TAMILNADU PHYSICAL EDUCATION AND SPORTS UNIVERSITY
CHENNAI-600 127

APPROVED SYLLABUS

(Applicable to the students admitted from the academic year 2023-2024 onwards)

Choice Based Credit System

M.TECH SPORTS TECHNOLOGY

DEGREE PROGRAMME OFFERED IN THE

DEPARTMENT OF SPORTS TECHNOLOGY

M.TECH. SPORTS TECHNOLOGY

Programme Educational Objectives (PEO)

- PEO-1 Graduate will have successful academic and research career.
- PEO-2 Graduates will have employment in public and private sectors and resolve economic, social and environmental issues.

Educational Program Outcomes (POs):

After completion of the program graduates will be able to

PROGRAMME OUTCOMES (PO'S)

The post graduates are able to

PO-1) Attain in–depth knowledge to solve Sports Engineering problems in current needs of stack holders at global perspective.

PO-2) Analyse complex Sports Engineering problems critically.

PO-3) Find optimal solutions for Sports Engineering and Technology problems considering social and environmental issues.

PO-4) Carryout researches in one or more domains of Sports Engineering and Technology

PO-5) Apply appropriate and upgraded tools like DARTFISH,CFD to solve present day Sports Engineering and Technology problems.

PO-6) Carryout projects & research using collaborative and multidisciplinary engineering to enhance sporting performance considering economic aspects.

PO-7) Communicate effectively socio-economic problems related to Sports Engineering and technology by appropriate documentations and presentations.

PO-8) Incline for independent life-long learning.

PO-9) Exhibit social responsibility adhering to ethical values.

PO-10) Make corrective measures based on their own experiences.

MAPPING OF PEO'S WITH PO'S

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
PEO-1	X	X	X	X	X	X	X	X	X	X
PEO-2						X	X		X	X

PROGRAM SPECIFIC OUTCOMES (PSO)

The post graduates are able to

PSO 1 Analyze, design and develop sports devices and players performance with latest available technologies.

PSO-2 Work on sports and interdisciplinary projects in their research and development activities.

I, II, III & IV TH SEMESTERS CURRICULUM AND SYLLABI

CURRICULUM 2023-CHOICE BASED CREDIT SYSTEM

M.TECH SPORTS TECHNOLOGY

I, II, III & IV TH SEMESTERS CURRICULUM AND SYLLABI

SEMESTER I

(Applicable to the students admitted from the academic year 2023-2024 onwards)

Sl.No.	Course type &Code No.	Course Title	Teaching Scheme			Credits	Marks		Total Marks
			Th	Tuto	Lab		IN	EX	
1	Core/ 23PH1CT101	Aerodynamics in sports	3	0	0	3	25	75	100
2	Core/ 23PH1C T102	Sports Materials Engineering and Design	3	0	0	3	25	75	100
3	Elective	Elective I	3	0	0	3	25	75	100
	Elective	Elective II	3	0	0	3	25	75	100
5	23PH1CL101	Sports Aerodynamics Lab	0	0	4	2	25	75	100
6	23PH1CL102	Numerical Analysis Lab	0	0	4	2	25	75	100
7	MLC/ 23PH1AE101	Research Methodology and IPR	2	0	0	2	25	75	100
8	Audit course 1	Audit course 1(Non GPA)	2	0	0	2	25	75	100
Total Credits for SGPA						18			
Total Credits Non SGPA						2			
Grand Total Credits						18			

(Th-Theory, Tuto- Tutorial, Lab – Laboratory)

SEMESTER II

(Applicable to the students admitted from the academic year 2023-2024 onwards)

Sl.No.	Course type &Code No.	Course Title	Teaching Scheme			Credits	Marks		Total Marks
			Th	Tuto	Lab		IN	EX	
1	Core/ 23PH1CT201	Biomechanical Analysis in Sports	3	0	0	3	25	75	100
2	Core/ 23PH1CT202	Applications of Sensors and Transducers in Sports	3	0	0	3	25	75	100
3	Programme Elective	Elective III	3	0	0	3	25	75	100
	Programme Elective	Elective IV	3	0	0	3	25	75	100
5	Core Lab 1/ 23PH1CL201	Sports Performance Analysis Lab	0	0	4	2	25	75	100
6	Core Lab 2/ 23PH1CL202	CFD and FEM Sports Simulation and Analysis Lab	0	0	4	2	25	75	100
7	Core/ 23PH1MP201	Mini Project	0	0	4	2	25	75	100
8	Audit course 2	Audit course 2 (Non GPA)	2	0	0	2	25	75	100
Total Credits for SGPA						18			
Total Credits for Non SGPA						2			
Grand Total Credits for SGPA						18			

(Th-Theory, Tuto- Tutorial, Lab – Laboratory)

Second Semester Summer Vacation

Sl.No.	Course type &Code No.	Course Title	Teaching Scheme			Credits	Marks		Total Marks
			Th	Tuto	Lab		IN	EX	
9	Core/ 23PH1IP201	Internship	0	0	0	2	25	75	100
Total Credits for SGPA						2			

Total Second Semester Credit - 18 + 2 = 20

SEMESTER III

(Applicable to the students admitted from the academic year 2023-2024 onwards)

Sl.No.	Course type &Code No.	Course Title	Teaching Scheme			Credits	Marks		Total Marks
			Th	Tuto	Lab		IN	EX	
1	Programme Elective 23PH1DE301	Elective V	3	0	0	3	25	75	100
2	Open Elective 23--1GE---	Open Elective I	3	0	0	3	25	75	100
3	Dissertation / 23PH1DP301	Dissertation Phase I	0	0	20	10	50	150	200
4	Core/ 23PH1IP301	Internship	0	0	0	2	25	75	100
Total Credits for SGPA						18			

(Th-Theory, Tuto- Tutorial, Lab – Laboratory)

Total Third Semester Credit = 18

SEMESTER IV

(Applicable to the students admitted from the academic year 2023-2024 onwards)

Sl.No.	Course type &Code No.	Course Title	Teaching Scheme			Credits	Marks		Total Marks
							IN	EX	
3	Dissertation/ 23PH1DP401	Dissertation Phase II	0	0	34	16	200	300	500
Total Credits for SGPA						16			

Total Credits for the programme for Calculating CGPA = 18+20+18+16 = 72

Total Non CGPA Credits for the entire programme = 2+2 = 4

List of Elective Courses Offered in I, II & III Semesters

(Applicable to the students admitted from the academic year 2023-2024 onwards)

Code No.	Course Title	Teaching Scheme			Credits	Marks		Total Marks
		Th	Tuto	Lab		IN	EX	
23PH1DE001	Robotics and Machine vision system	3	0	0	3	25	75	100
23PH1DE002	Digital Image Processing	3	0	0	3	25	75	100
23PH1DE003	Digital Video Processing	3	0	0	3	25	75	100
23PH1DE004	Computer Vision	3	0	0	3	25	75	100
23PH1DE005	Mobile Computing	3	0	0	3	25	75	100
23PH1DE006	Principles and Design of Sports Turf	3	0	0	3	25	75	100
23PH1DE007	Polymer Engineering	3	0	0	3	25	75	100
23PH1DE008	Surveying And Construction Materials	3	0	0	3	25	75	100
23PH1DE009	Reverse Engineering	3	0	0	3	25	75	100
23PH1DE010	Introduction to Embedded Systems	3	0	0	3	25	75	100
23PH1DE011	Introduction to Internet of Things(IOT)	3	0	0	3	25	75	100
23PH1DE012	Product Design and Development	3	0	0	3	25	75	100
23PH1DE013	Sports And Event Management	3	0	0	3	25	75	100
23PH1DE014	Additive Manufacturing Processes and Applications	3	0	0	3	25	75	100
23PH1DE015	CFD and FEM simulation for Sports Engineering	3	0	0	3	25	75	100
23PH1DE016	Motor Sports Application	3	0	0	3	25	75	100
23PH1DE017	Wind Engineering for Sports	3	0	0	3	25	75	100
23PH1DE018	Applications of Statistics in Sports	3	0	0	3	25	75	100
23PH1DE019	Aerodynamics in Automobile	3	0	0	3	25	75	100
23PH1DE020	Soil And Ground Improvement Techniques	3	0	0	3	25	75	100

(Th-Theory, Tuto- Tutorial, Lab – Laboratory)

List of Generic Elective Courses Offered for other Department Students

Course code	Course	Teaching Scheme			Credits	Marks		Total Marks
		Th	Tuto	Lab		IN	EX	
23PH1GE001	Fundamentals of Sports Technology	3	0	0	3	25	75	100
23PH1GE002	Intellectual Properties Rights	3	0	0	3	25	75	100
23PH1GE003	Design of Experiments and Research Applications	3	0	0	3	25	75	100
23PH1GE004	Industrial Safety	3	0	0	3	25	75	100
23PH1GE005	Physics of Sports	3	0	0	3	25	75	100

(Th-Theory, Tuto- Tutorial, Lab – Laboratory)

AUDIT COURSE 1 & 2

Course code	Course	Teaching Scheme			Credits	Evaluation
		Th	Tuto	Lab		
23PH1SE101	English for Research Paper Writing	2	0	0	2	Evaluation is 100 % internal and Marks are awarded in term of Grades like Satisfactory, Good and Excellent based on students performance
23PH1SE102	Disaster Management	2	0	0	2	
23PH1SE103	Sanskrit for Technical Knowledge	2	0	0	2	
23PH1SE104	Value Education	2	0	0	2	
23PH1SE105	Constitution of India	2	0	0	2	
23PH1SE106	Pedagogy Studies	2	0	0	2	
23PH1SE107	Stress Management by Yoga	2	0	0	2	
23PH1SE108	Personality Development through Life Enlightenment Skills.	2	0	0	2	
23PH1SE109	Professional Ethics in Engineering	2	0	0	2	

List of Value Added Courses Offered to All Department Students

Course code	Course	Teaching Scheme			Credits	Marks		Total Marks
		Th	Tuto	Lab		IN	EX	
23PH1VA001	Software Application in Match Analysis (Theory and Practical)	3	0	1	3	25	75	100
23PH1VA002	Ms Excel for Sports Science (Theory and Practical)	3	0	1	3	25	75	100
23PH1VA003	Practical Application of LaTeX (Theory and Practical)	3	0	1	3	25	75	100

SEMESTER I

(Applicable to the students admitted from the academic year 2021-2022 onwards)

Sl.No.	Course type &Code No.	Course Title	Teaching Scheme			Credits	Marks		Total Marks
			Th	Tuto	Lab		IN	EX	
1	Core/ 23PH1CT101	Aerodynamics in sports	3	0	0	3	25	75	100
2	Core/ 23PH1C T102	Sports Materials Engineering and Design	3	0	0	3	25	75	100
3	Elective	Elective I	3	0	0	3	25	75	100
	Elective	Elective II	3	0	0	3	25	75	100
5	23PH1CL101	Sports Aerodynamics Lab	0	0	4	2	25	75	100
6	23PH1CL102	Numerical Analysis Lab	0	0	4	2	25	75	100
7	MLC/ 23PH1AE101	Research Methodology and IPR	2	0	0	2	25	75	100
8	Audit course 1	Audit course 1(Non GPA)	2	0	0	2	25	75	100
Total Credits for SGPA						18			
Total Credits Non SGPA						2			
Grand Total Credits						18			

(Th-Theory, Tuto- Tutorial, Lab – Laboratory)

23PH1 CT101	AERODYNAMICS IN SPORTS
	Instruction : 3hr / week *Credits : 3* *Assessment : 25 + 75*
1	**SYLLABUS**

Course Objectives:

- To impart knowledge on Theory and Experimental knowledge in the application of the aerodynamics in sports to design the high performance equipments and to optimize the performance of the athlete.

UNIT I BASIC AERODYNMICS 9

Aerodynamic terminologies, aerodynamic force and moment , drag and lift, one and two dimensional flow, momentum equation, energy equation, Navier –stock equation, angular velocity.

UNIT II POTENTIONAL AND AXISYMMETRIC (INVISCID INCOMPRESSIBLE) FLOW 9

Laplace equation, Bernoulli's equation for rotational flow, Fundamentals of Invicid incompressible flow, sources of flow, Non lifting and lifting of flow over a cylinder, kutta-Joukowski theorem, vortex system and laws of vortex motion, incompressible flow, pitot tube equation, normal shock waves, Mach and shock waves in two dimensional flow.

UNIT III VISCOUS FLOW AND BOUNDARY LAYER 9

Development of boundary layer, boundary layer equation, laminar and turbulent flow, boundary layer separation, momentum integral equation, Reynolds number, Performance factors in bicycling- Human power, drag and rolling resistance.

UNIT IV AERODYNAMICS ON SPORTS EVENTS 9

Cycling aerodynamics, Factors influencing on running and running aerodynamics ,Skin suit aerodynamics, aerodynamics in cross country skiing and speed skiing. Performance factors in ski jumping, case studies ski jumping, Ski jumping aerodynamics.

