Syllabus

YEAR - I

PAPER 1 Fundamentals of Exercise Physiology

Unit 1

Physiology of Exercise - Fuels for Exercise - Carbohydrates -Fats - Proteins - High-Energy Phosphates Bioenergetics - Anaerobic ATP Production - Aerobic ATP Production - Aerobic ATP Tally - Physical Fitness - Efficiency of Oxidative Phosphorylation - Control of Bioenergetics - Control of ATP-PC System - Control of Glycolysis - Control of Krebs Cycle and Electron Transport Chain - Interaction Between Aerobic/Anaerobic ATP Production - Exercise Metabolism - Energy Requirements at Rest - Rest-to-Exercise Transitions -

Unit 2

Control of the Internal Environment Homeostasis: Dynamic Constancy Control Systems of the Body - Nature of the Control Systems - Negative Feedback - Positive Feedback - Gain of a Control System - Duration and Intensity - Short-Term, Intense Exercise - Prolonged Exercise - Incremental Exercise - Examples of Homeostatic Control - Regulation of Body Temperature - Factors Governing Fuel Selection - Exercise Intensity and Fuel Selection - Exercise Duration and Fuel Selection - Interaction of Fat/Carbohydrate Metabolism - Body Fuel Sources - Biological Energy Transformation

Unit 3

Skeletal Muscle: Structure and Function - Structure of Skeletal Muscle - Neuromuscular Junction - Muscular Contraction - Overview of the Sliding Filament Model - Energy for Contraction -Regulation of Excitation-Contraction Coupling - Fiber Types - Biochemical and Contractile Characteristics of Skeletal Muscle - Characteristics of Individual Fiber Types - Fiber Types and Performance - Alterations in Skeletal Muscle Due to Exercise, Inactivity, and Aging - Exercise-Induced Changes in Skeletal Muscles

The Nervous System: Structure and Control of Movement - General Nervous System Functions Organisation of the Nervous System - Structure of the Neuron - Electrical Activity in Neurons - Sensory Information and Reflexes - Joint Proprioceptors - Muscle Proprioceptors - Muscle Chemoreceptors - Reflexes - Somatic Motor Function - Vestibular Apparatus and Equilibrium - Motor Control Functions of the Brain and BrainStem

Unit 4

Circulatory Responses to Exercise - Organization of the Circulatory System - Structure of the Heart - Pulmonary and Systemic Circuits - Heart: Myocardium and Cardiac Cycle - Myocardium - Cardiac Cycle - Arterial Blood Pressure - Factors That Influence Arterial Blood Pressure - Electrical Activity of the Heart - Cardiac Output - Regulation of Heart Rate - Regulation of Stroke Volume - Hemodynamics - Physical Characteristics of Blood - Relationships Among Pressure, Resistance, and Flow - Sources of Vascular Resistance

Control of Ventilation - Ventilatory Regulation at Rest - Respiratory Control Center - Ventilatory Control During Submaximal Exercise - Ventilatory Control During Heavy Exercise - Lungs Adaptation to Exercise Training - Pulmonary System Limiting Maximal Exercise Performance - Acid-Base Balance During Exercise - Acids, Bases, and pH - Hydrogen Ion Production During Exercise - Importance of Acid-Base Regulation

Unit 5

Hormones: Regulation and Action - Hypothalamus and the Pituitary Gland - Thyroid Gland - Parathyroid Gland - Adrenal Gland - Pancreas - Testes and Ovaries -Hormonal Control of Substrate Mobilisation During Exercise - Muscle-Glycogen Utilisation - Blood Glucose Homeostasis During Exercise - Hormone-Substrate Interaction - Temperature Regulation - Overview of Heat Balance During Exercise - Temperature Measurement - During Exercise - Overview of Heat Production/Heat Loss - Heat Production - Heat Loss - Heat Storage in the Body During Exercise - Body’s Thermostat-Hypothalamus - Shift in the Hypothalamic Thermostat Set Point - Due to Fever - Thermal Events During Exercise

