercise in the cold Environment– physiological Responses to exercise in the cold; Health Risks during Exercises in the cold; acclimatization and adaptation in cold.

Suggested Reading

1. Astrand, P.-O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
2. C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
3. Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
4. K. Birch, D. MacLaren, K. George .(2005) Instant notes in sport and exercise physiology. Garland Science/BIOS Scientific Publishers.
5. Scott Kline Powers, Edward T. Howley. Exercise Physiology Theory and Application to Fitness and Performance, 2012; McGraw-Hill, Boston
6. Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
7. Tudor Hale (2003) Exercise Physiology A Thematic Approach. John Wiley & Sons Ltd, England
8. Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
9. William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA.

MEPC102 (Theory): Principles of Sports Training

Learning objectives	To gain knowledge about sports training
Learning outcome	Students will be able to measure the changes and interpret them in the context of sports
Unit 1	History, Importance, Aim and objectives of sports training; Characteristics of sports training; biological process in training; Components of physical fitness (motor abilities)– endurance, strength, speed, flexibility, co-ordination; agility.
Unit2	Principles of training - Overload, specificity, progression and reversibility; Meaning and concept of Training load; Adaptation and Recovery, supercompensation, training structure - volume, intensity, frequency; Peaking, errors in training
Unit3	Training plan; Need and importance in planning; Types of training plans - short term and long term plans; Training and competition cycles (training conception, macro, micro, meso); Periodzation – Need, Types; Aims of various phases of Periodzation (Preparatory, competition and transition); Competition -Types of Competition Preparation for competition; the number and frequency of competition. Training athletes with disability. Adapted games for Disabled; Special Olympics and Paralympics.
Unit4	Test, measurement and evaluation of performance, Test battery - AAHPERD tests, BROCKPORT test system, The Canadian Assessment of Physical Literacy tests, and other tests
Unit 5	Organizational aspects of sports; Olympic movement; Sports and games in Olympics, Asian Games, and other major international competitions; General structure of Rules and Regulations of different sports/games

Suggested Reading

- ACSM's health- related physical fitness assessment manual. Lippincott Williams & Wilkins, 2008.
- Dan Gordon. (2009) Coaching Science.; Learning Matters Ltd, UK.
- Dick Frank W. (1997), "Sports Training Principles", Bloomsbury, London.
- Hardayal Singh (1984), "Sports Training General Theory and Methods", New Delhi DVS Publications
- Holt, Laurence E., Pelham, Thomas E., Holt, Jason. Flexibility A Concise Guide. 2008; Humana Press Inc.. New Jersey.
- Jay Hoffman (2014) Physiological aspects of sport training and performance. Human Kinetics.
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- Terry McMorris and Tudor Hale (2006) Coaching Science-Theory into Practice. John Wiley & Sons Ltd
- Tudor Bompa, Carlo Buzzichelli (2019) Periodization-Theory and Methodology of Training, Human Kinetics
- Vance A. Ferrigno Lee E. Brown. Training for Speed, Agility, and Quickness. 2015; Human Kinetics, Champaign, IL.
- Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Will Freeman. Track & Field coaching essentials. 2015; Human Kinetics, Champaign, IL.

MEPC103 (Theory): Research Methodology in Exercise Physiology

Learning objectives	To learn methodology of carrying out scientific research
Learning outcome	Student will be able to generate new research topic, plan and execute research
Unit 1	Types of research; Criteria and Identification of a research problem; Research Design – sampling design, experimental design, variable selection, etc. Tools of Data Collection – sampling, questionnaire, types of data, etc;
Unit 2	Ethical guideline in research & publication. Plagiarism – what it is; avoiding plagiarism; paraphrasing and its methods. Style manual- (American Psychological Association etc.); Publication protocol - Preparation and publication of review article and / or original research work;
Unit 3	Introduction to review of literature – what, why, how; Types of research review and their relevance. Formulation of key questions for a review, keywords/descriptors; Searching the literature – sources of literature, Bibliographical database, other web sources; methods of literature search – keywords and Boolean logic. Evaluation of scientific literature; Organizing literature – strategies, use of software; Meta analysis. Writing review – structuring the review, quoting/paraphrasing, the citation referencing system,
Unit 4	Fundamentals of computer, Basic principle and use of computer. Hard ware, software, Net working, Application of computer in biology.

Suggested Reading

1. Kothari, C.R. Research Methodology. 2004; New Age International, New Delhi.
2. Baca, A. Computer Science in Sports - Research and Practice. 2014; Routledge, Taylor and Francis, UK.
3. Fink, A. Conducting research literature reviews from the Internet to paper. 2009; Sage Publications, New Delhi.
4. Hart, C. Doing a literature review Releasing the social science research imagination. 1999; Sage Publications Limited, New Delhi.
5. O' Donoghue, P. and Holmes, L. Data Analysis in Sport (Routledge Studies in Sports Performance Analysis) 1st Edition, 2014; Routledge, UK.
6. Ridley, D. The literature review a step-by-step guide for students. 2012; Sage Publications Limited, New Delhi.
7. ICMR. Ethical Guidelines for Biomedical Research on Human Subjects. 2006; ICMR, New Delhi.
8. Silyn-Roberts H. Writing for Science and Engineering Papers, Presentations and Reports. 2002; Butterworth-Heinemann, UK.

MEPE104 (Theory)
Discipline Specific Elective (DSE)

- a. Cardio-respiratory physiology in sports
- b. Neuromuscular physiology in sports
- c. Yoga in Sports
- d. Overtraining , Fatigue and Rehabilitation in Sports

a. Cardio-respiratory physiology in sports (Theory)

Learning Objectives	Learn specific response of the cardiorespiratory system to sporting activities
Learning Outcome	They will be able to interpret the changes recorded on athletes during and after training.
Unit 1	Detail structure of cardio-respiratory system including lymphatic system; electrical activity of heart, Exercise, Cardiovascular response to acute aerobic exercise, Cardiovascular response to acute resistance exercise, Vasomotor Regulation in Exercise, Circulatory Limits To Exercise, Adverse Circulatory Effects Of Exercise, Exercise and Hypertension
Unit 2	Cardiovascular adaptations to endurance and strength training, Hypertrophy, and Cardiomyopathy in Young and Older Athletes, cardiovascular and respiratory systems integrated action in exercise, respond to steady-state exercise, Heart rate training zone, Effects Of High Altitude. Sudden Cardiac Death and Exercise in Healthy Adults
Unit 3	Function and Structure of the Respiratory System, Mechanics of Breathing , Alveolar Ventilation, Blood Flow to the Lung, Ventilation-Perfusion Relationships, Changes in blood gasses and pH in exercise, Ventilatory response to exercise and its use in sports, Ventilatory threshold, Effects Of Exercise, response to steady- state exercise, Exercise-Induced Bronchoconstriction and Vocal Cord Dysfunction
Unit 4	Control of Breathing during exercise; The Respiratory System under Stress, respiratory systems adaptation to long-term exercise, Adaptations to systematic Training, Effects Of High Altitude. The Importance of Exercise Training in Pulmonary Rehabilitation Non-respiratory Functions of the Lung , Methods for Cardiopulmonary Exercise Testing, Interpretation of Pulmonary Function Tests, Mechanisms and Measurement of Exertional Dyspnea.

a. Cardio-respiratory physiology in sports (Practical):

Learning objectives

to learn the skill required for testing cardiorespiratory functions.