UNIT V SPORTS BALL AERODYNAMICS AND MEASURMENT 9

Sports Ball Aerodynamics- aerodynamics on Base ball, Golf ball, tennis ball, cricket ball, volley ball , soccer ball , magnus effect, effect of velocity and spin, Case studies,CFD simulations and wind tunnel test.

Total No.of periods : 45

	Reference 1. Aerodynamics for Engineering students , E.L. Houghton, P.W.Carpenter, BH, 2003 2. Sports Aerodynamics, Noerstrud, Helge (Ed.), Springer, 2008 3. Projectile Dynamics in Sport: Principles and Applications, By Colin White, Routledge, 2010 4. Aerodynamic Measurements , G P Russo, Woodhead Publishing, 2011.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand and attain knowledge on Theory and Experimental knowledge of aerodynamics in sports
	CO-2	Apply Theory and Experimental knowledge of aerodynamics in sports
	CO-3	Design the high performance equipments and to optimize the performance of the athlete.

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3			3						2
2		3		2						3
3			3		3	3				2

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	2	3
3	1	1

23PH1CT102– SPORTS MATERIALS ENGINEERING AND DESIGN

Course Objectives:

- To impart knowledge on material science and advance materials for the design and manufacture of the different sports apparel and equipments to increase the athlete performance and to avoid the sports injury.

UNIT I SPORTS EQUIPMENT AND PHILOSOPHY OF DESIGN 9

Materials in sports- Factors determining sports performance, role of bioengineering in sports equipment, Advanced materials in the design of sports equipment, materials selection in design of pole vaulting, Bicycle construction , relationship between advanced materials technology in designing sports equipments and performance.

UNIT II FUNDAMENTALS OF ADVANCED MATERIALS 9

Composite materials , Nano and smart materials, Comparing and selecting materials , Basis of sports shoe design , Cycle mechanics from bamboo to fibre composites, Space frame Materials The wheels, Case studies and Future trends .

UNIT III MATERIALS FOR TENNIS SQUASH RACKETS 9

String types, function of string in a racquet, frame stiffness loss in a string, perception of string properties, Racket mechanics: the sweet spot, Influence of materials on racket technology, Specific designs and tests on racket, frame materials, Ball construction , tennis and squash ball ,Case studies.

UNIT IV MATERIALS IN BOATS AND BOARDS AND MOUNTAINEERING 9

Materials for racing hulls, Canoes and Kayaks , Surfboards, Testing ski properties , Materials in boots and bindings , Ski-sticks, Advanced materials and design in skis, materials for ropes in mountaineering, harnesses and slings karabiners, belay, descending and ascending devices, rock protection, ice climbing equipment,

UNIT V MATERIALS FOR SPORTS BALLS AND HELMET 9

Materials for golf club and golf ball, cricket ball, baseball, soccer and volleyball, discus, javelin, archery, fencing and foam materials, material selection and design of helmets. Case studies on helmet materials selection.

Total No.of periods : 45

Reference

1. Mike Jenkins, Aleksandar Subic, "Materials in sports equipment" published by Woodhead publishing.
2. Easterling**, E.A.,** Advanced Materials for Sports Equipment, Springer, 1993
3. *A. Subic,* Materials in Sports Equipment ,Volume 2 , Woodhead, 2007

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand various kinds of materials and its properties
	CO-2	Apply specific materials for the design and manufacture of the different sports apparel and equipments
	CO-3	Modify suitable materials/ design to increase athlete performance and to avoid the injury.

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3			2	1	2				1
2		3	2						2	
3		2		3		3			2	1

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	1	2
3	1	3

23PH1AE101- Research Methodology and IPR

Course Objectives:

- To impart knowledge to the students to Understand research problem formulation, Analyze research related information and follow research ethics.

- To impart knowledge on understanding Intellectual Property Rights
- To create awareness among students about IPR

Syllabus Contents:

UNIT 1 **9**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT 2: **9**

Effective literature studies approaches, analysis Plagiarism, Research ethics Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT 3: **9**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT 4: **9**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT 5: **9**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"

Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

Ranjit Kumar, 2nd Edition , “Research Methodology: A Step by Step Guide for beginners”

Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.

Mayall , “Industrial Design”, McGraw Hill, 1992.

Niebel , “Product Design”, McGraw Hill, 1974.

Asimov , “Introduction to Design”, Prentice Hall, 1962.

Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.
T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand research problem formulation
	CO-2	Analyze research related information
	CO-3	. Follow research ethics
	CO4	Understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
	CO5	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
	CO6	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.
3	**MAPPING (CO’s and PO’s)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3			3		2				
2						3				

3									3	
4					3					
5								2	1	
6		3	2	1			3			

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		1
2	2	1
3	3	1
4	3	2
5	2	1
6	3	1

23PH1CL101 Sports Aerodynamics Lab

LIST OF EXPERIMENTS

1. Study on wind tunnel basis and low speed sub sonic wind tunnel
2. Finding Drag and lift coefficient of different sports balls using wind tunnel Test
3. Comparing drag coefficient various sports balls
4. Calculating side force and pressure distribution on various balls

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand the influence of air on various sports.
	CO-2	Develop specific models for testing the effect of air
	CO-3	Modify the position of the models to increase athlete performance

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3	1								
2				3		2				
3			3						2	

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	1	2
3	1	3

23PH1CL102 - NUMERICAL ANALYSIS LAB

LIST OF EXPERIMENTS

1- Expression and Variable command
2- Vector operation
3- Matrix operation
4- Conditional Branching
5- Interation 'for' statement Syntex
6- script and functioning
7- Plotting 2D graphs
8- user defined input and output
9- Numerical integration algorithm
10- Solving non linear equations
11- Linear equation Gaussian method
12- linear equations interactive method
13- Numerical Interpolation algorithms
14- ODEs using Euler Methods
15- ODEs Application

Reference

1. Introduction to Scilab: For Engineers and Scientists Book by Sandeep Nagar
2. IITB Spoken tutorial - https://spoken-tutorial.org/

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand vector and metrix operations.
	CO-2	Develop 2D plotting skills
	CO-3	Understanding and use numerical interpolation alogrithms

3 MAPPING (CO's and PO's)

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	2	1								
2				3		2				
3			2						1	

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	1	2
3	2	3

SEMESTER II

(Applicable to the students admitted from the academic year 2021-2022 onwards)

Sl.No.	Course type &Code No.	Course Title	Teaching Scheme			Credits	Marks		Total Marks
			Th	Tuto	Lab		IN	EX	
1	Core/ 23PH1CT201	Biomechanical Analysis in Sports	3	0	0	3	25	75	100
2	Core/ 23PH1CT202	Applications of Sensors and Transducers in Sports	3	0	0	3	25	75	100
3	Programme Elective	Elective III	3	0	0	3	25	75	100
	Programme Elective	Elective IV	3	0	0	3	25	75	100
5	Core Lab 1/ 23PH1CL201	Sports Performance Analysis Lab	0	0	4	2	25	75	100
6	Core Lab 2/ 23PH1CL202	CFD and FEM Sports Simulation and Analysis Lab	0	0	4	2	25	75	100
7	Core/ 23PH1MP201	Mini Project	0	0	4	2	25	75	100
8	Audit course 2	Audit course 2 (Non GPA)	2	0	0	2	25	75	100
Total Credits for SGPA						18			
Total Credits for Non SGPA						2			
Grand Total Credits for SGPA						18			

(Th-Theory, Tuto- Tutorial, Lab – Laboratory)

Second Semester Summer Vacation

Sl.No.	Course type &Code No.	Course Title	Teaching Scheme			Credits	Marks		Total Marks
			Th	Tuto	Lab		IN	EX	
1	Core/ 23PH1IP201	Internship	0	0	0	2	25	75	100
Total Credits for SGPA						2			

Total Credits in Second Semester - 18 + 2 = 20

23PH1CT201- Biomechanical Analysis in Sports

Course Objectives

- To learn the basic idea to integrate the Medical and Engineering science to study the motion of the athlete to optimize the performance and safety.

UNIT I BASIC TERMINOLOGY AND MOVEMENT PATTERN 9

Basic Terminologies in biomechanics , Movement patterns – walking, jumping , throwing, planes and axes of movement and postures, qualitative and quantitative analysis of sports movements, stages in a structured approach to analysis of human movement in sport,

UNIT II QUANTITATIVE ANALYSIS OF MOVEMENT 9

Quantitative video analysis of a sports technique, important features of video equipment for recording movements in sports, advantages and limitations of two- and three-dimensional recording of sports movements , two- and three-dimensional recording procedure , possible sources of error in recorded movement data, data processing, data smoothening, filtering and differentiation, Fourier series truncation Electromyography , force plates.

UNIT III FUNCTIONAL ANATOMY OF THE UPPER AND LOWER EXTREMITY9

Anatomical and Functional Characteristics of the Joints of the Shoulder, Combined Movement Characteristics , Muscular Actions, Injury Potential of the Shoulder, Elbow and Radioulnar Joints, Wrist and Fingers, Contribution of Upper Extremity Musculature to Sports Skills or Movements, External Forces and Moments Acting at Joints in the Upper Extremity, Pelvis and Hip Complex, Knee Joint, Ankle and Foot Movement Characteristics, muscle Actions, Contribution of Lower Extremity Musculature to Sports Skills or Movements, Forces Acting on Joints in the Lower Extremity, Vertebral Column, Muscular Actions, Contribution of the Trunk Musculature to Sports Skills or Movements, Stricture and mechanical properties of bone.

UNIT IV LINEAR AND ANGULAR KINEMATICS 9

Collection of Kinematic Data, Position and Displacement, Velocity and Speed, Acceleration, Differentiation and Integration, Linear Kinematics of Walking and Running, Linear Kinematics of the Golf Swing, Linear Kinematics of Wheelchair Propulsion Projectile Motion, Equations of Constant Acceleration, Angular Motion, Measurement of Angles, Lower Extremity Joint Angles, Representation of Angular Motion Vectors, Angular Motion Relationships, Relationship between Angular and Linear Motions, Angle–Angle Diagrams, Angular Kinematics of Walking and Running, Lower Extremity Angles, Angular Kinematics of the Golf Swing, Angular Kinematics of Wheelchair Propulsion. Case studies.

UNIT V LINEAR AND ANGULAR KINETICS 9

Force**,** types of forces, laws of motion, representation of Forces Acting on a System, Special Force Applications, Linear Kinetics of Locomotion, Linear Kinetics of the Golf Swing ,

Linear Kinetics of Wheelchair Propulsion, case studies, torque, types of torque, Newton's Laws of Motion: Angular Analogs, centre of mass, Rotation and Leverage, Representation of Torques Acting on a System, Analysis Using Newton's Laws of Motion, Special Torque Applications, Cinematography and video analysis, mathematical modelling.

References

1. Y.C. Fung, "Bio-Mechanics- Mechanical Properties of Tissues", Springer-Verlag, 1998
2. Subrata Pal, "Textbook of Biomechanics", Viva Books Private Limited, 2009.
3. Introduction to Sports Biomechanics Analysing Human Movement Patterns, Roger Bartlett, published in the USA and Canada by Routledge

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand the concepts of biomechanics in sports
	CO-2	Modify suitable body positions and movements to increase athlete performance and to avoid injury.
	CO-3	Optimize the performance and safety of athletes using the principles of biomechanics.
3	**MAPPING (CO's and PO's)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3	1		2						
2		2		3						
3			3	2		3				

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	1	2
3	1	3

23PH1CT202- Applications of Sensors and Transducers in Sports

Course Objectives:

• To understand the concepts of measurement technology.
• To learn the various sensors used to measure various physical parameters.
• To learn the fundamentals of signal conditioning, data acquisition and communication systems

UNIT I INTRODUCTION **9**

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

UNIT II MOTION, PROXIMITY AND RANGING SENSORS **9**

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS **9**

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS **9**

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V SIGNAL CONDITIONING and DAQ SYSTEMS **9**

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

Total No of periods: 45

Course Outcomes:

The students will be able to

- Expertise in various calibration techniques and signal types for sensors.
- Apply the various sensors in the sports applications
- Study the basic principles of various smart sensors.

References

- ***1..*** Franz Konstantin Fuss**,** Aleksandar Subic**,** Sadayuki Ujihashi "*The Impact of Technology on Sport II"* Taylor and Francis 2007
- *2. Craig J.J., " Introduction to Robotics Mechanics and Control ", Addison-Wesley, 1999.*
- *Murty, D.v.s. Transducers And Instrumentation Prentice Hall of India, 2008*

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Gain knowledge of the electronics and sensor technology
	CO-2	Measure performance of the athlete error free
	CO-3	increase athlete performance and to avoid injury by providing with feed to the players/athletes

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3					2				
2		2								
3			3	3		3				

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	1	2
3	1	3

23PH1MP201 MINI PROJECT

Teaching Scheme
Lectures: 2 hrs/week

Syllabus Contents:

- Students can take up small problems in the field of design engineering as mini project. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem etc.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Work in actual industrial environment if they opt for internship.
	CO-2	Solve a live problem using software/analytical/computational tools.
	CO-3	Write technical reports.
	CO-4	Present and defend their work in front of technically qualified audience.