Unit 6

The Physiology of Training: Effect on V02 Max. Performance, Homeostasis. and Strength - Principles of Training - Overload - Specificity - Research Designs to Study Training - Endurance Training and V02 Max - Training Programs and Changes In V02 Max - V02 Max: Cardiac Output and the Arteriovenous O2 Difference - Stroke Volume - ArteriovenousO2 Difference - Detraining and V02 Max - Endurance Training: Effects on

Performance and Homeostasis - Biochemical Adaptations and the Oxygen Deficit - Biochemical Adaptations and the Plasma Glucose Concentration - Biochemical Adaptations and Blood pH - Biochemical Adaptations and Lactate Removal - Endurance Training: Links Between Muscle and Systemic Physiology - Peripheral Feedback - Central Command - Physiological Effects of Strength Training - Physiological Mechanisms Causing Increased Strength - Neural Factors - Muscular Enlargement - Concurrent Strength and Endurance Training

PAPER 2 Assessments and Interpretation in Exercise Physiology

UNIT 1

Units of Measure Metric System - SI Units - Work and Power Defined Work Power - Measurement of Work and Power - Laboratory Assessment of Human Performance - Laboratory Assessment - Athlete Gains from Physiological Testing - Components of Effective Physiological Testing - Fitness Components - Health Related Fitness components - CardioRespiratory Endurance - Muscular Strength - Muscular Endurance - Flexibility - Body Composition - Skill/Performance Related Fitness Components - Power - Speed - Reaction Time - Balance - Agility - Co-ordination

Unit 2

Direct Testing of Maximal Aerobic Power - Direct Calorimetry - Indirect Calorimetry - Specificity of Testing - Exercise Test Protocol - Rating of Perceived Exertion - Termination Criteria - V02 Max - Estimation of V02 Max from Last Work Rate - Estimation of V02 Max from Submaximal HR Response - Field Tests for Estimating CRF Maximal Run Tests - WalkTests - Canadian Home Fitness Test - Graded Exercise Tests: Measurements - Heart rate - Blood Pressure - ECG - Graded Exercise Test: Protocols - Treadmill - Cycle Ergometer - Step Tests - Exercise - Determination of Peak V02 in Paraplegic Athletes - Laboratory Tests to Predict Endurance Performance - Use of the Lactate Threshold to Evaluate Performance

Unit 3

Measurement of Critical Power - Tests to Determine Exercise Economy / Estimation of Energy Expenditure Calculation of Exercise Efficiency - Factors that Influence Exercise Efficiency - Running Economy Training and Environment - Training in the cold, health implications, Injuries in cold, Training and heat, acclimatization, Heat illness, effect of training in Paediatric, Adult, and Geriatric population, selection of clothing and Rehydration. Estimating Success in Distance Running Using the Lactate Threshold and Running Economy - Measurement of Work, Power, and Energy Expenditure.

Unit 4

Determination of Anaerobic Power - Tests of Ultra Short-Term Maximal Anaerobic Power - Tests of Short-Term Anaerobic Power - Evaluation of Muscular Strength - Criteria for

Selection of a Strength-Testing Method - Isometric Measurement of Strength - Free-Weight Testing of Strength - Isokinetic Assessment of Strength - Variable-Resistance Measurement of Strength - Training for Performance

Unit 5

Flexibility Testing - Sit & Reach test - Range of motion testing of: Shoulder, Elbow, Wrist, Joints of fingers, Spine (Cervical, Thoracic, Lumbar), Hip, Knee, Ankle, Metatarso-phalangeal joints - Reaction time testing - Balance testing - Explosive power testing - Vertical Jump test - Broad Jump test - Co-ordination testing - Speed testing - 40 yard dash - Infrared Speed gates -Agility testing - Illinois T test, Shuttle run test - Zig Zag test - figures of 8 agility run test - hexagon test - quadrant jump test - Quick feet test - side step test - Battery of field tests :- YMCA, EUROFIT - FITNESSGRAM - ALPHA FIT battery and other battery of tests - Muscular Power - Jumping and Running Tests - Vertical Jump Test - Vertical Jump variations: using timing mat, test at home, off one step, with a run up (basketball), no arms, NHL combine (force plate)and AFL version - Vertical Jump in the water (for water polo players) - Max Touch - Bosco ErgoJump Tests: Squat Jump, Squat Jump with extra weight, CounterMovement Jump, Abalakov Jump, Drop Jump, Repetitive Jump. More about the Bosco Protocols - Standing Long (Broad) Jump Test - 3 Hop Test - 2 hop jump - Margaria Kalamen Power Test