Learning outcome

be able to implement test sessions and interpret the data

1. Measurement of Heart rate variability during rest and exercise.
2. Measurement of blood pressure during rest, exercise and recovery,
3. Recording of ECG in rest and during exercise
4. Heart rate monitoring during sports activities.
5. Study of the relationship between Cardiovascular and respiratory systems through exercise testing.
6. Measurement of anaerobic threshold from multiple variables
7. Measurement of anaerobic threshold by Conconi test
8. Determination of Heart rate training zone
9. Assignment on application of heart rate in real life training

Suggested Reading

1. Roy J. Shephard and Henry S. Miller, Jr. (1999) Exercise and the Heart in Health and Disease. Marcel Dekker, Inc
2. Shephard, R.J. and Astrand, P.-O. (1992) Endurance in sport. Blackwell Science Ltd, USA
3. McArdle, W.D., Katch, F.I., Katch, V.L. (2006) Essentials of Exercise Physiology. Lippincott Williams and Wilkins, USA.
4. Victor F. Froelicher, Jonathan Myers (2006) Exercise and the heart. Elsevier Inc.
5. Christopher B. Cooper and Thomas W. Storer (2004) Exercise testing and interpretation- A practical approach. Cambridge University Press.
6. K. Wasserman, J Hansen, D Sue, W Stringer, B Whipp, eds (2004) Principles of Exercise Testing and Interpretation, 4th edn.. Lippincott Williams & Wilkins, Philadelphia, USA.
7. Christopher Bell. Cardiovascular Physiology in Exercise and Sport . 1st Edition. 2008; Churchill Livingstone
8. Martin Schwellnus. Olympic Textbook Of Medicine In Sport. 2008; Blackwell Publishing Ltd.
9. Michael G. Levitzky. Pulmonary Physiology, 8e. 2013; Lange. The McGraw-Hill Companies.
10. Denise L. Smith and Bo Fernhall (2011) Advanced cardiovascular exercise physiology. Human Kinetics.
11. Idelle M. Weisman, R. Jorge Zeballos. (2002) Clinical exercise testing. In *Chris T. Bolliger* (Ed) Progress in Respiratory Research. Vol. 32, Karger, Basel.

b. Neuromuscular physiology in sports (Theory)

Learning objectives	To learn complex interaction between nervous system and muscles in relation to sporting activity.
Learning outcome	The student would be able to understand the mechanism of skill development and the basis of neuromuscular coordination.
Unit 1	Muscle Fibers, , Motor Units, and Motoneurons; Muscle Heterogeneity; Orderly Motor Unit Recruitment, size of motor units and their excitability, Membrane Resistivity and Motoneuron Size, Other Factors Determining Action Potential Generation, Minimal Firing Rates and After hyperpolarization Durations, Motoneuron Current–Frequency Relationship and Excitability
Unit 2	Motor Unit Recruitment During Different Types of Movements; Measuring Human Motor Unit Recruitment; Influence of Task; Slow-Ramp Isometric Contractions; Maintained Isometric Contractions; Isometric Contractions Versus Movements; Lengthening Contractions; Stretch shortening cycle; Co-contraction of Agonists and Antagonists; Unilateral Versus Bilateral Contractions; Rhythmic Complex Contractions
Unit 3	Muscular Mechanisms in Aerobic Endurance Training; Neural Mechanisms in Aerobic Endurance Training, Muscle Molecular Mechanisms in Strength Training, Muscle Property Changes in Strength Training, Neural Mechanisms in Strength Training. initial responses of the neuromuscular systems to exercise; Training Adaptation of the Neuromuscular System
Unit 4	Muscle Biopsy Procedure and Interpretation, Metabolic Exploration of Muscle Biopsy; basic physiology and biophysics of EMG signal generation, Electromyography and its use in sports; needle and wire detection techniques, detection and conditioning of the surface EMG signal, Computer aided Electromyography; Muscle involvement in different skilled movements in sports; myoelectric manifestations of muscle fatigue, its role in fibre composition analysis

b. Neuromuscular physiology in sports (Practical)

Learning objectives	To learn the skill involved in Electromyographic analysis of muscle involvement, muscle fibre composition and fatigue
Learning outcome	<p>Would be able to support the athlete and coaches by providing EMG analysis of motor skill level, fatigue and suitability of athletes in particular sport.</p> <ol style="list-style-type: none">1. Detection of Motor points by Transcutaneous neuromuscular electrical stimulation2. Recording of EMG signals and analysis3. EMG recording and detection of muscle involvement patterns in selected sporting activity4. Fatigue analysis through EMG5. Detection of muscle boundaries and stiffness by palpation method.6. Measurement of force applied during high jump, long jump.
Suggested reading	<ol style="list-style-type: none">1. PAAVO V. KOMI (2011) Neuromuscular aspects of sport performance. John Wiley & Sons Ltd2. Challa Sundaram (Ed)(2011) Muscle Biopsy. InTech, Croatia3. Roger M. Enoka (2008) Neuromechanics of Human movement. Human Kinetics.4. Desmedt J.E (1989) Computer Aided Electromyography and Expert Systems. Elsevier Science Limited.5. Eleanor Criswel (2010) Introduction to Surface Electromyography. Jones and Bartlett Publishers6. Phillip Gardiner. Advanced Neuromuscular Exercise Physiology. 2011; Human Kinetics.7. Roberto Merletti and Philip Parker (Eds) (2004) ELECTROMYOGRAPHY- Physiology, Engineering, and Noninvasive Applications. John Wiley & Sons, Inc., Hoboken, New Jersey.8. Florence Peterson Kendall, Elizabeth Kendall McCreary, Patricia Geise Provance, Mary McIntyre Rodgers, William Anthony Romani (2005) Muscles9. Testing and Function, with Posture and Pain. Lippincott Williams & Wilkins.

c. Yoga in Sports (Theory)