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1		2	2	3		1				
2					3	2				
3	2					2	3			
4						3	3	2	3	1

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	1	2
3	1	3

23PH1CL201 Sports Performance Analysis Lab

Course Objectives:

- To apply movement analysis through image capturing through high resolution camera and motion analysis software to evaluate and optimize the sports performance.

LIST OF EXPERIMENTS

1 - Tagging using default setup

2 - Tagging panel creation and Analysis for basketball

3 - Tagging panel creation and Analysis for volleyball

4 - Tagging panel creation and Analysis for Circket

5 - knee angle analysis for cyclist

6 - Basketball shoot analysis in stroMo

7 - Chucking analysis of the bowler in Dartfish

8 - Data generation and analysis from the Dartfish

Reference

1. Dartfish feedback and support - https://support.dartfish.tv/support/solutions/folders/27000053999

LIST OF EQUIPMENTS AND SOFTWARES REQUIRED

1.Computers with latest configuration 30 Nos.

2.Power back up for the required capacity

3.Colour printer

4. High resolution camera

5.Motion analysis software like Dartfish and SportCAD etc .

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Acquire knowledge on Athletes movement capturing using high resolution camera Movement analysis software
	CO-2	Capture and analyse movements in various sports and athletic events
	CO-3	Optimize players performance

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3				3					
2					3	3	2			
3			3						2	

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	1	2
3	1	3

23PH1CL202 CFD and FEM Sports Simulation and Analysis Lab

Course Objectives:

- To implement the CFD and FEM simulation for the Sports engineering problems

1. Flow over laminar and turbulent pipe
2. Flow over a cylinder and 2D Airfoil
3. Flow over a cyclist
4. Flow over a Golf ball
5. Cross ventilation study at indoor stadium
6. Plate with hole
7. Bike Crank FEM simulation
8. Cantilever beam FEM analysiss
9. Plane frame FEM analysis
10. A step shaft in axial teny FEM analysis.

Outcome

- Increasing the sports performance through the CFD and FEM simulation
- To design and implementation of the CFD and FEM Analysis for sports apparel and infrastructure

Reference

1. EDX - A Hands-on Introduction to Engineering Simulations
https://www.edx.org/course/a-hands-on-introduction-to-engineering-simulations

LIST OF SOFTWARES REQUIRED

1. **Any latest modelling software like ProE, CATIA, CAD etc.,**
2. **Analysis package such as ANSYS ,MATLAB etc**

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Classify a given problem on the basis of its dimensionality as 1-D, 2-D, or 3-D, time-dependence as Static or Dynamic, Linear or Non-linear.
	CO-2	Develop system level matrix equations from a given mathematical model of a problem following the Galerkin weighted residual method or principle of stationary potential.
	CO-3	While demonstrating the process mentioned in 2 above, he will be able to identify the primary and secondary variables of the problem and choose correct nodal degrees of freedom and develop suitable shape functions for an element, implement Gauss-Legendre scheme of numerical integration to evaluate integrals at element level, and assemble the element level equations to get the system level matrix equations. He will also be able to substitute the essential boundary conditions correctly and obtain the solution to system level matrix equations to get the values of the field variable at the global nodes.
	CO-4	state three sources of errors in implementing FEM and suggest remedies to minimize the same for a given problem, viz. Modeling errors, Approximation errors, and numerical errors.
	CO-5	Obtain consistent and lumped mass matrices for axial vibration of bar sand transverse vibration of beams and obtain fundamental frequency of natural vibration using the methods mentioned in the curricula.
	CO-6	use MATLAB for implementation of FEM to obtain elongations at nodes of a bar subjected to traction and concentrated loads and prescribed boundary conditions
	CO-7	use commercial software like ANSYS or ABAQUS for implementation of FEM to obtain stress concentration due to a small hole in a rectangular plate subjected to traction on edges and concentrated loads at points on the edges and prescribed boundary conditions and present his/her work using the above software in a conference or publish the work in a peer reviewed journal 3
3	**MAPPING (CO's and PO's)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	1	3								
2	2	2								
3	3	3								
4					3					
5	3	3								

6					3					
7						3	3	3	2	

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	2	
3		
4		2
5	1	
6	3	
7		3

SEMESTER III

(Applicable to the students admitted from the academic year 2021-2022 onwards)

Sl.No.	Course type &Code No.	Course Title	Teaching Scheme			Credits	Marks		Total Marks
			Th	Tuto	Lab		IN	EX	
1	Programme Elective/ 23PH1DE301	Elective V	3	0	0	3	25	75	100
2	Open Elective/ 23--1GE---	Open Elective I	3	0	0	3	25	75	100
3	Dissertation / 23PH1DP301	Dissertation Phase I	0	0	20	10	50	150	200
4	Core/ 23PH1IP301	Internship	0	0	0	2	25	75	100
Total Credits for SGPA						18			

(Th-Theory, Tuto- Tutorial, Lab – Laboratory)

Total Credits in Third Semester=18

23PH1DP301 Dissertation Phase-1

Teaching Scheme
Lectures: 20 hr/week

Guidelines:

- The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.
- Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech.
- The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review.
- The preliminary results (if available) of the problem may also be discussed in the report.
- The work has to be presented in front of the examiners panel set by Head and PG coordinator.
- The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Exposed to self-learning various topics.
	CO-2	Survey the literature such as books, national /international refereed journals and contact resource persons for the selected topic of research.
	CO-3	Write technical reports.
	CO-4	Develop oral and written communication skills to present and defend their work in front of technically qualified audience.
3	**MAPPING (CO's and PO's)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3	2	1	2				3		3

2					2	3				
3							3			
4							3	1	3	2

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	
2	1	2
3		1
4	3	

SEMESTER IV

(Applicable to the students admitted from the academic year 2018-2019 onwards)

Sl.No.	Course type &Code No.	Course Title	Teaching Scheme			Credits	Assessment
			Th	Tuto	Lab		
1	Dissertation 23PH1DP401	Dissertation Phase II	0	0	34	16	100+200
Total Credits						16	

Total Credits for the programme for Calculating CGPA = 18+20+18+16 = 72

Total Non CGPA Credits for the entire programme = 2+2 = 4

23PH1DP401 Dissertation Phase- II

Teaching Scheme

Lectures: 32 hr/week

Guidelines:

- It is a continuation of Project work started in semester III. He has to submit the report in prescribed format and also present a seminar.
- The dissertation should be presented in standard format as provided by the department.
- The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
- The report must bring out the conclusions of the work and future scope for the study.
- The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator.
- The candidate has to be in regular contact with his guide.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Prepare comprehensive report based on literature survey and Use different experimental techniques
	CO-2	Use different software/ computational/analytical tools.
	CO-3	Design and develop an experimental set up/ equipment/test rig relevant to sports technology
	CO-4	Conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
	CO-5	Either work in a research environment or in an industrial environment.
	CO-6	Conversant with technical report writing.
	CO-7	Present and convince their topic of study to the engineering community or to publish the work in a peer reviewed journal/conference.

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3		3				3	3	3	1
2	3	3	3		3	3	3	2	3	3
3	3	3	3	1	2	3		3	3	3
4	3	3	3		3	3		3	3	3
5	3	3	3	2	2	3		1	3	1
6	1						3		2	
7	3			3			3		3	3

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	

2		1
3	2	
4		3
5		
6		2
7	3	

List of Elective Courses Offered in I, II & III Semesters

(Applicable to the students admitted from the academic year 2021-2022 onwards)

Code No.	Course Title	Teaching Scheme			Credits	Marks		Total Marks
		Th	Tuto	Lab		IN	EX	
23PH1DE001	Robotics and Machine vision system	3	0	0	3	25	75	100
23PH1DE002	Digital Image Processing	3	0	0	3	25	75	100
23PH1DE003	Digital Video Processing	3	0	0	3	25	75	100
23PH1DE004	Computer Vision	3	0	0	3	25	75	100
23PH1DE005	Mobile Computing	3	0	0	3	25	75	100
23PH1DE006	Principles and Design of Sports Turf	3	0	0	3	25	75	100
23PH1DE007	Polymer Engineering	3	0	0	3	25	75	100
23PH1DE008	Surveying And Construction Materials	3	0	0	3	25	75	100
23PH1DE009	Reverse Engineering	3	0	0	3	25	75	100
23PH1DE010	Introduction to Embedded Systems	3	0	0	3	25	75	100
23PH1DE011	Introduction to Internet of Things(IOT)	3	0	0	3	25	75	100
23PH1DE012	Product Design and Development	3	0	0	3	25	75	100
23PH1DE013	Sports And Event Management	3	0	0	3	25	75	100
23PH1DE014	Additive Manufacturing Processes and Applications	3	0	0	3	25	75	100
23PH1DE015	CFD and FEM simulation for Sports Engineering	3	0	0	3	25	75	100
23PH1DE016	Motor Sports Application	3	0	0	3	25	75	100
23PH1DE017	Wind Engineering for Sports	3	0	0	3	25	75	100
23PH1DE018	Applications of Statistics in Sports	3	0	0	3	25	75	100
23PH1DE019	Aerodynamics in Automobile	3	0	0	3	25	75	100
23PH1DE020	Soil And Ground Improvement Techniques	3	0	0	3	25	75	100

(Th-Theory, Tuto- Tutorial, Lab – Laboratory)

23PH1DE001– ROBOTICS AND MACHINE VISION SYSTEM

OBJECTIVES:

- Students will learn about basics of robots
- programming and Machine vision applications in robots

UNIT I BASICS OF ROBOTICS **9**

Introduction- Basic components of robot-Laws of robotics- classification of robot-work spaceaccuracy-resolution –repeatability of robot. Power transmission system: Rotary to rotary motion,Rotary to linear motion, Harmonics drives

UNIT II ROBOT END EFFECTORS **9**

Robot End effectors: Introduction- types of End effectors- Mechanical gripper- types of gripper mechanism- gripper force analysis- other types of gripper- special purpose grippers.

UNIT III ROBOT MECHANICS **9**

Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation

UNIT IV MACHINE VISION FUNDAMENTALS **9**

Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology

UNIT V ROBOT PROGRAMMING **9**

Robot programming: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- application of robots.

OUTCOMES:

- knowledge for the design of robotics
- Upon completion of this course, the students can able to apply the basic engineering

TEXT BOOKS:

1. M.P.Groover, M.Weiss ,R.N. Nagal, N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata , McGraw-Hill Education Pvt Limited, 2008

REFERENCES

1. Sathya Ranjan Deb, robotics Technology & flexible Automation Sixth edition, Tata Mcgraw-Hill Publication, 2003.
2. Gorden M.Dair, Industrial Robotics, PHI 1988.
3. K.S.Fu, R.C.Gonzalez, C.S.G.Lee, Robotics: Sensing, Vision& Intelligence, Tata Mcgraw-Hill Publication, 1987.
4. John.J.Craig, Introduction to Robotics: Mechanics & control, Second edition-2002.
5. M.P.Groover, Industrial robotics- Technology, programming and Applications, McGraw-Hill, 1986

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	To Understand the foundational and latest robotic technology used in the sports and physical education
	CO-2	Implementing the robotics technology to enhancement of the sports manufacturing, equipment and instrument
	CO-3	Understanding the programming and algorithm for the robotic technology

3 **MAPPING(CO's and PO's)**

Course Outcomes	ProgramOutcomes									
	1	2	3	4	5	6	7	8	9	10
1	1					2		1		
2		1						1	2	
3	1		3				2	3		

MAPPING(CO'sandPSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	2	3
3	3	1

23PH1DE002–Digital Image Processing

OBJECTIVES:

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

UNIT IDIGITAL IMAGE FUNDAMENTALS 9

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Colour fundamentals and Colour models.

UNIT IIIMAGE ENHANCEMENT 9

Spatial Domain: Basics of intensity transformation – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain: Preliminary concepts.

UNIT III IMAGE RESTORATION 9

Image Restoration – degradation model, properties, noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.

UNIT IV IMAGE SEGMENTATION 9

Edge detection – Edge models and basic edge detection thresholding – Foundation, basic global thresholding - Region based segmentation – Region growing – Region splitting and merging – Use of motion segmentation.

UNIT V IMAGE COMPRESSION 9

Need for data compression, fundamentals of compression – Coding redundancy, Spatial and temporal redundancy, irrelevant information, image compression – Basic compression methods – Huffman, Coulomb, Arithmetic and Run Length coding.

OUTCOMES:

At the end of the course, the students should be able to:

- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods,Digital Image Processing, Pearson, Third Edition, 2010.
2. Anil K. Jain,Fundamentals of Digital Image Processing Pearson, 2002.