Unit 6

Methods of Assessing Body composition - Methods of assessing Overweight and Obesity - Methods of Measuring Body Composition - Two-Component System of Body Composition - Anthropometry measurements - Body Fatness for Health and Fitness - Standards of Nutrition -

INTERNAL PAPER 1 Exercise physiology in Sports

UNIT 1

Physiology of Performance - Factors Affecting Performance - Sites of Fatigue - Central Fatigue - Peripheral Fatigue - Factors Limiting All-Out Anaerobic Performances - Prescriptions for Health and Fitness Contents Prescription of Exercise Dose-Response - Physical Activity and Health - General Guidelines for Improving Fitness Screening - Progression - Warm-Up, Stretch, and Cool-Down, stretch.

Physiology of Training :– specificity, SAID, Biochemistry and Molecular Exercise physiology, Training for strength and power , cardio pulmonary endurance, Circuit Training specific for Triathalon, cross training, circuit training, Training for Flexibility, Physiology of tapering for competition, travel and Jet lag, physiological measure of Athletes, Physiological factors affecting performance, Lab based testing,

UNIT 2

Physiology of Endurance Training:- Muscle oxygen uptake, Lactate fractional utilization,, training for endurance performance, LSD,moderate duration, Threshold training, Short duration very high intensity training, Weight training, Resistance training, Flexibility, Thermoregulation, strength training for endurance, flexibility - evaluating elite athletes, VO 2 max and functional utilization, Derivation of economy , Lactate threshold, field based testing. Exercise Prescription for CRF Frequency Duration - Intensity - Sequence of Physical Activity - Walking - Jogging - Games and Sports - Factors Limiting All-Out Aerobic Long, Slow-Distance Exercise - High-Intensity, Continuous Exercise - Altitude Training Improves Exercise Performance at Sea Level - Injuries and Endurance Training

UNIT 3

Physiology of Anaerobic training :- Terminology, ATP – CP pathway, Anaerobic glycolysis, energy contribution to short duration high intensity training, characteristics of short duration high intensity athletes, Anaerobic endurance /Muscular endurance, Depletion of ATP – CP, Resynthesis, Metabolic acidosis, Glycogen depletion, training methods, Types of Anaerobic endurance training, resistance training, running, cycling, swimming, field sports, racquet sports, water sports, planning of Anaerobic endurance training and training schedule, muscle fiber composition, neural changes during training, Aerobic assessment of Anaerobic endurance, Maximal Accumulation Oxygen Deficit (MAOD) and Excessive Post Exercise oxygen Consumption (EPOC), Intramuscular substrate enzyme activity. Training to Improve Anaerobic Power - Training to Improve the ATP-PC System

Performances - Moderate-Length Performances (Three to Twenty Minutes) - Intermediate-Length Performances (Twenty-One to Sixty Minutes) - Long-Term Performances (One to Four Hours] - Athlete as Machine

Physiology of Sprint and Power training :- Factors affecting speed, strength – length tension relationship, force velocity relationship, strength and ability to sustain power output, optimizing the power and weight ratio, muscle bio and fibre typing, muscle elasticity and stretch, shortening cycle, plyometeric training, Strength and Flexibility Training - Environmental Concerns - Ultra Short-Term Performances (Less than Ten Seconds) - Short-Term Performances (10 to 180 Seconds).

UNIT 4

Physiology of Strength training:- Quantification of exercise performance, bone and connective tissue training and adaptation, hypertrophy, muscle growth, Hyperplasia, neurological changes, neural adaptation, endocrine response to strength training, strength training principles, overload principle, progressive overload, training frequency, rest periods, workout compensation, training schedule.