Learning objectives	Learn basic philosophical and spiritual aspects of Yoga and how it could be applied to improve performance in sports
Learning outcome	Students will be able to apply Yoga to reduce stress in sports persons
Unit 1	General introduction to yoga and Indian philosophy History, Evolution of Yoga and Schools of Yoga, Basic Yoga Texts Philosophy, Patanjali Yoga Sutra, Shivasamhita, Gherandasamhita, Concept by Swami Vivekananda
Unit 2	Shodhana-Kriyas And Asanas, Hatha Yogic Practices : Hatha Yoga Practices Pranayama, Bandhas And Mudras Meditation.
Unit 3	Yoga and Sports : Ideal performance and Peak performance for sport persons; Enhancing Physical capacities; Integrated system of yoga practices to increase cognitive and motor skills with learning for performance improvement. Warm-up or loosening exercises; Strengthening poses; Relaxing postures; Yogic breathing practices, Yogic exercises like Suryanamaskar to development strength, flexibility and endurance power.
Unit 4	Yogic Management with respect to Health, Diseases & Hygiene; Diet & Nutrition; Therapeutic use; Preventive Health Care; Yogic Contribution for- Maintaining wellness, Healthy living, Stress management, Physical fitness management, increasing concentration of mind.

c. Yoga in Sports (Practical)

Learning objectives	Learn Yoga through Practice
Learning outcome	They will be able to formulate yoga programmes for sports persons
	a. The following are to be practiced by the students
	1. Loosening Exercise, Sukshma Vayama, Yogic Stretching Exercise (Suryanamaskar)
	2. Satkarma / Cleansing Practices- Dhauti, Neti, Kapalabhati, Agnisara
	3. Yogasana postures that involve - Standing, Sitting, lying in Supine and Prone, Inverted, , Balancing, forward bending, backward bending
	4. Pranayama : Concept of correct breathing, Deep Breathing, Nadi Shodhana, Bharamari,
	5. Bandha & Mudra : Concept of Bandha & Mudra, Jalandhar Bandha, Uddiyana Bandha, Mula Bandha, Viparitkarani Mudra
	6. Meditation: Guided Meditation, Transcendental Meditation
	b. Students will design Yoga programmes for different sports groups based on scientific knowledge.

Suggested Readings

- Bianca MacHliss and Simon Borg-Olivier. Applied Anatomy & Physiology of Yoga. 2005; Yogasynergy
- M. M. Gore. Anatomy and Physiology of Yogic Practices Understanding of the Yogic concepts and physiological mechanism of the yogic practices . 2017; New Age Books.
- H. David Coulter (2001) Anatomy of Hatha Yoga. Body and Breath, Inc., 2114 Ames Hill Rd., Marlboro, VT 05344 USA
- Swami Vivekananda Rajayoga, Advaita Ashram, Culcutta, 2000 Woods, J.H. The Yoga System of Patanjali, M.L.B.D., Delhi, 1988
- BKS Iyenger(2005) The Illustrated Light on Yoga. Harper Collins Publishers.
- Burnier, Radha: Hathayoga Pradipika of Svatmarama, The Adyar Library publications, Chennai. 2000
- Burley, Mikel: Hatha Yoga, Its' Context Theory and Practice (M.L.B.D. Delhi, 2000)
- Gheranda Samhita: Shri Sadguru Publication, New Delhi.
- Dr R Nagarathna and Dr H R Nagendra: Yoga and Health, Swami Vivekananda Yoga Prakashana, 2002

d. Overtraining, Fatigue and Rehabilitation in Sports (Theory)

Learning objectives	To acquire knowledge about overloading, overtraining and related phenomenon that happens in athletes
Learning outcome	Be able to detect overtraining and staleness and support in developing better training programme
Unit 1	Concept of overloading, overtraining, fatigue and staleness; Sites of fatigue; Causes of fatigue; Energy depletion, Metabolic acidosis, Dehydration and hyperthermia, Potassium and calcium, Central fatigue and central regulation of performance, Central-Serotonergic system and central fatigue, Supra spinal factor and central fatigue, Carbohydrate and central fatigue, Central Governor theory; Peripheral-Metabolite depletion, Phosphagens (ATP & PC), Blood glucose and glycogen, Metabolite accumulation, Lactic acid and H ⁺ , ADP and Pi, Calcium flux, Na ⁺ -K ⁺ ATPase, ATPase microenvironment hypothesis, Catastrophe theory of muscular fatigue;
Unit 2	Oxygen Uptake During Recovery: The So-Called "Oxygen Debt", Metabolic Dynamics of Recovery Oxygen Uptake-A.V. Hill's 1922 Oxygen Debt Theory, recovery oxygen uptake or excess post-exercise oxygen consumption (EPOC), Implications of EPOC for Exercise and Recovery, Optimal Recovery From Steady-Rate Exercise and Non-Steady-Rate Exercise, Intermittent Exercise and Recovery
Unit 3	Definition, Types, Symptoms, Findings, Underlying Mechanisms, and Frequency of Overtraining and Overtraining Syndrome; Overtraining Syndrome; Monitoring overloading, Neuroendocrine System : Exercise Overload and Regeneration, Overtraining and the Central Nervous System.
Unit 4	The Interval Training Approach. Recovery-Active recovery, Deep water running, Heat and cold, Soft tissue massage, Nutrition, Psychology. Sports Injury- Causes, types, related to sports, recovery time.

d. Overtraining, Fatigue and Rehabilitation in Sports (Practical)

Learning objectives
Learning outcome

To learn methods of Monitoring of Training, Warm Up, and Performance in Athletes

Be able to detect overtraining and suggest remedial measures

1. Detection of abnormalities in ECG in relation to overtraining syndrome
2. Identification of overtraining through resting heart rate measurement
3. Identification of type of overtraining using resting HRV, HR, submaximal oxygen consumption
4. Identification of mental fatigue through questionnaire technique. (Profile of Mood State (POMS scale))
5. Survey of presence of overtraining markers in athletes.
6. Measurement of selected enzyme activities and blood markers.

Suggested Reading

1. Shaun Phillips (2015) Fatigue in sport and exercise. Routledge, NY
2. Manfred Lehmann, Carl Foster, Uwe Gastmann, Hans Keizer and Jtirgen M. Steinacker(Eds) (1997) Overload, performance incompetence, and regeneration In sport. Kluwer Academic / Plenum Publishers, NY.

MEPE105 (Theory): Science of Exercise

Learning outcome

Understand how body responds to exercise, and will be able to identify behaviours, choices and environments that impacts athletes health and training.

Learners will explore a number of significant adjustments made by human body in order to properly respond o physical stress of exercise, including changes in carbohydrate, fat, and protein metabolism, nutritional considerations, causes of muscle soreness and fatigue, and the effectiveness of dangers of performance enhancing drugs.

Learner will examine and understand the scientific evidences for the health benefits of exercise including the prevention and treatment of heart disease, diabetes, cancer, obesity, depression and dementia.