REFERENCES:

1. Kenneth R. Castleman,Digital Image Processing Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau,Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt,Digital Image Processing John Wiley, New York, 2002
5. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

2	**COURSEOUTCOMES:Studentsareableto**	
	CO-1	Operate on images using the techniques of smoothing, sharpening andenhancement.
	CO-2	Learn the basics of segmentation, features extraction, compression and recognition methods for color models.
	CO-3	Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.

3 **MAPPING (CO's and PO's)**

Course Outcomes	ProgramOutcomes									
	1	2	3	4	5	6	7	8	9	10
1	3		2			1				
2			1			2				
3			3			1				

MAPPING(CO'sandPSO's)

Course Outcomes (CO)	ProgramSpecific Outcomes(PSO)	
	1	2
1		3
2	2	
3		3

23PH1DE003– Digital Video Processing

COURSE OBJECTIVE:

- To introduce the fundamentals of digital video representation, filtering and compression,
- Popular algorithms for 2-D and 3-D motion estimation,
- Object tracking, frame rate conversion, deinterlacing, image enhancement,

the emerging international standards for image

- video compression, with such applications as digital TV, web-based multimedia, videoconferencing,

videophone and mobile image communications.

- more advanced image compression techniques such as entropy coding, subband coding and object-based coding.

UNIT IDIGITAL VIDEO FUNDAMENTALS 9

Basics of Video – Analog video, digital video, digital video processing – Time varying image formation models – Three dimensional motion models, geometric image formation, photometric image formation, observation noise.

UNIT IISPATIO-TEMPORAL SAMPLING 9

Sampling structures – Two dimensional rectangular sampling – Two dimensional periodic sampling – Sampling on 3D structures – Reconstruction from samples.

UNIT III MOTION DETECTION AND ESTIMATION 9

Introduction – Notations and preliminaries – Motion detection methods – Hypothesis testing and MAP detection – Motion estimation – Models, estimation and search – Practical motion estimation algorithms.

UNIT IV VIDEO SEGMENTATION 9

Introduction – Change detection – Dominant motion segmentation – Multiple motion segmentation – Simultaneous estimation and segmentation – Semantic video object segmentation.

UNIT V VIDEO COMPRESSION 9

Introduction – Application requirements – Digital video signals and formats – Video compression techniques – Video encoding standards and H.261

TEXT BOOKS:

1. A.Murat Tekalp, Digital Video Processing, Prentice Hall,Signal Processing Series, 1995.
2. Al Bovik, Hand book of Image and Video Processing, Academic Press, 2000.

References:

1."Multimedia Communication Technology", J.R.Ohm, Springer Publication.
2. "Video Coding for Mobile Communications" David Bull et al, Academic Press.
3. "Handbook on Image and Video Processing", A.I.Bovik, Academic Press.

2	**COURSE OUTCOMES : Students are able to**	
	CO-1	Implementing and understanding the importance of the digital technology in sports
	CO-2	To understand the video technology in the broadcast of the sport event and performance improvement
	CO-3	To improve the video technology on the sports performance and research

3 **MAPPING(CO'sandPO's)**

Course Outcomes	ProgramOutcomes									
	1	2	3	4	5	6	7	8	9	10
1	2	3								
2				2	1	2				
3		1		2	1			2		

MAPPING(CO's and PSO's)

CourseOutcomes(CO)	ProgramSpecific Outcomes(PSO)	
	1	2
1	2	
2		3
3	1	

23PH1DE004– Computer Vision

Objectives:

- Students will learn basic principles of image formation
- image processing algorithms and different algorithms for 3D reconstruction and recognition from single or multiple images (video). This course
- Emphasizes the core vision tasks of scene understanding and recognition.
- Applications to 3D modelling, video analysis, video surveillance, object recognition and vision based control will be discussed.

UNIT I IMAGE FORMATION 9

Geometric primitives and transformations – 2D transformations, 3D transformations, 3D rotations, 3D to 2D projections and lens distortion.

UNIT IIFEATURE DETECTION AND MATCHING 9

Points and patches – Feature detectors and descriptors – Edges – Detection and linking – Lines – Successive approximation, Hough transforms and vanishing points.

UNIT III SEGMENTATION 9

Active contours – Snakes, Scissors, level sets – Split and Merge – Watershed, region splitting, region merging, graph-based segmentation – Mean shifting and mode finding.

UNIT IV FEATURE BASED ALIGNMENT 9

2D and 3D feature based alignment – Alignment using least squares, Iterative algorithms, 3D alignment – Pose estimation algorithms – Geometric intrinsic calibration.

UNIT V TRACKING 9

Simple tracking strategies – Tracking using matching – Tracking linear dynamical models using Kalman filters – Data association – Particle filtering – The simplest particle filter.

Course Outcome:

After learning the course the students should be able to:

1. To implement fundamental image processing techniques required for computer vision
2. Understand Image formation process
3. To perform shape analysis
4. Extract features form Images and do analysis of Images
5. Generate 3D model from images
6. To develop applications using computer vision techniques
7. Understand video processing, motion computation and 3D vision and geometry

TEXT BOOKS:

1. Richard Szeliski, Computer Vision: Algorithms and applications, Springer, 2010.
2. David A.Forysyth & Jean Ponce, Computer Vision : A Modern Approach, Second Edition,Pearson, 2012.

2	**COURSE OUTCOMES : Students are able to**	
	CO-1	To implement fundamental image processing techniques required for computer vision
	CO-2	Understand video processing, motion computation and 3D vision and geometry
	CO-3	Extract features form Images and do analysis of Images

3 **MAPPING(CO's and PO's)**

Course Outcomes	ProgramOutcomes									
	1	2	3	4	5	6	7	8	9	10
1	2	3			1	3	2			
2			3		2	2	3			
3	3	2		2		3	3			

MAPPING(CO's and PSO's)

CourseOutcomes(CO)	ProgramSpecific Outcomes(PSO)	
	1	2
1	3	
2		3
3		

23PH1DE005– Mobile Computing

OBJECTIVES:

- To understand the basic concepts of mobile computing.
  - To learn the basics of mobile telecommunication system .
  - To be familiar with the network layer protocols and Ad-Hoc networks.
  - To know the basis of transport and application layer protocols.
  - To gain knowledge about different mobile platforms and application development.

UNIT I INTRODUCTION **9**

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA

UNIT II MOBILE TELECOMMUNICATION SYSTEM **9**

Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRSUMTS – Architecture – Handover - Security

UNIT III MOBILE NETWORK LAYER **9**

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

UNIT IV MOBILE TRANSPORT AND APPLICATION LAYER **9**

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

UNIT V MOBILE PLATFORMS AND APPLICATIONS **9**

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

OUTCOMES:

At the end of the course, the students should be able to:

- Explain the basics of mobile telecommunication systems
- Illustrate the generations of telecommunication systems in wireless networks
- Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
- Explain the functionality of Transport and Application layers
- Develop a mobile application using android/blackberry/ios/Windows SDK

TEXT BOOKS:

1. Jochen Schiller, ―Mobile Communications‖, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, ―Fundamentals of Mobile Computing‖, PHI Learning Pvt.Ltd, New Delhi – 2012

REFERENCES

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, ―Principles of Mobile Computing‖, Springer, 2003.
3. William.C.Y.Lee,―Mobile Cellular Telecommunications-Analog and Digital Systems‖, Second Edition,TataMcGraw Hill Edition ,2006.
4. C.K.Toh, ―AdHoc Mobile Wireless Networks‖, First Edition, Pearson Education, 2002.
5. Android Developers : http://developer.android.com/index.html
6. Apple Developer : https://developer.apple.com/
7. Windows Phone DevCenter : http://developer.windowsphone.com
8. BlackBerry Developer : http://developer.blackberry.com

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Explain the basics of mobile telecommunication systems
	CO-2	Explain the functionality of Transport and Application layers
	CO-3	Determine the functionality of MAC, network layer and Identify a routing protocol for a given Adhoc network

3 **MAPPING(CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1		2	3		3					
2	3			3						
3				2		2	3			

MAPPING (CO's and PSO's)

CourseOutcomes(CO)	ProgramSpecific Outcomes(PSO)	
	1	2
1		3
2	3	
3		2

23PH1DE006– Principles and Design of Sports Turf

UNIT I INTRODUCTION **9**

Turf grasses Biology and identification- Turf grass selection, Planting times and rates, soil preparation, Planting techniques, establishment, overseeding warm season fields, Soils and soil science, soil as a medium for turfgrass, soil for hard surfaces, fertility and fertilizers, nutrient requirements, nutrient uptake, soil reaction, fertilizer analysis, fertilizer sources, application rates and frequencies, micro nutrients.

UNIT II AERATION, MOWING AND IRRIGATION **9**

Aeration- Aeration for optimum Turf responses, aeration equipment, topdressing. Thatch-definition of thatch, advantages and disvantages of thatch in sports turf, how thatch develops, maintaining a managed thatch layer, reducing excessive thatch buildings, Mowing- types of mowers, Turf response, height and frequency, pattern, clipping removal, equipment and safety, chemical regulators. Irrigation – Irrigation and turf grass culture, general principles of turf grass irrigation, Portable irrigation systems, Installed irrigation systems.

UNIT III DRAINAGE

Drainage – Surface drainage, internal drainage, Installed drainage systems, Other drain system practices. Turf grass stresses and remedies, Mechanical stresses, environmental stresses, weeds, insects and disease, wise use of chemicals, the label is the law, Planning and performance applications, record keepings.

UNIT IV APPLICATION IN DIFFERENT FIELDS I **9**

Base ball and softball fields, Rugby, Lacrosse and Field hockey fields, Lawn Bowling Greens and croquet courts - Design, construction and reconstruction, renovation, maintenance and management procedures, Rules and regulations.

UNIT V APPLICATION IN DIFFERENT FIELDS I **9**

Tennis courts, Track and field facilities, sand volleyball courts, playgrounds, Bocce courts - Design, construction and reconstruction, renovation, maintenance and management procedures, Rules and regulations.

Total No.of Periods: 45

Reference

1 .Jim Puhalla, Jeff Krans, Mike Goatley, ”Sports Fields – A manual for design, construction and maintenance.” John Wiley and Sons

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understanding the sports turf and infrastructure for different sports events
	CO-2	Implementation of the sports infra for training and coaching
	CO-3	Aware of the application and physics in the sports turf

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	2			2	3			3		
2		1	3							2
3	2				2			3		

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes(PSO)	
	1	2
1	3	
2		2
3	3	

23PH1DE007– Polymer Engineering

UNIT I Introduction **9**

Importance of polymers in sports, types and Classification of polymers, Concept of functionality, Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD], various methods of determination of MWD.

UNIT II Kinetics and Mechanism: **9**

Polymerization Kinetics Free radical polymerization, Mechanism of Polycondensation Techniques of Polymerization and nanocomposites:

UNIT III Techniques of Polymerization and nanocomposites **9**

Techniques of polymerization, bulk, emulsion, suspension, Polymer composites and nano-composites.

UNIT IV Polymer Processing **9**

Methods of spinning for additive manufacturing: Wet spinning, Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting of polymers, Polymer processing techniques and the effect of these processing techniques on polymer structure,

UNIT V Designing of polymeric devices and application of polymers for Sports: 9

Aspects of designing polymeric devices and polymer additives, Polymers used for sports goods and equipment manufacturing: polyamide, PF resin, polyesters and case studies.

REFERENCES

1. F.W. Billmeyer Jr Text book of Polymer Science, Inter science Publisher John Wiley and Sons, 3rd edition 1999
2. G Odian Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4th edition, 2005
3. V.R. Gowarikar Polymer Science, , New Age Int., 2002

2	**COURSE OUTCOMES :Students are able to**	
	CO-1	Implementation of the polymer technology in the sports goods and equipment
	CO-2	Understanding the importance and manufacturing of the polymer
	CO-3	Manufacturing of the polymer sports goods and equipment
3	**MAPPING (CO's and PO's)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10

1		3	2							3
2	3		3	2	3		2		2	
3	3	2		3	2		3	2		

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	3
2		3
3	3	2

23PH1DE008– Surveying and Construction Materials

Course Objectives:

- To attain the better sound in development of the different sports facility and the infrastructure

UNIT I – INTRODUCTION AND CHAIN SURVEYING **9**

Definition - Principles - Classification - Field and office work - Scales - Conventional signs - Survey instruments, their care and adjustment - Ranging and chaining - Reciprocal ranging - Setting perpendiculars - well - conditioned triangles - Traversing - Plotting - Enlarging and reducing figures.