Periodization of Training in Sport and Fitness:- Training theories and methodology, training adaptation, Supercompensation , Recovery, Fatigue, over reaching, overtraining, unexplained underperformance syndrome, signs and symptoms, treatment, GAS, LAS, Percodyation – definition , concepts, phases, Muscycle, Mesocycle, Macrocycle, Periodization for Aerobic endurance, specific endurance periodization for developing strength.

UNIT 5

Exercise and the Environment - Altitude - Atmospheric Pressure - Short-Term Anaerobic Performance - long-Term Aerobic Performance - Maximal Aerobic Power and Altitude - Adaptation to High Altitude - Training for Competition at Altitude - The quest for Everest - Heat - Hyperthermia - Cold - Environmental Factors - Insulating Factors - Heat Production - Descriptive Characteristics - Dealing with Hypothermia - Air pollution - Particulate Matter - Ozone - SulfurDioxide - Carbon Monoxide Altitude and training, altitude and endurance training, altitude and Anaerobic training, Train high and live low, short term intermittent hypoxic training, Hypoxia and exercise and clinical problems.

Physiology of Training for Dance - various dance types - Physiology of Training for Martial arts - various martial arts.

UNIT 6

Training for the Female Athlete, young athlete - Factors Important to Women Involved in Vigorous Training - Exercise and Menstrual Disorders - Training and Menstruation - The Female Athlete and Eating Disorders - Bone Mineral Disorders and the Female Athlete - Exercise During Pregnancy - Medical conditioning and training - Reproductive health in exercising women, exercise related menstrual regularity, PCOD, secondary effects of hypothalamic dysfunction in athletes, Fertility, Bone mineral density, exercise related amenorrhea - Athletes triad - Sports Conditioning for Children - Training and the Cardiopulmonary System - Training and the Musculoskeletal System - Progress in Pediatric Exercise Science - Competitive Training for Diabetics - Training for Asthmatics - Epilepsy and Physical Training - Exercise & Seizures - Risk of Injury Due to Seizures - Ergogenic Aids - Drugs - Amphetamines - Caffeine - Nicotine - Physical Warm-Up - Research Design Concerns Dietary Supplements Aerobic Performance - Blood Doping - Anaerobic Performance - Blood Buffers

INTERNAL PAPER 2 Exercise physiology in Health and Fitness

UNIT 1

Physical activity monitoring and guidance - Relative versus absolute intensity of physical activity - Aerobic exercise - Muscular strength and endurance - Establishing the strength training prescription – Flexibility balance / coordination / proprioception and movement control.

Obesity and diabetes - Aetiology of obesity and diabetes - Obesity - Diabetes - Prevalence of obesity and diabetes - Obesity - Diabetes - Evidence that physical activity reduces the risk of obesity and diabetes - Obesity - Diabetes - Role of physical activity in managing obesity and diabetes - Obesity - Diabetes - Exercise prescription for the prevention and management of obesity and diabetes - Obesity - Diabetes - Co-morbidities - Obesity - Diabetes - Gaps in the evidence and practical issues - Obesity - Diabetes

UNIT 2

Cardiac disease and dysfunction - General epidemiology of cardiovascular disease - Pathophysiology of coronary heart

disease - Historical overview of physical activity and Exertion-related cardiac events - Physical activity and exercise in primary prevention of Aerobic endurance exercise for preventing - Muscular strength and endurance exercise in prevention of CHD - Balance and proprioceptive/coordination exercise in prevention of CHD - of preventative exercise - prescription in Exercise in rehabilitation and secondary prevention of CHD - Aerobic endurance exercise for patients with CHD - Muscular strength and endurance exercise for patients with CHD - Considerations for exercise and cardiac medications Exercise capacity and medication

Lung disease and dysfunction - Introduction - The pathophysiology of COPD - The pathophysiology of asthma - Evidence for a therapeutic effect of exercise in respiratory disease - Exercise training in COPD - Exercise training in asthma - Evidence-based guidance on exercise training in COPD - Overload (intensity) - Specificity - Reversibility - Evidence-based guidance on exercise training in asthma