Learning objectives

To study about the various metabolic pathways that are activated in order to supply the necessary energy required for the mechanical work of skeletal muscle during exercise.

This will also exhibit how various physiological systems are regulated during exercise to help homeostasis.

It will teach about the training guidelines needed to optimize endurance and strength adaptations associated with a regular exercise program.

It will also teach role of exercise as medicine in both the prevention and treatment of various diseases.

Unit - 1

The Energetics of Exercise – introduction to exercise science, principles in exercise physiology, calorimetry and oxygen consumption, ATP and muscle work, carbohydrate metabolism during exercise, fat metabolism during exercise, protein metabolism during exercise.

Unit – 2

Physiological system during exercise – skeletal muscle structure and function, respiratory system responses to exercise, cardiovascular system responses to exercise, endocrine system responses to exercise, immune system response to exercise.

Unit – 3

Exercise for fitness and performance – adaptation to endurance training, adaptation to strength training, nutritional consideration for exercise, causes of muscle fatigue, causes for muscle soreness, performance enhancing drugs.

Unit – 4

Exercise in health, wellness and disease – exercise is medicine, diet, exercise and weight control, exercise and risk factors for heart disease, exercise and risk factor for diabetes, exercise and risk factors for cancer, exercise and successful aging, exercise and brain function.

MEPP106 (Practical-I): Fundamentals of Exercise Physiology

Learning objectives To gain skill in measurement of various physiological responses

Learning outcome Students will be able to measure the changes and interpret them in the context of sports

Experiments

1. Measurement of heart rate and blood pressure during and after exercise.
(Each student is expected to practice measurement on 50 volunteers and determine intra experimenter and inter-experimenter variation)
2. Heart rate response recording during sporting activities. (To be carried out as project and on sports persons). At least three different sports are to be covered by each student)
3. Cardio-pulmonary resuscitation practice on Human Mannequin
4. Aerobic power measurement using Queens' college test, Astrand-Rhyming test.
5. Tests for anaerobic power (Wingate Test)
6. Determination of Physiological adaptation with training through sub-maximal exercise on treadmill / bicycle ergometer.
7. Target Aerobic Movement Test (Brockport)
8. Measurement of lung volumes and capacities.

MEPC201 (Theory): Kinesiology and Motor Learning

Learning objectives	<ul style="list-style-type: none">• Define Kinesiology and explain its importance to the students of human motions.• Describe The major components of a sports kinesiological analysis.
Learning outcome	<ul style="list-style-type: none">• Develop knowledge, skills, and abilities related to performance physiology techniques, testing and training
Unit 1	Foundations of Kinesiology Definition, its importance in human motion. Anatomy- Anatomical position and terminology (e.g., planes, directions), Individual muscles/muscle groups, Muscle attachments, Muscle fiber direction, Tendons, Fascia, Joint structure, Ligaments, Bursae, Dermatomes. Planes of Motion, Cavities of the Body, Body Movements, Muscle Movers.
Unit 2	Physiology- Properties of Muscle, Excitation of muscle, Mechanism of muscle contraction, Types of muscle contractions (e.g., concentric, eccentric, isometric). Kinesiology- Actions of individual muscles/muscle groups, Types of muscle contractions (e.g., concentric, eccentric, isometric), Joint movements, Movement patterns, Proprioception. study of human body movements, performance, and function.
Unit 3	Applications of kinesiology. Adaptation through exercise, Neuroplasticity, Motor redundancy. Describe the major components of a kinesiological analysis, Prepare a description of a selected motor skill, breaking it down into component phases and identifying starting and ending points,
Unit 4	Determine the simultaneous-sequential nature of a variety of movement skills, Classify motor skills using the classification system presented, State the mechanical purpose of a variety of movement skills, methods of identify the joints and basic muscle groups active in a movement skill.

Kinesiology and Motor Learning (Practical)

Learning outcome	Evaluate the learner's motor skill performance level and determine appropriate progressions to improve performance by using equipments.
	<ol style="list-style-type: none">1. Correctly identify and label the composition, structure and types of bone using skeletal models.2. Differentiate accurately between palpating tendon, muscle, bone, artery and nerve.3. Properly demonstrate and instruct the osteokinematic movements of the body -flexion, extension, rotation etc.4. Analyze precisely a given functional activity by joint angle, joint movements and muscle activity.5. Analyze accurately activities based on the center of gravity and base of support of a person.6. Identify accurately and palpate the structures, bones and bony landmarks of the upper and lower extremities.7. Prepare a description of a selected motor skill, breaking it down into component phases and identifying starting and ending points.8. Determine the simultaneous-sequential nature of a variety of movement skills.

**Suggested
Reading**

1. Terry Wood, Weimo Zhu. Measurement Theory and Practice in Kinesiology. 2006; Human Kinetics.
2. Peter Klavora. Foundations of Kinesiology
3. Studying Human Movement and Health. 3rd Edition, 2007; Sport Books Publisher.
4. Declan Connolly. Basic and Applied Sports Kinesiology. 2016; LWW
5. Bruce Abernethy, Vaughan Kippers, Stephanie Hanrahan, Marcus Pandy, Ali McManus, Laurel Mackinnon. Biophysical Foundations of Human Movement 3rd Edition. 2013; Human Kinetics.

MEPC202 (Theory): Applied Sports Physiology

**Learning
objectives**

To understand the physiological adaptation and metabolic changes during exercise at varying intensities.

**Learning
outcome**

Enables the students to gain an overall understanding of human body functioning during exercise and thus provide appropriate nutrition/fuel.

Unit 1

Physiology of Endurance Performance: Cardiovascular control during exercise, cardiovascular response to endurance exercise, Respiratory regulation during exercise, Cardiovascular and respiratory adaptation to training.

Unit 2

Physiology of Strength Performance :
Types of muscle fibers, Generation of muscle force, Factors influencing force generation, Strength curve and rate of force development for various muscles ,
Measuring muscular performance, Muscle size, Muscle hypertrophy and hyperplasia,

Unit 3

Resistance training, Periodization of resistance training development for various muscle.

Unit 4

Physiological adaptation in response to resistance training, Delayed Onset Muscle Soreness (DOMS).

MEPP206 (Practical): Application of Sports Physiology

Learning objectives

To determine the aerobic and anaerobic threshold of athletes.

Learning outcome

To be able to direct and assess aerobic and anaerobic capacity of athletes.