UNIT II – COMPASS SURVEYING, LEVELLING AND APPLICATIONS **9**

Prismatic compass - Surveyor's compass - Bearing - Systems and conversions - Local attraction - Magnetic declination - Dip - Traversing - Plotting - Adjustment of errors - Level line - Horizontal line - Levels and Staves - Spirit level - Sensitiveness - Bench marks - Temporary and permanent adjustments - Fly and check levelling - Booking - Reduction - Curvature and refraction - Reciprocal levelling - Longitudinal and cross sections - Plotting - Calculation of areas and volumes - Contouring - Methods - Characteristics and uses of contours - Plotting - Earth work volume

UNIT III – ENGINEERING SURVEYS **9**

Reconnaissance, preliminary and location surveys for engineering projects - Lay out - Setting out works - Route Surveys for highways, railways and waterways - Curve ranging - Horizontal and vertical curves - Simple curves - Setting with chain and tapes, tangential angles by theodolite, double theodolite - Compound and reverse curves - Transition curves - Functions and requirements - Setting out by offsets and angles - Vertical curves - Sight distances

UNIT IV – CONSTRUCTION MATERIALS I **9**

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacture of clay bricks – Tests on bricks – Compressive Strength - Water Absorption – Efflorescence –Bricks for special use – Refractory bricks

UNIT V**– CONSTRUCTION MATERIALS II** **9**

Cement and Concrete hollow blocks – Light weight concrete blocks -Lime – Preparation of lime mortar – Cement. Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Aggregates – Natural stone aggregates – Industrial by products – Crushing strength – Impact strength – Grading – Sand – Bulking .

Reference:

1) R. K. Rajput, "Engineering Materials", S. Chand & Company Ltd., 2000.
2) M. S. Shetty, "Concrete Technology (Theory and Practice)", S. Chand & Company

Ltd., 2003
3) Kanetkar T.P., Surveying and Levelling, Vols. I and II, United Book Corporation, Pune, 1994.
4) Punmia B.C. Surveying, Vols. I, II and III, Laxmi Publications, 1989

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand the significance of various kinds of tools used for development of sports facility and infrastructure
	CO-2	Apply various tools for development of different sports facility and infrastructure
	CO-3	Gain knowledge on construction materials to increase athlete performance and to avoid the injury.

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3	1		1						
2		3		2		3				1
3			3				2		2	

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	3	
2		2
3	2	

23PH1DE009– Reverse Engineering

Course Objective:

• Understand basic engineering systems.
• Understand the terminologies related to re-engineering, forward engineering, and reverse engineering.
• Disassemble products and specify the interactions between its subsystems and their functionality
• Understand Reverse Engineering methodologies.
• Understand Reverse engineering of Systems, Mechanical RE, Electronic RE, and Computer RE.

UNIT I Introduction to reverse engineering: 9

Reverse Engineering–The Generic Process Methodologies and Techniques for Reverse Engineering – The Potential for Automation with 3-D Laser Scanners, What Is Not Reverse Engineering, Computer-aided (Forward) Engineering, Computer-aided Reverse Engineering.

UNIT II Reverse Engineering–Hardware and Software: 9

Contact Methods Noncontact Methods, Destructive Method ,Computer Vision and Reverse Engineering, reverse engineering verses forward engineering

UNIT III Selecting a Reverse Engineering System: 9

The Selection Process, Some Additional Complexities, Point Capture Devices, Triangulation Approaches, "Time-of-flight" or Ranging Systems, Structured-light and Stereoscopic Imaging Systems, issues with Light-based Approaches, Tracking Systems, Internal Measurement Systems, X-ray Tomography, Destructive Systems, Some Comments on Accuracy, Positioning the Probe, Post processing the Captured Data, Handling Data Points, Curve and Surface Creation, Inspection Applications, Manufacturing Approaches

UNITIV Integration Between Reverse Engineering and Additive manufacturing 9

Modeling Cloud Data in Reverse Engineering, Data Processing for Rapid Prototyping, Integration of RE and RP for Layer-based Model Generation, he Adaptive Slicing Approach for Cloud Data Modeling, Planar Polygon Curve Construction for a Layer, Determination of Adaptive Layer Thickness

UNIT V Reverse Engineering in Sports, Medical, Automotive, Aerospace sectors: 9

Legal Aspects of Reverse Engineering: Copyright Law, Reverse Engineering, Recent Case Law Barriers to Adopting Reverse Engineering, case studies.

Outcomes:

1. The basic understanding of engineering systems. - Understanding the terminologies related to re-engineering, forward engineering, and reverse engineering.

2. The Understanding of Reverse Engineering methodologies. - Understanding of Reverse engineering of Systems, Mechanical RE, Electronic RE, and Computer RE.

REFERENCES

1. K. Otto and K. Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Prentice Hall, 2001.
2. Reverse Engineering: An Industrial Perspective by Raja and Fernandes, Springer-Verlag 2008.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	The basic understanding of engineering systems. - Understanding the terminologies related to re-engineering, forward engineering, and reverse engineering.
	CO-2	The Understanding of Reverse Engineering methodologies. - Understanding of Reverse engineering of Systems, Mechanical RE, Electronic RE, and Computer RE.

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3	3		3						
2			2	3		3		2		

MAPPING(CO'sandPSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	3	2
2	3	

23PH1DE010– Introduction to Embedded Systems

OBJECTIVES:

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in Various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one
- real-time operating system tool

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING 9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols -RS232 standard – RS422 – RS485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, ЧC/OS-II, RT Linux.

UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT 9

Case Study of Washing Machine- Automotive Application- Smart card System Application,.

TOTAL: 45

Course Outcomes:

1. Ability to understand and analyse, linear and digital electronic circuits.
2. Apply the concepts studied in sports engineering applications

TEXT BOOKS:

1. Rajkamal, ‘Embedded System-Architecture, Programming, Design’, Mc Graw Hill, 2013.
2. Peckol, “Embedded system Design”, John Wiley & Sons,2010
3. Lyla B Das,” Embedded Systems-An Integrated Approach”, Pearson, 2013

REFERENCES:

1. Shibu. K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill,2009.
2. Elicia White," Making Embedded Systems", O' Reilly Series,SPD,2011.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning,2009.
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Ability to understand and analyse, linear and digital electronic circuits.
	CO-2	Apply the concepts studied in sports engineering applications

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	2		2			3				
2		3		3	2			2		

MAPPING(CO'sandPSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		3
2	3	

23PH1DE011– Introduction to Internet of Things (IOT)

Objectives

- Describe what IoT is and how it works today
- Recognise the factors that contributed to the emergence of IoT
- Design and program IoT devices
- Use real IoT protocols for communication
- Secure the elements of an IoT device 6. Design an IoT device to work with a Cloud Computing infrastructure.
- Transfer IoT data to the cloud and in between cloud providers
- Define the infrastructure for supporting IoT deployments

UNIT I INTRODUCTION TO IoT 9

Introduction - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs- Health and lifestyle

UNIT II IoTand M2M **9**

Introduction-M2M –Difference between IoT and M2M –SDN and NFV for IoT-IoT System Management with NETCONF-YANG

UNIT III IOT PLATFORMS DESIGN METHODOLOGY **9**

Introduction- purpose and requirement specification- process, domain model, information model and service specification- IoT level, functional view, operational view specification- device and component integration- application development- case study on IoT system for weather monitoring

UNIT IVLOGICAL DESIGN USING PYTHON **9**

Installing python- python data types and data structures- control flow- function- modules – packages- file handling- date time operations- classes- python packages of interest for IoT

UNITV IOT PHYSICAL DEVICES AND ENDPOINTS **9**

Building blocks of an IoT device- Rasperry Pi- Linux on Raspberry Pi- Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

OUTCOMES:

Upon completion of the course, the students will be able to Identify and design the new models for market strategic interaction

- Design business intelligence and information security for WoB

- Analyze various protocols for IoT
- Design a middleware for IoT
- Analyze and design different models for network dynamics

REFERENCES:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
3. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Design business intelligence and information security for WoB
	CO-2	Analyze and design different models for network dynamics

3 **MAPPING(CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3					3	3		3	
2		2		3			2			

MAPPING(CO'sandPSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	3
2	3	3

23PH1DE012– Product Design and Development

OBJECTIVE

- The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

UNIT I INTRODUCTION 9

Modern Product development and design theories: Understanding the opportunity, Develop a concept, Implement a concept, Reverse engineering and redesign methodology. Product development process tools: Product development teams, Planning Process, Planning and scheduling tools.

UNIT II CUSTOMER NEEDS AND ANALYSIS 9

Understanding customer needs: Kano diagram of customer satisfaction, Prioritising Customer needs Establishing product function: Function analysis system technique, Function structure. Product tear down and experimentation: Tear down process, methods, applications, Post teardown reporting.

UNIT III BENCHMARKING AND CONCEPT GENERATION 9

Benchmarking and establishing engineering specifications:
Product Portfolios and portfolio Architecture: Portfolio architecture types and choice, Product modularity, Clustering.Generating concepts and concept selection: Information gathering, Brainstorming, TRIZ, Morphological Evaluation, Concept selection Process, Numerical Concept scoring.

UNIT IV CONCEPT EMBODEMENT 9

Concept embodiment: System modeling and embodiment principles. Modelling of Product metrics: Modelling approaches and case studies.

UNIT V DESIGN FOR ENVIRONMENT 9

Design for the environment: DFE methods, Life cycle assessment, Techniques to reduce environmental impact. Analytical and Numerical model solutions: Simulation and optimization techniques. Design for robustness: Robust Design model construction, methods.

OUTCOMES:

On completion of the course the student will be able to understand the integration of customer requirements in product design

Apply structural approach to concept generation, selection and testing

- Understand various aspects of design such as industrial design , design for manufacture , economic analysis and product architecture

REFERENCES

1. Kevin N. Otto, Kristin L. Wood, Product Design, Pearson Education, 2004.
2. Gahl, W Beitz J Feldhusun, K. G. Grote, Engineering Design, 3rd Edition, Springer 2007.
3. W. Ernest Eder, S. Hosendl., Design Engineering, CRC Press, 2008.
4. Ali K. Kamrani and Emad Abouel Nasr, "Engineering Design and Rapid Prototyping", Springer, 2010

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand various aspects of design such as industrial design , design for manufacture , economic analysis and product architecture
	CO-2	On completion of the course the student will be able to understand the integration of customer requirements in product design

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	1		3			3			2	
2		1	3	2			2			3

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	3	
2	2	2

23PH1DE013– Sports and Event Management

UNIT I INTRODUCTION **9**

Parameters and definition, history of sports, trends in sports paorticipation, pricing of sports participation, the economic impact of sports, sports clubs. Sports club's effectiveness, issues facing sport, trends affecting sports. The role and importance of sport in our society, the benefit of sports, the aim and objectgivees of sport, current issues, sports and society, sport and health.

UNIT II THE VOLUNTARY SECTOR AND LEADERSHIP **9**

Voluntary organizations, sports is a voluntary concept, voluntary ethos, voluntary sports organizations, management of sports organizations, the nature of voluntary organizations, organizsational structures and personalities, governing bodies volunteerism and change, voluntary commitment paid staff dynamic, to retain volunteers, the many roel of sports development officer. Leadership – Transactional or transroamationa, leadership qualities in sports situation. Partnership ana liasions, agenecies involved in sports.

UNIT III PEOPLE AND ORGANISATIONAL MANAGEMENT **9**

Performance appraisal, managing people, what makes a manager, staff app;raisal, staff motivation, delegation, communication, getting the right people, team building team development, personel management. The role of the sports manager, general management approaches, quality management, strategic management, measuring performance, the complexity of sports management, plannint, objectives, control, organizational changers, the management of change, decision making.

UNIT IV MANAGEMENT IN PRACTICE AND CHALLENGES **9**

Management process, financial management, legislation, management of safety, health and safety at work, managing support services, administration, the management of sport as a public service. Challenges – citizens charter, competition, best value, financial control, national standards, pressure for change, voluntary input and management, philosophical challenges, investors in people, leisure trusts, ageing facilities, performance indication.

UNIT V MARKETING, EVENT MANAGEMENT, EDUCATION AND TRAINING AND PERSONAL SKILLS **9**

Marketing ethics, maketing participation, implementing the marketing process, marketing activites, public relations, fund raising, sports spornsorship. Event management – Event feasibility, event planning, event requirements, characteristics of the best events, event evaluation. Education and training – Coaching awards, education versus training, sports management education, running sport, volunteering in sports. Personal Skills – Time management, time management action plan, managing meetings, meetings in practice, personal management.

Total No.of Periods : 45

Reference

1. Hans Westerbeek, Aaron Smith, Paul Turner, Paul Emery, Christine Green, Linda van Leeuwen "Managing Sport Facilities and Major Events", Routledge July 2006

2. David C Watt "Sports Management and Administration", Routledge, Taylor & Francis Group, 2003

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand various kinds of management concepts
	CO-2	Apply specific leadership styles different state
	CO-3	Modify suitable management skills for different sports event organization
3	**MAPPING (CO's and PO's)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3									
2										
3										

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	3	
2		
3		3

23PH1DE014– Additive Manufacturing Processes and Applications

Unit I Introduction **9**

Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM, AM process chain: Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build , removal and clean up, post processing.

Unit II Classification of AM processes and Design **9**

Liquid polymer system, discrete particle system, molten material systems, solid sheet system.Design for AM: Motivation, DFMA concepts and objectives, AM unique capabilities, Exploring design freedoms, Design tools for AM, Part Orientation, Removal of Supports, Hollowing out parts, Inclusion of Undercuts and Other Manufacturing Constraining Features, Interlocking Features, Reduction of Part Count in an Assembly, Identification of markings/ numbers etc.