UNIT 3

Arthritis and low back pain

Exercise for osteoarthritis and rheumatoid arthritis - Primary prevention - Secondary prevention - Aerobic activity - Flexibility exercise - Proprioceptive exercise - Strength training for osteoarthritis
and rheumatoid arthritis - Water-based resistance training - on exercise and arthritis - Low back pain - Epidemiology - Pathophysiology - Exercise for low back pain - Exercise for acute low back pain

Ageing and older people - Exercises in Geriatrics - Introduction - Ageing is not a disease - Definitions of ageing - The ageing process - Quantitative aspects of ageing - The 'greying' of the population - Theories of ageing - Quality of life - Successful ageing - Can the ageing process be slowed? - Impact of ageing on major physiological systems and performance - Cardiovascular and respiratory systems - Effects on the cardiovascular and respiratory systems - Effects on the musculoskeletal system - Effects on the nervous system - Effects on the endocrine system - Effects on falls and fall-related injuries -

UNIT 4

Bone health:- Background information on bone tissue and bone remodelling - Background to diseases of poor bone health – osteoporosis and osteopenia - Assessment of osteoporosis - Physical activity and bone health -

UNIT 5

Neurological and neuromuscular disorders, a guide to pathological processes and primary symptoms - Introduction - Stroke and traumatic brain injury - Pathophysiology - Cardiorespiratory fitness - Muscle endurance - Strength/power/speed - Flexibility - Balance/skill/coordination - Exercise in primary prevention - General health and secondary prevention - Strength of evidence summary - Parkinson's disease (PD) – Pathophysiology - General fitness - Cardiorespiratory fitness - Muscle endurance - Muscle strength/speed/power - Flexibility - Skill and Coordination - Exercise in primary prevention -General health and secondary prevention -Strength of evidence -
Multiple sclerosis (MS) - Pathophysiology - - Overload - Specificity - of the gaps in the evidence; components, mode and dose of exercise.
Spinal cord injury
Physical activity and spinal cord injury - Benefits of exercise in SCI - Aerobic capacity - Types of exercise and suitability for SCI groups - Exercise volume: manipulations of intensity and duration - Monitoring training intensity - Cautions - Future research requirements.

UNIT 6

Physiology of Yoga -

REGULATIONS FOR THE POST GRADUATE DIPLOMA IN EXERCISE PHYSIOLOGY IN SPORTS & FITNESS (ONE YEAR)

1. SHORT TITLE AND COMMENCEMENT : These regulations shall be called **THE REGULATIONS FOR THE POST - GRADUATE DIPLOMA IN EXERCISE PHYSIOLOGY IN SPORTS & FITNESS".**

2. REGISTRATION: A candidate admitted into Post-Graduate Diploma Courses in any of the affiliated Institutions of the Tamil Nadu Dr. M.G.R. Medical University, Chennai shall register with the University by remitting the prescribed fees along with the application form for registration duly filled in and forwarded to the Controller of Examinations of t his University through the Head of the affiliated institution within the stipulated date. The candidate's name must be registered in the University within 3 months from the date of his/her admission.

3. ELIGIBILITY: Candidates for admission to the **One year Post-Graduate Diploma in Exercise Physiology in Sports & Fitness Course** shall be required MBBS / Bachelors of Physiotherapy (BPT) from a recognised University acquired as a full-time student.

4. . AGE LIMIT:

No upper age limit for Admission

5. ELIGIBILITY CERTIFICATE:

Candidates who have passed any qualifying examination as stated in (1) other than the Tamil Nadu Dr. M.G.R. Medical University shall obtain an "Eligibility Certificate" from this University by remitting the prescribed fees along with the application form and required documents before seeking admission to any one of the affiliated institutions. The application form is available in the University website :web.tnmgrmu.ac.in.

6. DURATION OF THE COURSE : The period of certified study and training for the Post - Graduate Diploma course shall be **ONE YEAR**.