1. Recording of ECG during sub-maximal, maximal exercise and recovery.
2. Determination of VO₂max during sub-maximal, maximal exercise and recovery.
3. Determination of anaerobic power.
4. Determination of muscle strength.
5. Measurement of metabolic / physiological demand of sports
 - a) Ball games
 - b) Racket sports
 - c) Track and Field events
 - d) Combat sports

Suggested Reading

1. Nigel Thomas and Andrew Smith (2009) Disability, sport, and society an introduction. Routledge, NY
2. Komi, Paavo V. (Ed) (2003) Strength and power in sport. Blackwell Science Ltd, USA
3. Shephard, R.J. and Astrand, P.-O. (1992) Endurance in sport. Blackwell Science Ltd, USA.
4. Ron J. Maughan (2009) The Olympic textbook of science in sport. Blackwell Publishing Ltd
5. Yves C. Vanlandewijck and Walter R. Thompson (2011) The Paralympic athlete handbook of sports medicine and science. Wiley-Blackwell.
6. John Wesson(2002) The Science of Soccer. Institute of Physics Publishing, Bristol and Philadelphia.
7. John J. Fontanella (2006) The physics of basketball. The Johns Hopkins University Press
8. Monèm Jemni (2011) The Science of Gymnastics. Routledge, NY.
9. T.Reilly, N.Secher, P.Snell and C.Williams () **Physiology of Sports.** SPON PRESS
10. Thomas Reilly (1996) Science and Soccer. SPON PRESS
11. T.Reilly, J.Clarys and A.Stibbe () Science and Football II. SPON PRESS

MEPC203 (Theory): Statistical methods in Exercise Physiology

Learning objectives	To understand Research Methods, Processing & Presentation of Data & Analysis Techniques using software programmes.
Learning outcome	Enables students to Learn Scientific Methods, Statistical Analysis Techniques Using Software Programmes and Manually.
Unit 1	Probability and distribution; Descriptive statistics; Inferential statistics – parametric statistics and non-parametric statistics
Unit 2	Errors in research, Errors types; Methods of Data Collection, Processing and Analysis of Data, Sampling Fundamentals,
Unit 3	Testing of Hypotheses-I (Parametric or Standard Tests of Hypotheses), Chi-square Test, Analysis of Variance and Covariance, Testing of Hypotheses-II (Nonparametric or Distribution-free Tests),
Unit 4	Multivariate Analysis Techniques, Correlation and regression, Graphical presentation of data.
Unit 5	Modelling the development of world records in running, Statistical analysis of the effectiveness of the FIFA World Rankings, Outcome uncertainty measures how closely do they predict a close game? Patterns of world records in sports, Competition, rankings, and betting in soccer.

Statistical methods in Exercise Physiology (Practical)

Learning objectives	To practically determine the various statistical analysis and equation used for data analysis and the understanding statistical tools and software.
Learning outcome	To be able carry out basic statistical analysis using software.

1. Descriptive statistics (Central tendency, dispersion, CI, distribution test).
 2. Box plot, X-Y plot, fitting equations, non-linear plots, funnel plot.
 3. Student's 't' test, ANOVA, ANCOVA.
 4. Correlation and regression (Linear), partial correlation, Logistic regression.
 5. Non-parametric tests (Chi, Kendall's Tau, Odds ratio, etc.)
- Application of Statistical software SPSS, STATISTICA etc.

Suggested

Reading

1. Dutta N.K. Fundamentals of Bio-Statistics. 2002; Kanishka Publishers, New Delhi.
2. Gupta S.P. Statistical Methods. 2004; S. Chand & Sons, New Delhi
3. Ruud H. Koning and James H. Albert (2008) Statistical thinking in sports. Chapman & Hall/CRC, Taylor & Francis Group

MEPC204 (Theory): Exercise Biochemistry

Learning objectives	To gain detail knowledge about metabolic process in the body in relation to sporting activities
Learning outcome	The student would be able to understand the state of athletes in terms of metabolic requirement and deficiency.
Unit 1	Introduction, Major metabolic pathways in human -carbohydrate, lipid and protein.
Unit 2	Energy sources for muscular activity -Energy Sensing, Carbohydrate Metabolism in Exercise Metabolic Pathways Producing ATP, Anaerobic Energy Production, Aerobic Energy Production, Lactate shuttle concept, Lactate threshold and tolerance
Unit 3	Lipid Metabolism in Exercise, Relevance of lipid in sports and exercise, Energy Yield of Fatty Acid Oxidation, Changes in the Plasma Fatty Acid Concentration and Profile During Exercise,
Unit 4	Role of Protein and Amino Acids in Energy Metabolism, Protein Contribution to Energy Metabolism, Use of Amino Acids for Energy—Catabolic Effects of Exercise, BCAAs and Muscle Hypertrophy, Role of amino acids in exercise.
Unit 5	Regulation of metabolism in sports and exercise - High intensity exercise, endurance exercise, intermittent exercise, Hormonal control and cell signalling. Integration of Exercise Metabolism.

Suggested Reading

1. Donald MacLaren and James Morton. Biochemistry for Sport and Exercise Metabolism. 2011; Wiley.
2. Vassilis Mougios. Exercise Biochemistry. 1st Edition. 2006; Human Kinetics.
3. Mauro G. Di Pasquale (2008) Amino Acids and Proteins for the Athlete The Anabolic Edge. CRC Press Taylor & Francis Group, London.
4. David L. Nelson and Michael M. Cox (2005) Lehninger Principles of Biochemistry. W. H. Freeman.
5. Susan R. Mikkelsen, Eduardo Corton (2004) Bioanalytical chemistry. John Wiley & Sons, Inc.
6. David Metzler (2001) Biochemistry-The Chemical Reactions of Living Cells. Academic Press.

MEPC301 (Theory): Sports Nutrition

Learning objectives	Understanding the basic physiology and nutrition/fuelling demands specific to a sporting event.
Learning outcome	Capable of handling and providing event-specific nutritional guidance.
Unit 1	Nutrition and Physical Performance, Nutrition for weight control, Energy Systems, Muscles, and Physical Performance. Optimal Nutrition for Athletic Performance, Energy Intake and Exercise
Unit 2	Fuel for training, Formula to estimate calorie needs- Carbohydrate and Exercise- High-carbohydrate diets, Carbohydrate loading. Carbohydrate intake - Before exercise, during exercise, after exercise, Dietary Fat and Exercise- Major Fuel source for endurance activities, High-fat diet not needed, Recommendations Protein and Exercise- Protein recommendations, Protein sources, Protein intake after exercise, Dangers of high-protein intake
Unit 3	Vitamins, Minerals, and Athletic Performance- B vitamins, Calcium, Iron, Copper and zinc, Hydration- Fluid schedule.
Unit 4	Menu planning- Breakfast, Lunch, Dinner, Snacks, Meal timing & spacing, Training diets, Pre-exercise Meals, Nutrition during Exercise, Post-exercise Meals, Nutrition Needs of Youth in Sports- Priority on growth and development. Nutrition Supplements and Ergogenic Aids, Doping.