Unit III AM process selection and applications **9**

Guidelines for process selection: Introduction, selection methods for a part, challenges of selection, example system for preliminary selection, production planning and control AM Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Sports, Aerospace, defense, automobile, Bio-medical and general engineering industries

Unit IV :Post processing of AM parts **9**

Post processing of AM parts: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.

Unit V Future Directions of AM **9**

Future Directions of AM: Introduction, new types of products and employment and digiproneurship. Current research on sports products.

REFERENCES

1. Chua Chee Kai, Leong Kah Fai, “Rapid Prototyping: Principles & Applications”, World Scientific, 2003.
2. Ian Gibson, David W Rosen, Brent Stucker., “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010
3. Ali K. Kamrani, EmandAbouel Nasr, “Rapid Prototyping: Theory & Practice”, Springer, 2006.
4. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Learning the foundation of additive manufacturing and applying in sports manufacturing process
	CO-2	Understanding the improvement of sports performance and injury prevention due to additive manufacturing process.
	CO-3	Exploring the R&D of additive manufacturing for sports goods

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3				3		2		3	
2			2	3	2		2			
3		2		2			3	2	3	3

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	2
2	2	1
3	3	2

23PH1DE015– CFD and FEM simulation for Sports Engineering

Unit 1. Introduction to engineering simulation **9**

History of engineering simulation - Why we need simulation - Experiment vs simulation - Need of Verification and validation - Problem solving through simulation - Simulation accuracy vs Experimental cost - challenges in sports

Unit 2. CFD Equations and Process **9**

Continuity equation, momentum equation, energy equation - Steps involved in the CFD - Equation of state - Navier stoke equation - Boundary condition - RANS, URANS, LES, DES - Introduction to discretisation - structured and unstructured Grid - Grid independent study - Types of errors in CFD - Verification and validation with case study - FDM VS FEM - Guide line and best practices in CFD

Unit 3. FEM Equations and Process **9**

Introduction to FEM - FEM governing equations - 1D FEM analysis - linear and quadratic bar elements - beam and frame elements - 2D FEM analysis - 3, 4 & 6 node elements - Natural coordination and transformation coordination

Unit 4. Heat transfer Simulation **9**

Introduction to Heat transfer Simulations - Types of heat transfer - heat transfer in fluid and related CFD Equations - heat transfer in solids and FEM 1D heat transfer problem.

Unit 5. CFD and FEM application in sports with case studies **9**

Sport's engineering CFD and FEM applications - Stadium and athletes CFD simulation case study - Sport ball and cycle crank FEM simulation case study - athletes helmet heat transfer Simulation case study - Simulation documentation

Text Books

1. An Introduction to Computational Fluid Dynamics: The Finite Volume Method Book by H. K. Versteeg and W. Malalasekera
2. TEXTBOOK OF FINITE ELEMENT ANALYSISTextbook by P. SESHU

References

3. A Hands-on Introduction to Engineering Simulations - https://www.edx.org/course/a-hands-on-introduction-to-engineering-simulations
4. Routledge Handbook of Sports Technology and Engineering. Edited By Franz Konstantin Fuss, Aleksandar Subic, Martin Strangwood, Rabindra Mehta

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Learning the FEM and CFD foundational equation for the simulation
	CO-2	Understanding and implementing the FEM and CFD for the Sports performance improvement and equipment manufacturing
	CO-3	In building the practical knowledge in FEM and CFD for industry readiness and for R&D

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3	2		2		3	3	1	2	3
2		3	3	2			2	1	2	
3			3		3			1	3	3

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes(PSO)	
	1	2
1	3	
2	3	2
3		1

23PH1DE016– Motor Sports Application

UNIT I SPORTS INJURY 9

Definition and meaning of sports injury – Classification of injuries. Definition, Causes, Features, Management and Prevention of the following injuries : Contusion – Abrasion – Laceration – Sprain – Strain – Fracture – Subluxation – Dislocation – Punctured wounds – Heat Cramp – Heat exhaustion – Heat Stroke – Frost Bite.

UNIT II INFECTIVE DISORDERS IN SPORTS 9

Infection – Types of infection – Mode of transmission – Definition, Causative Organism, Signs & Symptoms , Management and Prevention of Common Cold – Amoebiasis – Salmonellasis – Tetanus - Typhoid – Cholera – Tuberculosis - Malaria - Filariasis – Hepatitis B - Hepatitis A - AIDS.

UNIT III FIRST AID IN SPORTS 9

Definition of first aid - Qualities of good first aider - Principles of first aid - Contents of first aid box - Safety and accident prevention in sports – Definition, types and management of Shock - First aid measures in Head injury and Spine Injury, Bleeding, Burns, Drowning, Epilepsy, Electrical shock – Cardio Pulmonary Resuscitation.

UNIT IV SPORTS INJURY REHABILITATION 9

Principles of injury prevention – Warm up and cool down – Stretching – Static, Dynamic, Ballistic, PNF stretching. Principles of rehabilitation – Muscle conditioning – Flexibility – Proprioceptive sports skills – Cardiovascular fitness – Progression and stages of rehabilitation. Physiotherapy – Exercise Therapy, Electrotherapy, Hydrotherapy, Massage Therapy, Manual Therapy.

UNIT V PROTECTIVE EQUIPMENTS IN SPORTS 9

Protective Equipments – Materials used – Helmets – Protective Equipments of Face – Neck Protection – Shoulder pads – Rib and flank pads – Chest protection – Hip pads –Thigh Pads – Knee protection – Shin Guards – Ankle braces – Hand pads – Footwear – Orthotics and Prosthetics in sports.

Total No. of periods : 45

References :

1. Lars Peterson and Per Renstron: Sports Injuries – Their prevention and treatment, Dunitz.
2. Richard B. Birrer: Sports Medicine for the primary care Physician, CRC Press.
3. Bahr, Clinical Guide to Sports Injuries – Human Kinetics
4. Norris, Sports injuries Diagnosis and Management - Butterworth
5. Brukner and Khan: Clinical Sports Medicine, McGraw Hill.
6. Reed: Sports Injuries – Assessment and Rehabilitation, W.B. Saunders

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand various kinds of sports injuries and its prevention
	CO-2	Acquire knowledge on different protective device on sports equipments

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	2			1			1			
2		2	3			2	2		1	

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	
2		2

23PH1DE017– Wind Engineering for Sports

Objectives:

- Understanding the wind importance and effect in the sports and infrastructure
- Understand the building aerodynamics
- Effect of wind in the sports performance

Unit 1 - Introduction to Wind Engineering **9**

Wind science - atmosphere composition and layers - wind and aerodynamics - wind classification - wind atmosphere boundary layer - ground level measurements.

Unit 2 - Wind action and effect of structure **9**

Evolution of suspension bridge, skycrapter and tower - Design wind speed - Building aerodynamics - Dynamic response to turbulent wind - vortex shedding - galloping - flutter

Unit 3 - Wind measurements in sports and Boundary layer wind tunnel **9**

Measurements of wind speed in sports (100m sprint and long jump) - Effect of wind in the different stadium in running track - ultrasonic anemometer - Wind tunnel - ABL Wind tunnel

Unit 4 - Wind effect in the sports **9**

Effect of wind in the 100 m sprint - wind effect in the field sports - need of indoor stadium

Unit 5 - Wind Engineering Infrastructure and Arena **9**

Building aerodynamics - wind effect on sports infrastructure (long span roof and long High Poles) - stadium cross ventilation - wind comfort and pollution - bioclimatic city planning and architecture

Outcome

1. Optimization of the sports athletes performance from the wind effect
2. Applying the wind science to design the effective and efficient sports infrastructure

Reference

1. Wind Science and Engineering: Origins, Developments, Fundamentals and Advancements (Springer Tracts in Civil Engineering) written by Giovanni Solari
2. MOOC :- Sports and Building Aerodynamics by Eindhoven University of Technology https://www.coursera.org/

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Optimization of the sports athletes performance from the wind effect
	CO-2	Applyingthewindsciencetodesigntheeffectiveandefficientsportsinfrastructure
3	**MAPPING (CO's and PO's)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3			2	2		2	1	2	3
2		3		3	2	3		1	2	

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	1
2	1	3

23PH1DE018- APPLICATIONS OF STATISTICS IN SPORTS

Course Objectives:

- To attain the skill in applying the maths especially statistics in the different sports to predict the success and maximum chance of winning technique.

UNIT I STATISTICS IN FOOTBALL **9**

Introduction use of sports in teaching statistics . Football articles, Geometry model for NFL fixed goal kickers .predictions for NFL games via linear – model methodology , probability of winning a football game

UNIT II STATISTICS IN BASEBALL **9**

Introduction to baseball articles – exploring baseball hitting data – player game percentage, estimation with selected binomial information – progress of the score during a baseball game

UNIT III - STATISTICS IN BASKETBALL **9**

Introduction to basketball articles – Improved NCAA basketball Tournament modeling via point spread and team strength information, probability models for basketball tournaments

UNIT IV – STATISTICS IN ICE HOCKEY & MISCELLANEOUS SPORTS **9**

Introduction to ice hockey articles – statistical methods for rating college hockey teams ,deciding ties in hockey rating skating, estimating the effect of a red card in soccer, heavy defeats in tennis – psychological momentum or random effect.

UNIT V – STATISTICAL METHODOLOGIES AND MULTIPLE SPORTS **9**

Introduction to the methodologies and multiple sports articles, bridging different Eras in sports, Data analysis using stein's estimator and its generalizations, assigning probabilities to outcomes of multi – entry competitions, basketball, baseball and the null hypothesis lessons from sports statistics, TQM in athletic performance, Brownian motion model for the progress of sports scores.

Total No. of Periods: 45

Course Outcomes:

- Application of statistics in different games
- Detailed in depth understand of statistics in sports

Reference :

1. Jim Albert, Jay Bennett, James J.cochran, "Anthology of statistics in sports" – Cambridge university press – 2005
2.Jim Albert, "Teaching statistics using baseball", mathematical association of America

1. Jim Albert, Jay Bennett, “Curve Ball Baseball statistics and the role of chance in the game” Springer - 2005

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Acquire the knowledge of basic statistics concepts and planning aspects
	CO-2	Apply TQM in athletic performance
	CO-3	Derive mathematical model for different sports activities and assess the reliability of the modeled sports activities
	CO-4	Apply the knowledge of reliability and planning concepts to the practical and real time systems.
3	**MAPPING (CO’s and PO’s)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3	2								
2		3								
3			3		2		1			
4				3		3	2			

MAPPING (CO’s and PSO’s)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	3	
3		3
4	2	

23PH1DE019– Aerodynamics in Automobile

Objectives

- To understand the sports car design and vehicle aerodynamics in sports race.
- To understand the Aerodynamics of different vehicles

Unit 1. Introduction to Basic concepts **9**

Introduction to aerodynamics - 1-D frictionless flow (venturi, pitot tube, orifice, nozzle and injector) - high Reynolds number flow and turbulence - Types of drag - drag in different shape - lifting surface - effect of Reynolds number in drag and lift.

Unit 2. Automobile Aerodynamics **9**

Ground effect, Generic automobile shape and vortix, Downflow and vehicle performance, Expected results in CFD, wind tunnel and road (measurements techniques)

Unit 3. Aerodynamics devices and vehicle example **9**

Variable and adaptive devices, passenger car, pickup truck, motorcycle, comparative cars and open wheel race cars

Unit 4. Automobile Aero - Acoustic **9**

Introduction - sound as pressure wave - sound loudness scale - 1D linear wave equation - sound radiation, transmission, reflection, absorption - vortex sound - buffeting - sound and flow control.

Unit 5 Supersonic Aerodynamics - high speed cars **9**

Compressible flow - Normal shock equation- expansion and oblique shock relations - flow over a wedge and cone - Detached shock wave - supersonic nozzle - turbojet engine - thrust SSC land speed record

Outcome

- To design a power efficient and less drag race cars for Sports
- To design environmental friendly race car with less Emission and sound.

Reference

1. Automotive Aerodynamics Book by Joseph Katz
2. Fundamentals of Aerodynamics Book by John D. Anderson
3. Meet the fastest cars in the world 20 years after Thrust SSC's land speed record By Craig Glenday
Published 15 October 2018
https://www.guinnessworldrecords.com/news/2018/10/meet-the-fastest-cars-in-the-world-20-years-after-thrust-sscs-land-speed-record-544103

2	**COURSEOUTCOMES: Students are able to**	
	CO-1	To design a power efficient and less drag race cars for Sports
	CO-2	To design environmental friendly race car with less Emission and sound.

3 **MAPPING(CO'sandPO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	2	3	2	3	2		1	2		
2	3	1	3	2			3	2	3	3

MAPPING(CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	3
2	1	3

23PH1DE020– Soil and Ground Improvement Techniques

Course Objectives:

- To aware of the different sports surface engineering technique for the good performance of the athlete and to avoid the sports injury.