7. COMMENCEMENT OF THE COURSE:

The course shall commence from **1st September** of the academic year. Cut off date for Admission is **30th September every year**.

8. .MEDIUM OF INSTRUCTION:

English shall be the Medium of Instruction for all the Subjects of study and for examinations for the **POST-GRADUATE DIPLOMA IN EXERCISE PHYSIOLOGY IN SPORTS & FITNESS COURSE.**

9. CURRICULUM:

The Curriculum and the syllabus for the course shall be as prescribed in these regulations and are subject to modifications by the Standing Academic Board from time to time.

10. CUT-OFF DATE OF THE COURSE:

i) 30th September of the year concerned

ii) The candidates admitted upto **30th September** of the Academic Year shall be registered to take up the **1st year examination during October of the next year**.

11. COMMENCEMENT OF THE EXAMINATION:

15th October / 15 April

If the date of commencement of Examination falls on Saturdays, Sundays or declared Public Holidays, the examination shall begin on the next working day.

12. WORKING DAYS IN AN ACADEMIC YEAR. : The academic year shall consist of not less than **270 working days.**

13. ATTENDANCE REQUIREMENTS FOR ADMISSION TO EXAMINATIONS:

No candidate shall be permitted to appear for the Examination unless he/she put in 85% attendance during his/her period of study and training in the affiliated institution recognized by this University and produces the necessary certificate of study, attendance and progress from the Head of the Institution by maintaining log book.

14. MAINTAINENCE OF LOG BOOK:

- Every Post-graduate Diploma candidate shall maintain a record of skills he has acquired during the one year training period certified by the various Heads of Departments he has undergone training.

- The candidates should also be required to participate in the teaching and training programme of the institute.

- In addition, the Head of the Department shall involve their post-graduate candidates in Seminars, Journal Clubs, Group discussions and conferences.

- The Head of the Department shall scrutinize the Log Book once in every three

months.

- At the end of the course, the candidate should summaries the contents and get the Log Book certified by the Head of the Department.

- The Log Book should be submitted at the time of practical examination for the scrutiny of the Board of Examiners.

15. MIGRATION/TRANSFER OF CANDIDATES:

- A student studying in **POST-GRADUATE DIPLOMA IN EXERCISE PHYSIOLOGY IN SPORTS & FITNESS** can be allowed to migrate/transfer to another institution of Allied Health Science under the same or another University.

- Under extraordinary circumstances, the Vice Chancellor shall have the powers to place any migration/transfer he/she deems fit before the Governing Council and get its approval for grant of permission/ratification for Migration/Transfer to the candidates undergoing the course of study in affiliated institutions of this University.

16. RE-ADMISSION AFTER BREAK OF STUDY: The regulations for re-admission are as per the University Common Regulation for Re-admission after break of study for all courses**.**

17. VACATION:

There is no vacation

Examination Pattern - I year

Paper	Subjects	Internal Assessment (IA)		Theory		Practical		Viva Voice	
		Max	Min	Max	Min	Max	Min	Max	Min
I.	Fundamentals of Exercise Physiology	50	25	100	50	100	50	50	25
II	Assessments and Interpretation in Exercise Physiology	50	25	100	50	100	50	50	25

DISTRIBUTION OF THE THEORY MARKS

Type of Questions	Distribution of Marks	Total Marks
Long Essays	2 x 20	40
Short Notes	10 x 6	60

Total 100 mark and Minimum pass mark 50

PRACTICAL & VIVA

Practical		Viva Voce		Total	
Max.	Min.	Max.	Min.	Max.	Min.
100	50	50	25	150	75

Practical's should include the following:

Case Discussion / Flash Card / Spotters / Instruments / Specimens (Where ever it is applicable)

18. Submission of Project:

1. Project with Compulsory _____ should be in a bound volume of a minimum of 30 - 50 pages of typed in Double line spacing and on one side only.
2. It is mandatory to have the "_____" in the final research project
3. The Project should be submitted to the Institution 3 months before the Third Year Examination.
4. **T**he student should prepare a PPT presentation of the project at the time of Viva – Voce Examination.

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