MEPC302 (Theory): Environmental exercise physiology

Learning objectives

The objective of this course is to examine the responses and adaptations of the human body to exercise under different environmental conditions

Learning outcome	Students will be able to describe and discuss the stresses placed on the human body during exercise performed under different environmental conditions and the adaptations made by the body with extended or repeated exposure to those conditions.
Unit 1	Environment and exercise Thermoregulation, exercise in cold - physiological responses to exercise in cold, health risks during exercise in cold, effect of cold on human performance;
Unit 2	Physiological changes in desert, heat illness, heat stroke Exercise in hot environment- physiological responses to exercise in heat, health risks during exercise in heat, exercise in high; Desert and Human Adaptation
Unit 3	Hypobaric and Hyperbaric Condition Physiological changes in Hypobaric and Hyperbaric Condition, safety and management. Exercise underwater. Pressure, O ₂ , CO ₂ , Temperature and Relative humidity,
Unit 4	The travelling athlete altitude- Altitude training effect of altitude on sports performance –adaptation to altitude detraining. Atmospheric requirements of Man in space

MEPC303 (Theory): Sports Biomechanics

Learning objectives	<ol style="list-style-type: none">1. To study about kinetic and kinematics concepts for analyzing human movements2. To study about linear kinematics of human movement3. To study about angular kinematics of human movement4. To provide the knowledge of linear and angular kinetics as applied to human movement
Learning outcome	<ol style="list-style-type: none">1. Describe motion with precise, well defined mechanical2. Understand and quantify linear and angular characteristics of motion3. Understand the quantitative relationships between angular and linear motion characteristics of a rotating body4. Understand and quantify the cause and effect relationship between force and linear and angular motion5. Understand the mechanics of human body on water
Unit 1	Exercise and sports biomechanics basic concepts of kinematics and kinetics – vectors, motion, degrees of freedom, force, moment of force, equilibrium, biomechanical considerations in reducing sporting injury rates.
Unit 2	Posture static and dynamic posture, postural diversity within individuals, posture and its relationship to somatotype posture assessment, desirable postures for high level sport performance, modifying posture and technique to improve performance.
Unit 3	Image analysis in sports performance errors in motion analysis, planar video analysis, 3d motion analysis, data filtering.
Unit 4	Movement patterns – the essence of sports biomechanics, Qualitative analysis of sports movements, More on movement patterns – the geometry of motion, Quantitative analysis of movement, Causes of movement – forces and torques.

MEPE304 (Theory) Discipline Specific Elective (DSE)

- a. Ergogenic aids and Doping
- b. Exercise physiology and Gender
- c. Physiological Aspects of Aging
- d. Adaptations to exercise and training

a. Ergogenic aids and Doping (Theory)

Learning Objectives	To learn the effects of ergogenic aids and nutritional supplements, effect of doping and doping control procedures
Learning Outcome	The students would be able to work in dope control teams
Unit 1	Ergogenic Aids Mechanical Aids; Nutritional Aids- Carbo-Loading, Fluids; Creatine, Carnitine, Amino Acids, Dietary Supplements; Antioxidants;
Unit 2	Physiological Aids- Bicarbonate Loading, Altitude Training History of Doping and Doping Control, THE FUNDAMENTAL RIGHTS OF ATHLETES IN DOPING TRIALS
Unit 3	the world anti-doping agency: transnational doping policy and globalisation; drug testing in amateur sports, the prohibited list, substances & methods prohibited at all times, prohibited methods, substances & methods prohibited in-competition, substances prohibited in particular sports
Unit 4	Caffeine, Psychological Pharmacological Aids. Doping in sports, Drugs In Sports- Human Growth Hormone, Anabolic Steroids, Hormones and Related Substances, Beta-2 Agonists, Agents with Anti-Oestrogenic Activity, Diuretics and Other Masking Agents, Stimulants, Narcotic Analgesics, Cannabinoids, Glucocorticosteroids, Blood Doping, Erythropoietin, Enhancement of Oxygen Transfer, Chemical and Physical Manipulation, Gene Doping; Doping Control, Anti-Doping Rules, WADA and IADA, regulation, IOC regulation, Ethical issues, Testing and Sample Analysis, In-Competition Testing, Out-of-Competition Testing.

Ergogenic aids and Doping (Practical)

Learning objectives	To learn the skills of detection of substances in urine or blood samples
Learning outcome	They will be employable in dope control laboratories. Determination of the effects of Creatine, Carnitine on sports performance. Determination of the effects of Amino Acids on sports performance. Determination of the effects of Carbohydrate and Fluids on sports performance. Determination of drugs in blood and urine samples. Collection of dope samples
Suggested Reading	1. William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA. 2. Detlef Thieme and I Peter Hemmersbach (2004) Doping in Sports. Springer-Verlag Berlin 3. John O'Leary (Ed) (2001) Drugs and Doping in Sport Socio-Legal Perspectives. Cavendish Publishing Limited

b. Exercise physiology and Gender (Theory)

Learning objectives	To develop knowledge about the issues of female athletes
Learning outcome	The student would be able to understand the problems of female athletes and suggest remedial measures
Unit 1	Women and the Olympic Games; Physiology of the Female Athlete; Anatomy of male and female, Body type and composition, Physiology of male and female reproductive system, The Prepubescent Female
Unit 2	Growth, Performance, Activity, and Training During Adolescence, Musculoskeletal system, Cardio-respiratory system, Aerobic capacity, Strength. Training adaptation. Nutrition and metabolism,
Unit 3	The female athlete triad, eating disorders, body weight control and training in female menstruation and other related factors, Exercise and pregnancy. Menstruation and Menstrual Disorders,. Menopause, Hormone Replacement Therapy
Unit 4	The Breast and related injuries; protective clothing, Orthopaedic Concerns; Gender Verification

Exercise physiology and Gender (Practical)

Learning objectives	To learn techniques and methods of testing female athletes
Learning outcome	<p>The student will be able to detect different disorders and condition of the female athlete</p> <ol style="list-style-type: none">1. Determination of VO₂max of male and female athletes (height, weight, age matched).2. Determination of anaerobic power of male and female athletes (height, weight, age matched).3. Determination of strength of male and female athletes (height, weight, age matched).4. Determination of lung volumes and capacities of male and female athletes (height, weight, age matched).5. Survey of issues related to female athletes6. Detection of eating disorder
Suggested Reading	<ol style="list-style-type: none">1. Mona M. Shangold, Gabe Mirkin (1994) Women and exercise : physiology and sports medicine. F. A. Davis Company2. Barbara L. Drinkwater (Ed) (2000) Women in sport. The encyclopaedia of sports medicine; v. 8. Blackwell Science Ltd3. Catherine M. Gordon and Meryl S. LeBoff (2015) The Female Athlete Triad A Clinical Guide. Springer New York

c. Physiological Aspects of Aging (Theory)