UNIT 1 SOIL PROPERTIES **9**

Soil formation – Geotechnical engineering – Soil formation – Soil profile. Soil Composition –Water content determination – Determination of specific gravity of solids. Index properties of soil – Shape and size of particle –Shrinkage ratio - Volumetric shrinkage – Atterberg indices – Classification of soil.

UNIT II – PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES **9**

Role of ground improvement in foundation engineering – methods of ground improvement – Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

.

UNIT III – DEWATERING **9**

Dewatering Techniques - Well points – Vacuum and electroosmotic methods – Seepage analysis for two – dimensional flow for fully and partially penetrated slots in homogeneous deposits (Simple cases only).

UNIT IV – INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS **9**

In-situ densification of cohesion-less soils and consolidation of cohesive soils: Dynamic compaction Vibroflotation, Sand compaction piles and deep compaction. Consolidation: Preloading with sand drains, and fabric drains, Stone columns and Lime piles-installation techniques only – relative merits of above methods and their limitations - stabilization of expansive soils.

UNIT V – GROUT TECHNIQUES **9**

Types of grouts – Grouting equipments and machinery – injection methods – Grout monitoring – stabilization with cement, lime and chemicals.

Referance:

1. Purushothama Raj, P.Ground Improvement Techniques, Laxmi Publications (P) Ltd. New Delhi, 1999.
2. Koerner, R.M. Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill, 1994.
3. Moseley, M.P., Ground Improvement Blockie Academic and Professional, Chapman and Hall, Glassgow, 1998.

4. Jones J.E.P. Earth Reinfocement and Soil Structure, Butterworths, London, 1985

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand various kinds of soils and ground improvement technique and its properties
	CO-2	Aware of the different sports surface engineering technique for the good performance of the athlete and to avoid sports injury.
	CO-3	Apply ground improvement techniques to improve players performance

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3	2								
2	3	3								
3			3	2		3	1			

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	3	
2		
3		2

List of Generic Elective Courses Offered for other Department Students

Course code	Course	Teaching Scheme			Credits	Marks		Total Marks
		Th	Tuto	Lab		IN	EX	
23PH1GE001	Fundamentals of Sports Technology	**3**	**0**	**0**	**3**	**25**	**75**	**100**
23PH1GE002	Intellectual Properties rights	**3**	**0**	**0**	**3**	**25**	**75**	**100**
23PH1GE003	Design of Experiments and Research Applications	**3**	**0**	**0**	**3**	**25**	**75**	**100**
23PH1GE004	Industrial Safety	**3**	**0**	**0**	**3**	**25**	**75**	**100**
23PH1GE005	Physics of Sports	**3**	**0**	**0**	**3**	**25**	**75**	**100**

23PH1GE001- FUNDAMENTALS OF SPORTS TECHNOLOGY

Course Objectives:

At the end of the course, students will be able to:
Appreciate the different technological advances available for application in sports domain.

UNIT I SPORTS TECHNOLOGY BASIC CONCEPTS 9

History of Engineering in Sports, The relationship between sports engineering and sports science, need , scope and objectives , advantages and applications of Sports Technology, Sports Technology terminologies, carrier opportunities.

UNIT II IMPACT OF ENGINEERING IN SPORTS 9

Concepts of human engineering , Impact of various modern technologies in Materials engineering, role of technology in equipments design and development, importance of Ergonomics in sports equipments. Recent technological advancements in various sports goods.

UNIT III COMPUTER AND INSTRUMENTATION IN SPORTS 9

Role and importance of computer and instrumentation technology in various sports, computer simulation for sports, applications and advantages, video technology, hawk-eye technology in sports.

UNIT IV VARIOUS ENGINEERING APPLICATIONS IN SPORTS 9

Aerodynamics and sports applications, Nano technology and its sports applications, sensor technology and its sports applications, software based sports performance analysis, Sport analytics, and Internet of Things.

UNIT V BUSINESS AND RESEARCH APPLICATIONS IN SPORTS ENGINEERING 9

Entrepreneurial skills and business opportunities in sports, Research opportunities in sports technological research, Recent Research trend in various sports equipment design, ball sports, tennis racket technology, and water sports, various Sports Engineering research groups, and journals in sports technology.

Course Outcomes:

Students will be able to appreciate the opportunities available in the domain of sport technology, innovation and entrepreneurship, and be able to act upon it.

Reference.

1. An overview of sports engineering: history, impact and research, Zahari Taha, Mohd Hasnun Arif , Hassan Anwar P.P., Abdul Majeed , Mohd Azri, Aris Nina, Nadia Sahim, Movement, Health & Exercise, 2, 1-14, 2013
2. Ross, S. (2012). Sports technology. Mankato, Minn: Smart Apple Media.
3. Fuss, F. K. (2014). Routledge handbook of sports technology and engineering. New York: Routledge.
4. Ciletti, D., & Chadwick, S. (2012). Sports entrepreneurship: Theory and practice. Morgantown, WV: Fitness Information Technology.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Acquire knowledge on • Sports Science and Sports Engineering • Applications of Engineering in Sports
	CO-2	Understand engineering concepts and techniques used in different sports .
	CO-3	Understand business opportunities in sports engineering.
3	**MAPPING (CO's and PO's)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3									
2	3	2					1		2	
3		3								1

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	
2		1
3	3	

23PH1GE002 INTELLECTUAL PROPERTIES RIGHTS

UNIT 1: **3**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

UNIT 2: **3**

International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT 3: **3**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT 4: **3**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc.

UNIT 5: **3**

Traditional knowledge Case Studies, IPR and IITs.

References:

Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

Mayall , "Industrial Design", McGraw Hill, 1992.

Niebel , "Product Design", McGraw Hill, 1974.

Asimov , "Introduction to Design", Prentice Hall, 1962.

Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

2	**COURSE OUTCOMES: Students are able to**	
	CO1	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
	CO2	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
	CO3	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3	2								
2	3	3				2				
3				2		3			2	1

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	
2		2
3	3	1

23PH1GE003- DESIGN OF EXPERIMENTS AND RESEARCH APPLICATIONS

Course Objectives:

• To impart knowledge about Design of Experiments, Taguchi's Methods and Robust Design.

UNIT- I: INTRODUCTION **9**

Importance of experiments, experimental strategies, Planning of Experiments- Experimental design-basic principles of Experimental design, terminology, steps in experimentation, sample size, normal probability plot, Simple linear regression models, Analysis of variance (ANOVA) – one way and two way.

UNIT- II: SINGLE FACTOR EXPERIMENTS **9**

Completely randomized design, Randomized block design, Latin square design, Statistical analysis and estimation of model parameters, model adequacy checking, pair wise comparison tests.

UNIT-III: MULTIFACTOR EXPERIMENTS **9**

Two and three factor full factorial experiments, Randomized block factorial design, Experiments with random factors, rules for expected mean squares, approximate F- tests. 2K factorial Experiments.

UNIT- IV: ROBUST DESIGN PROCESS **9**

Classical design of Experiments- Taguchi's design of experiments –Comparison of classical and Taguchi' approach- Factor selection-variability due to noise factors- Principle of robustization, classification of quality characteristics and parameters, objective function in robust design, S/N ratios.

UNIT- V: TAGUCHI METHODS AND PRODUCT / PROCESS OPTIMIZATION **9**

Orthogonal Arrays, Variable data analysis, Robust design- control and noise factors, S/N ratios, parameter design, Multi-level experiments, Inner and outer OA experiments, Optimization using S/N ratios, attribute date analysis, a critique of robust design.

Course Outcomes:

• At the end of the course students can able to apply Design of Experiments, Taguchi's Methods and Robust Design techniques in research.

Reference

1. Krishnaiah, K. and Shahabudeen, P. Applied Design of Experiments and Taguchi Methods, PHI learning private Ltd., 2012.

2. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, Eighth edition, 2012.

3. Nicolo Belavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.

4. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.

5. Montgomery, D.C., Design and Analysis of Experiments, Minitab Manual, John Wiley and Sons, Seventh edition, 2010

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Acquire knowledge on • Design of Experiments • Taguchi's Methods and • Robust Design techniques.
	CO-2	Understand Design of Experiments, Taguchi's Methods and Robust Design techniques in research
	CO-3	Apply Design of Experiments, Taguchi's Methods and Robust Design techniques in research
3	**MAPPING (CO's and PO's)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3	2								
2		2	3	3						
3				3		3			2	1

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	
2		1
3	1	2

23PH1GE004- INDUSTRIAL SAFETY

Lecture: - 3 h/week

Course objectives:

- To aware of the safety procedure during accident and the maintenance of the machinery and the production sit to avoid the accident.

UNIT-I: INDUSTRIAL SAFETY 9

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II: FUNDAMENTALS OF MAINTENANCE ENGINEERING 9

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III: WEAR AND CORROSION AND THEIR PREVENTION 9

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, workingand applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV: FAULT TRACING 9

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V: PERIODIC AND PREVENTIVE MAINTENANCE 9

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1.Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2.Maintenance Engineering, H. P. Garg, S. Chand and Company.

3. Pump-hydraulic Co mpressors, Audels, Mcgrew Hill Publicat ion.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Acquire knowledge on • Industrial safety • Maintenance engineering
	CO-2	Apply safety and the maintenance to avoid the accident and injury.
	CO-3	Plant efficiency improved

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	3						1			1
2		3						1	3	
3			3			1		1		

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		3
2	2	
3	3	2

23PH1GE005 PHYSICS OF SPORTS

Objectives

- To understand the Physics begin the sports action and apparels

Unit 1 Physics Foundation

Measurements and units - fundamental and derived quantity - S.I unit system - Theory of error - Types of error - error reduction - rules of significant figures and round off - Dimensional formula - Kinematics: rest and motion - types of motion - Distance and displacement - velocity and acceleration - Relative velocity - average acceleration - Equation of motion under gravity: falling object, vertically throwing upward - Projectile motion: Horizontal and angular projection - Circular motion.

Unit 2 law of motion, Work, power and energy

Newton's laws of motion - application of Newton law in sports - 2 body contact in horizontal surface - Motion of connected bodies - Lami's theory - conservation of momentum - impulse - Friction - centrifugal and centripetal force

Unit 3 Physics of Field and track sports

Physics of sprint take off and running aerodynamics - wind and altitude effect in the 100 m sprint - Physics of shot put - Physics of high jump

Unit 4 Physics of ball sports

Basic fluid flow - Reynolds number - laminar and turbulent - boundary layer - cricket ball swings - golf ball dimple effect - football banana shot

Unit 5 Physics of water and winter sports

Water resistance, Physics of swimming and sailing- Physics of skiing and ice hockey

Outcome

- Applying the Physics concepts to the sports for coaching and Analysis
- Increasing the athletic performance using Physics

Reference

1. For the love of Physics by Walter Lewin
2. An introduction to Physics of sports by VassiliosMacInnes.
3. The Physics Of Sports
https://www.real-world-physics-problems.com/physics-of-sports.html

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Applying the Physics concepts to the sports for coaching and Analysis
	CO-2	Increasing th eathletic performance using Physics

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	2	3	2		2		1	1		
2		3		3		3	2	2	3	

MAPPING(CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	3	1
2	3	2

AUDIT COURSE 1 & 2

Course code	Course	Teaching Scheme			Credits
		Th	Tuto	Lab	
23PH1SE101	English for Research Paper Writing	2	0	0	0
23PH1SE102	Disaster Management	2	0	0	0
23PH1SE103	Sanskrit for Technical Knowledge	2	0	0	0
23PH1SE104	Value Education	2	0	0	0
23PH1SE105	Constitution of India	2	0	0	0
23PH1SE106	Pedagogy Studies	2	0	0	0
23PH1SE107	Stress Management by Yoga	2	0	0	0
23PH1SE108	Personality Development through Life Enlightenment Skills.	2	0	0	0
23PH1SE109	Professional Ethics in Engineering	2	0	0	0

23PH1SE101: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:

Students will be able to:

1.Understand that how to improve your writing skills and level of readability
2.Learn about what to write in each section
3.Understand the skills needed when writing a Title
4.Ensure the good quality of paper at very first-time submission

Syllabus

Units	Content	Hrs
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	4
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.	4
5	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4
6	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4

Suggested Studies:

1.Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Improve your writing skills and level of readability
	CO-2	Understand what to write in each section
	CO-3	Submit good quality of paper at very first-time

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	1						3			2
2		2		3					2	
3				3		3				

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	
2		2
3		

23PH1SE102 : DISASTER MANAGEMENT

Course Objectives:

Students will be able to:

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Syllabus

Units	Content	Hrs
1	Introduction Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	**Repercussions Of Disasters And Hazards:** Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	4
3	**Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4
4	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	4
5	**Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment,Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4
6	**Disaster Mitigation**	4

	Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand key concepts in disaster risk reduction and humanitarian response.
	CO-2	Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
	CO-3	Understand the strengths and weaknesses of disaster management approaches.