Learning objectives	To know the issues related to ageing starting from childhood to elderly
Learning outcome	Be able to relate growth and development with sporting performance. Will be able to work with masters athlete training process.
Unit 1	Growth and Biologic Maturation: Relevance to Athletic Performance; Muscle Development During Childhood and Adolescence, Relevance to Understanding Effects of Growth on Performance, Growth and Maturation: Methods of Monitoring; Body Composition Assessment in the Young Athlete
Unit 2	Theory of aging, Age related changes in different body systems, Cardiovascular Concerns in the Young Athlete, Physiologic and Health Aspects of Exercise in Hot and Cold Environments
Unit 3	Muscle Strength, Endurance, and Power: Trainability During Childhood, Aging and muscular strength, aging and joint flexibility
Unit 4	Exercise guideline for geriatric populations. Introduction to Masters sport and the study of older athletes, Aging, performance, and the role of continued involvement, Psychosocial issues in Masters sport, model of lifespan physical activity, health, and performance

Physiological Aspects of Aging (Practical)

Learning objectives	Learn procedures and safety system in testing athletes in different age groups.
Learning outcome	Be able to execute various tests <ol style="list-style-type: none">1. Determination of VO₂max of young and older athletes (sex matched).2. Determination of anaerobic power of young and older athletes (sex matched).3. Determination of strength of young and older athletes (sex matched).4. Determination of lung volumes and capacities of young and older athletes (sex matched).5. Statistical modelling of age trends
Suggested Reading	<ol style="list-style-type: none">1. Helge Hebestreit and Oded Bar-Or (2008) The young athlete. Blackwell Publishing Ltd2. Joseph Baker, Sean Horton and Patricia Weir (200) The masters athlete: understanding the role of exercise in optimizing aging. Routledge

MEPE305 (Theory): EXERCISE AND OBESITY

Objective: To Enhance knowledge about Various problems and proper management of Obesity

Outcome: To utilize acquired Knowledge in Decision Making and further Treatment process

UNIT-I: OBESITY

1. Introduction - the Measurement of Obesity
 - a. Oldern method of Body Composition Analysis
 - b. BMI and its Significance
 - c. Recent Advanced Method of Evaluation
2. Etiology, classification

UNIT II : HEALTH RISKS ASSOCIATED WITH OBESITY

1. Cardiovascular Disease – Hypertension - Hyperlipidemia/hypercholesterolemia – Osteoarthritis – Psychological
2. Complication - Prevalence of Obesity and Overweight - Prevalence of CVD and Obesity

UNIT III : OBESITY MANAGEMENT

1. Scientific Principles of Weight Loss
2. The Role of Nutrition/Diet and the “non dieting approach”
3. The role of Exercise/Physical Activity
 - a. Aerobic Exercise
 - b. Resistance Training
4. The role of Behavior Change – school based physical activity intervention

UNIT IV : WEIGHT LOSS PROGRAMS

1. Commercial Weight Loss Programs
 - a. Biometrics
 - b. Jenny Craig
 - c. Nutrasystem
 - d. Weight Watchers etc
2. Non-Commercial Weight Loss Programs
 - a. Medifast
 - b. Optifast
3. Non-Commercial Support Groups
 - a. Taking Off Pounds Sensibly (TOPS)
 - b. Overeaters Anonymous

UNIT V : Exercise Prescription

- a. ADA/ACSM/AMA Position Stands
- b. Health Fraud and Weight Loss Products and Programs
- c. The Future of Weight Loss

Suggested Readings:

- Bouchard, C. (Ed) (2000). Physical activity and obesity. Champaign, IL: Human Kinetics.
- Brownell, K.D. & Wadden T.A. (1999). The LEARN® Program for weight control: special medication edition. Dallas: American Health Publishing

MEPP306 (Practical): Sports Biomechanics

Learning objectives

To learn application of theoretical aspects for improving sporting performance

Learning outcomes

1. Biomechanical study of work posture, joint angle study, determination of spinal curvature, analysis of posture by video graphic method – OWAS, REBA, RULA, OCRA etc. Determination of range of motion.
2. Determination of center of gravity of human body under resting and working conditions.
3. Determination of gait pattern.
4. Determination of foot pressure.
5. Determination of Planar video analysis.
6. Determination of 3d motion analysis, data filtering.

MEPC401 (Theory): EXERCISE IMMUNOLOGY

Learning objectives

1. An understanding of humeral and cellular immunity and their relative significances to transfusion science theory and practice.
2. An understanding of the characteristics of antigens and antibodies
3. An understanding of the nature of antigen-antibody reactions.
4. An appreciation of the importance of immunology as a foundation of transfusion medicine theory and practice.

Learning outcome

This course provides with knowledge and understanding of, and practical skills in, immunology and the way it is applied in diagnostic and therapeutic techniques and research.

Unit 1

Immunological system and exercise : Exercise and innate and humoral immunity, Exercise induced change in Ig and antibody, exercise and cytokines.

Unit 2

Sex Differences in Immune Function after Aerobic Exercise, Sex differences in immune variables and respiratory infection, Killer cell immunoglobulin-like receptors and exercise, Anti inflammatory influence of exercise training- Physical activity, fitness, and chronic inflammation, C-Reactive Protein (CRP),

Unit 3

Cytokines, Free radicals, Antioxidants, Effect of exercise on immunity, Physical activity – A stimulator and an inhibitor to the immune system. Exercise and upper respiratory tract infection,

Unit 4

Infection and exercise performance, Exercise and HIV infection, Exercise and Cancer, Exercise aging and immunity, Maintaining immune health, Importance of exercise immunology in health promotion.

Suggested Reading

1. Michael Gleeson, Nicolette Bishop, and Neil Walsh.(Eds) (2013) Exercise immunology. Routledge
2. Warren Levinson (2016) Review of Medical Microbiology and Immunology. LANGE, Mc Graw Hill.

MEPC402 (Theory): BEHAVIORAL PHYSIOLOGY

Learning Objectives to understand the biological basis in forming the behavioral patterns heredity and behavior of individuals

Learning Outcome To able to relate biological basis, heredity with sports performance, will be able to work with athletic training process also to motivate the athlete to achieve best performance

Unit I

The evolution of psychology. Definition, methods, The work of psychologists. Psychology comes to age as a profession. Psychology today- Research areas of psychology. The scientific approach to behavior. Experimental research. The biological basis of behavior. Brain and behavior – Neurons, synapse, Association cortex, behavior and experience. Right and left hemisphere functions. Heredity and behavior. Basic principles of genetics. Investigating hereditary Influence-Research. The interplay of heredity and environment. Sensory process and perception, sensory channels, the visual system, the auditory system, gustatory system, olfactory system, sensory system on the skin. Other senses - Kinesthetic and vestibular system.