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	2								2	1
2		2							3	2
3		3						2		1

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		3
2	2	
3		2

23PH1SE103 SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives :

1.To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2.Learning of Sanskrit to improve brain functioning
3.Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
4.The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Syllabus

Units	Content	Hrs
1	• Alphabets in Sanskrit, • Past/Present/Future Tense, • Simple Sentences	8
2	• Order • Introduction of roots • Technical information about Sanskrit Literature	8
3	• Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	8

Suggested reading

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understanding basic Sanskrit language
	CO-2	Ancient Sanskrit literature about science & technology can be understood
	CO-3	Being a logical language will help to develop logic in students

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1								2		2
2								2	2	
3						2				1

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2		3
3		

23PH1SE104: VALUE EDUCATION

Course Objectives

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Syllabus

Units	Content	Hrs
1	• Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. • Moral and non- moral valuat ion. Standards and principles. • Value judgements	4
2	• Importance of cultivation of values. • Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. • Honesty, Humanity. Power of faith, National Unity. • Patriotism. Love for nature ,Discipline	6
3	• Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. • Punctuality, Love and Kindness. • Avoid fault Thinking. • Free from anger, Dignity of labour. • Universal brotherhood and religious tolerance. • True friendship. • Happiness Vs suffering, love for truth. • Aware of self-destructive habits. • Association and Cooperation. • Doing best for saving nature	6
4	• Character and Competence –Holy books vs Blind faith.	6

	• Self-management and Good health. • Science of reincarnation. • Equality, Nonvio lence , Humilit y, Role of Women. • All religions and same message. • Mind your Mind, Self-control. • Honesty, Studying effectively	

Suggested reading

1 Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Knowledge of self-development
	CO-2	Learn the importance of Human values
	CO-3	Developing the overall personality

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1								3	1	1
2						1			2	2
3								2		3

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	
2		2
3		2

23PH1SE105: CONSTITUTION OF INDIA

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus

Units	Content	Hrs
1	**History of Making of the Indian Constitution:** • History • Drafting Committee, (Composition & Working)	4
2	**Philosophy of the Indian Constitution:** • Preamble • Salient Features	4
3	**Contours of Constitutional Rights & Duties:** • Fundamental Rights • Right to Equality • Right to Freedom • Right against Exploitation • Right to Freedom of Religion • Cultural and Educational Rights • Right to Constitutional Remedies • Directive Principles of State Policy • Fundamental Duties.	4
4	**Organs of Governance:** • Parliament • Composition • Qualifications and Disqualifications • Powers and Functions • Executive • President • Governor • Council of Ministers • Judiciary, Appointment and Transfer of Judges, Qualifications • Powers and Functions	4

5	**Local Administration:** • District's Administration head: Role and Importance, • Municipalities: Introduction, Mayor and role of Elected • Representative, CEO of Municipal Corporation. • Pachayati raj: Introduction, PRI: Zila Pachayat. • Elected officials and their roles, CEO Zila Pachayat: Position and role. • Block level: Organizational Hierarchy (Different departments), • Village level: Role of Elected and Appointed officials, • Importance of grass root democracy	4
6	**Election Commission:** • Election Commission: Role and Functioning. • Chief Election Commissioner and Election Commissioners. • State Election Commission: Role and Functioning. • Institute and Bodies for the welfare of SC/ST/OBC and women.	4

Suggested reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Acquire knowledge about • fundamental of Indian constitution • Constitutional Rights & Duties:
	CO-2	Understand civil and economic rights and social justice in India
	CO-3	Acquire knowledge about • Local Administration • Election commission

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1							2	3		
2									3	2
3									3	1

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	2	
2		2
3	2	

23PH1SE106: PEDAGOGY STUDIES

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Syllabus

Syllabus

Units	Content	Hrs
1	**Introduction and Methodology:** • Aims and rationale, Policy background, Conceptual framework and terminology • Theories of learning, Curriculum, Teacher education. • Conceptual framework, Research questions • Overview of methodology and Searching.	4
2	**Thematic overview:** Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. • Curriculum, Teacher education.	2
3	• Evidence on the effectiveness of pedagogical practices • Methodology for the in depth stage: quality assessment of included studies. • How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? • Theory of change. • Strength and nature of the body of evidence for effective pedagogical practices. • Pedagogic theory and pedagogical approaches. • Teachers' attitudes and beliefs and Pedagogic strategies.	4
4	• Professional development: alignment with classroom practices and follow-up support • Peer support • Support from the head teacher and the community. • Curriculum and assessment • Barriers to learning: limited resources and large class sizes	4
5	**Research gaps and future directions** • Research design • Contexts • Pedagogy • Teacher education	2

	• Curriculum and assessment • Dissemination and research impact.	

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, PryorJ, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf

.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
	CO-2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
	CO-3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
3	**MAPPING (CO's and PO's)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	1									2
2		2					1			
3								2	2	

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2

1	2	
2		2
3	2	3

23PH1SE107 : STRESS MANAGEMENT BY YOGA

Course Objectives:

1. To achieve overall health of body and mind
2. To overcome stress

Syllabus

Units	Content	Hrs
1	• Definitions of Eight parts of yog. (Ashtanga)	8
2	• Yam and Niyam. Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	8
3	• Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects- Types of pranayam	8

Suggested reading

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Develop healthy mind in a healthy body thus improving social health also.
	CO-2	Improve efficiency.

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1				2				2	3	1
2				2		2				

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		3
2	3	

23PH1SE108 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives:

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Syllabus

Units	Content	Hrs
1	• Neetisatakam-Holistic development of personality • Verses- 19,20,21,22 (wisdom) • Verses- 29,31,32 (pride & heroism) • Verses- 26,28,63,65 (virtue) • Verses- 52,53,59 (dont's) • Verses- 71,73,75,78 (do's)	8
2	• Approach to day to day work and duties. • Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, • Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, • 23, 35, • Chapter 18-Verses 45, 46, 48.	8
3	• Statements of basic knowledge. • Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 • Chapter 12 -Verses 13, 14, 15, 16,17, 18 • Personalit y o f Ro le model. Shrimad Bhagwad Geeta: • Chapter2-Verses 17, Chapter 3-Verses 36,37,42, • Chapter 4-Verses 18, 38,39 • Chapter18 – Verses 37,38,63	8

Suggested reading

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,Rashtriya Sanskrit Sansthanam, New Delhi.

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life .
	CO-2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity .
	CO-3	Study of Neetishatakam will help in developing versatile personality of students.

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1								2	2	2
2								1	2	3
3								2	2	3

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	3	
3		3

23PH1SE109: PROFESSIONAL ETHICS IN ENGINEERING

COURSE OBJECTIVES

- Provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues
- To provide knowledge about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards, Exposure to Safety and Risk, Risk Benefit Analysis
- To Have an idea about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee
- To Have an adequate knowledge about MNC's, Business, Environmental, Computer Ethics, Honesty, Moral Leadership, sample Code of Conduct.

UNIT I HUMAN VALUES

Concepts on morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV COMMERCIAL AWARENES

Commercial awareness and business acumen, Planning ahead and future proofing, Professional self-awareness, Data analysis and manipulation

UNIT V GLOBAL ISSUES

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

REFERENCES :

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, (2000).

3. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
4. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003)
5. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001)
6. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
7. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University *Press, (2003)*

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	The students will understand the basic perception of profession, professional ethics, various moral & social issues, industrial standards, code of ethics and role of professional ethics in engineering field.
	CO-2	The students will aware of professional rights and responsibilities of an engineer, responsibilities of an engineer for safety and risk benefit analysis.
	CO-3	The students will acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.
3	**MAPPING (CO's and PO's)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1							1	2	3	
2									3	2
3									3	2

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1		
2	3	2
3	1	3

List of Value Added Courses Offered to All Department Students

Course code	Course	Teaching Scheme			Credits	Marks		Total Marks
		Th	Tuto	Lab		IN	EX	
23PH1VA001	Software Application in Match Analysis (Theory and Practical)	**3**	**0**	**6**	**6**	**50**	**150**	**200**
23PH1VA002	Ms Excel for Sports science (Theory and Practical)	**3**	**0**	**6**	**6**	**50**	**150**	**200**
23PH1VA003	Practical Application of LaTeX (Theory and Practical)	**3**	**0**	**6**	**6**	**50**	**150**	**200**

23PH1VA001 Software Application in Match Analysis

Unit 1: Introduction to Match Analysis **9**
Match Analysis - Rules, notation and variable of the Cricket, Volley ball and Basketball Match - Case study: Score sheet for any sports in university

Unit 2: Match Analysis in Excel **9**
Introduction to Excel - Creating the tagging table in the Excel sheet - Case Study: Tagging in Excel any international matches (Cricket, volleyball, football and basketball)

Unit 3: Dartfish tagging panel creation **9**
Introduction to Dartfish - Panel creation and key features

Unit 4: Tagging the match **9**
Case Study: Tagging in Dartfish any international matches (Cricket, volleyball, football and basketball)

Unit 5: Documentation and presentation **9**
Dartfish analysis - Exporting the data in Excel - Analysing the data through graphs comparison of the 2 teams - Presentation the post match Analysis

Reference
1. How to Code Sport with Microsoft Excel
https://thevideoanalyst.com/code-sport-microsoft-excel/
2. Dartfish feedback and support
https://support.dartfish.tv/support/solutions/folders/27000053999
3. Excel for Analysts
http://thevideoanalyst.com/courses/excel-for-analysts/
4. Handbook of Soccer Match Analysis: A Systematic Approach to Improving Performance Book by A. Mark Williams, Christopher Carling, and Thomas Reilly

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Understand the concept of Match Analysis and analyse the matches
	CO-2	Gain indepth knowledge about DartFish by video analysis by which Performance of the players can be studied
3	**MAPPING (CO's and PO's)**	

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1	1						2	2	2	

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes(PSO)	
	1	2
1	2	
2		2

23PH1VA002 Ms Excel for Sports science

Objective

- Implementation of the MS Excel Analysis skill in the Sports data

Unit 1: Basic Excel operation **9**

Introduction to Excel - creating and saving spreadsheet - Basic formula's - Sum, Average, Count, CountTA, IF, TRIM, Max & Min, Case study - collecting sports information from the class students and perform the formula

Unit 2: Database in Excel **9**

Database - Collecting sports Database from the Google form - filters operation - DAVERAGE - DCOUNT - DCOUNTA - DGET - DMAX - DMIN - DPRODUCT - DSTDEV - DSYSEVP - DSUM - DVAR - DVARP - Case study: Analysing the Database of the sports event

Unit 3: Analysis through charts **9**

Bar chart - column chart - pictograph - line graph - pie.
chart - area chart - XY graphs - Histogram - Case study: Analysis the the sports performance of the class students

Unit 4: Advanced Analysis **9**

Pivot table, VLOOKUP, XLOOKUP, Tool park in excel Case study: performance of Sports Retail store

Unit 5: Documentation and presentation **9**

Microsoft excel in cloud, Google spreadsheet, E-mailing the data, presentation of the data and output analysis, Case study: 3 Students in group will Presentation of the sports project using Excel

Outcome

- Understanding the MS EXCEL formulas and tool for sports data analysis
- Implementation for charts and graphs to represent the data output for Analysis documentation and presentation

Reference

1. Excel 2019 Bible
Book by John Walkenbach, Michael Alexander, and Richard Kusleika
2. Excel for dummies Book by Greg Harvey
3. Statistical Sports Models in Excel book by Andrew Mack

2	**COURSEOUTCOMES:Studentsareableto**	
	CO-1	Understanding the MS EXCEL formulas and tool for sports data analysis
	CO-2	Implementation for charts and graphs to represent the data output for Analysis documentation and presentation

3 **MAPPING(CO'sandPO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1			1	2	3		2	3	2	
2				3	2	3	3	2	1	

MAPPING(CO'sandPSO's)

Course Outcomes (CO)	Program Specific Outcomes (PSO)	
	1	2
1	3	3
2	2	2

23PH1VA003 Practical application of LaTeX

Objective

1. To learn the LaTeX programming for the report and documentation for research

Outcome

1. Research thesis and journals can be created through LaTeX software

List of Experiments

1 - Report writing
2 - Letter writing
3 - Mathematical typesetting
4 - Equations and Numbering equation
5 - Tables and figures
6 - Presentation using Beamer
7- Bibilography
8 - Feedback diagram with maths

Outcome

1. Research thesis and journals can be created through LaTeX software

Reference

1. Latex Document Preparation System Users
Book by Leslie Lamport
2. ITB Spoken tutorial https://spoken-tutorial.org/

2	**COURSE OUTCOMES: Students are able to**	
	CO-1	Research thesis and journals can be created through LaTeX software

3 **MAPPING (CO's and PO's)**

Course Outcomes	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
1							3	3	2	

MAPPING (CO's and PSO's)

Course Outcomes (CO)	Program Specific Outcomes(PSO)	
	1	2
1	2	
2		3