Variation of Consciousness, The stream of consciousness. Levels of awareness, Consciousness and brain activity. The sleep and wakefulness cycle. Manipulating biological clock. The world of dreams. Hypnosis - Altered consciousness or Role of meditation – pure consciousness or relaxation. Altering consciousness with drugs.

Unit II

Language and thought: Cognitive revolution in psychology. Language- What is language, structure of language, ape language controversy, language development, Theories of language acquisition.

Problem Solving: Types, barriers to effective problem solving, Approaches to problem solving, cognitive style and problem solving.

Unit III

Decision making: Making choices - Selecting alternative, taking chances - Risky decision making. Motivation and emotion Theories and concepts- Instinct theory, Drive theory, Incentive theory, The range and diversity of human motives. Arranging needs in hierarchy. Classification – Hunger, sexual motivation, thirst Dive.

Unit IV

Social motives: Affiliation, achievements, The elements of emotional experience –cognitive component, Physiological component, behavioural component. Theories of emotion. Personality – Theory research assessment, Nature, definition, Psycho dynamic perspective (Freed, Jung, Adler) evaluation.

Behavioural Perspective: Skinner's ideas applied to personality. Bandera's social learning theory. Mischel and the Person- situation controversy evaluation.

Unit V

Humanistic perspective: Rogers Person centered theory. Maslow's theory of self actualisation, evaluation. Application: Understanding personality assessment, Uses of personality scale, Self report inventories, Projective tests. Stress, coping and health: Nature of stress, Types of stress- Frustration, conflict, changes, pressure. Responding to stress: Emotional response, Physiological response, behavioural response. Effect of stress on physical health: Type A behaviour and heart disease. Stress and other disease. Stress and immune functioning. Factors moderating impact of stress social support, Hardiness, optimism autonomic reactivity. Health impairing life style: Smoking, poor nutritional habits, Lack of exercise, alcohol and drug use.

Application – Imposing coping and stress management. Rational thinking a stress reducer. Relaxing Pent-up emotions, Relaxation minimizing physiological vulnerability.

References

1. Physiology of Behavior, 11th ed. Pearson. Carlson, N.R., 2012.
2. Psychology: science of behavior, ettinger, r.h., 2014/e ed. BVT Publishing.
3. Brain & Behavior: An Introduction to Biological Psychology, Garrett, B.L., 2010 Third Edition. ed. SAGE Publications, Inc.

MEPC403 (Theory): Physiological Support of Athletes

Learning objectives	To improve health care in general and the profession of athletic training in particular and that places the patient's needs at the center of their world views.
Learning outcome	Students will be able to identify injury and illness risk factors associated with participation in competitive athletics and will be able to plan and implement all components of comprehensive athletic injury and illness prevention program.
Unit 1	Concept of athlete support, Athlete development stages - child, pre-adolescent, adolescent and adult. Human growth and development. Age related development in performance. Concept of talent in sports. Talent identification.
Unit 2	Physiological testing of athletes Maximal aerobic capacity- Explanation of result, its implication in sports, Training intensity and improvement in VO_{2max} , Limitations of assessing VO_{2max} , Indirect assessment of VO_{2max} - Multi-stage shuttle run test, Cooper test, Queens College Step test. Sub-maximal aerobic test- Astrand nomogram, PWC 170. Assessment of strength- Dynamometers, 1 repetition maximum (1RM). Assessment of dynamic strength; Assessment of muscular endurance; Assessment of flexibility; Assessment of anaerobic power- Mergaria power test, de Bruyn Prevost test; Wingate test-Peak power output, Relative peak power output, Anaerobic fatigue, Anaerobic capacity/power. Running based Anaerobic Sprint Test (RAST)- Maximum power, Minimum power, Fatigue index. Peak lactate and its importance- Talent selection and transfer of talent, Changes of lactate peak during season, Lactate peak and training,
Unit 3	Athlete Monitoring And Analysis, Time-motion analysis in sport; analysis of athlete tracking systems; GPS and accelerometer analysis of training and competition; monitoring and analysis of sport-specific physical and psychological variables; physiological monitoring; external sources of data relating to sports performance; reliability of data and sources. The use of performance indicators in performance analysis
Unit 4	Feedback based analysis of performance, Sport-specific notational systems; computerized notational analysis; notation in individual sports; notation in team sports; augmented feedback through video-based technologies; modelling of competitive sport; analysis of structures of sports informing performance indicators; flowcharts and presentation models of sports performance; reliability and validity of notational data; data processing; probability analysis; literature searching; critical evaluation of literature

MEPD404 : Project Work including Presentation, Comprehensive Viva

(Related to their Specialization selected)

The student has to do a dissertation based on a topic of his own choice and under the supervision of a teacher. The project work shall begin by the third semester. The student has to plan a research proposal and make an initial synopsis presentation wherein he introduces the problem, its relevance, the method, expected outcome etc., and internal evaluation of the presentation will be made. The supervising teacher will monitor the student's progress in the study which will be evaluated internally. The final project report has to be submitted in the prescribed format (APA guidelines) by the end of the fourth semester which will be evaluated for the external examination. The student should produce a synopsis of his research work for the external examination and also make a power point presentation of the same.

VIVA

There will be a comprehensive viva at the end of the fourth semester based on the theory papers the student has covered in the four semesters, which will be evaluated externally.

MEPP406 (Practical IV): Physiological Support of Athletes

Learning objectives	The subject will include practical sessions to plan, implement and assess physiological preparation of athletes in the high performance sport setting. Students will develop skills in areas that contribute to athlete preparation, program development and delivery and methods of identifying and measuring the fundamental physiological demands of specific sports and strength and conditioning activities.
Learning outcome	Demonstrate practical application of performance development methods, including the assessment of strength, power, speed and endurance as they relate to sports specific consideration. <ol style="list-style-type: none">1. Determination of VO_{2max} by direct and indirect method.2. Determination of Sub-maximal aerobic fitness.3. Determination of anaerobic power by Mergaria power test and Wingate test.4. Determination of strength by Dynamometers and 1repetition maximum (1RM).5. Assessment of Peak lactate, lactate tolerance, lactate clearance.6. Determination of anaerobic threshold.7. Assessment of agility.8. Assessment of EMG and ECG.
Suggested Reading	<ol style="list-style-type: none">1. Peter O'Donoghue.(2015) An introduction to performance analysis of sport.2. Carol-Lynne and Moore, Kaoru Yamamoto (2012) Beyond words movement observation and analysis. Routledge, NY.3. Routledge, NYMike Hughes and Ian M. Franks.(2015) Essentials of performance analysis in sport. Routledge, NY

