B.Tech. Electrical Engineering (New Scheme)

Semester III

S. No.	Course Category	Course Title	Course Code	Lecture (L)/Tutorial (T)/Practical (P) per week			Credit
				L	T	P	
1.	IC	Machine Learning and Data Analytics	CSIC221	3	0	2	4
2.	PC	AC Machines	EEPC201	3	0	0	3
3.		Analog and Digital Electronics	EEPC202	3	0	0	3
4.		Generation, Transmission and Distribution	EEPC203	3	0	0	3
5.		Signals and Systems	EEPC204	3	0	0	3
6.		Network Synthesis and Filters	EEPC205	3	0	0	3
7.		Linear System Theory	EEPC206	3	0	0	3
8.	Lab	Computational Techniques Lab	EEPC207	0	0	3	1
9.	NC	NCC/Sports/Yoga	SWNC101	0	0	4	2*
10.		NSS/Club/Technical Societies	SWNC102	0	0	4	2*
Total				**18**	**0**	**5**	**23**

*(to be awarded at the end of 6th semester based on Cumulative performance upto 6th semester)

Semester IV

S. No.	Course Category	Course Title	Course Code	Lecture (L)/Tutorial (T)/Practical (P) per week			Credit
				L	T	P	
1.	IC	Mathematics III	MAIC203	3	0	0	3
2.	PC	Control Systems	EEPC208	3	0	0	3
3.		Power System Analysis	EEPC209	3	0	0	3
4.		Power Electronics-I	EEPC210	3	0	0	3
5.		DC and Synchronous Machines	EEPC211	3	0	0	3
6.		Measurement and Instrumentation	EEPC212	3	0	0	3
7.	Lab	Analog and Digital Electronics Lab	EEPC213	0	0	3	1
8.		Electrical Machines Lab	EEPC214	0	0	3	1
9.		Measurement and Instrumentation Lab	EEPC215	0	0	3	1
10.	NC	NCC/Sports/Yoga	SWNC101	0	0	4	2*
11.		NSS/Club/Technical Societies	SWNC102	0	0	4	2*
Total				**18**	**0**	**9**	**21**

*(to be awarded at the end of 6th semester based on Cumulative performance upto 6th semester)

#After the end of 4th semester, students will have two-month internship/Industrial Training program of one credit. The viva voce examination will be conducted in 5th semester.

Course Code	:	CSIC 221
Course Title	:	Machine Learning & Data Analytics
Number of Credits and L/T/P scheme	:	4 & 3/0/2
Prerequisites (Course code)	:	Problem solving & Programming using C
Course Category	:	IC (CE, EE, ECE, ME, PIE, IIOT, M & C)

Course Learning Objectives:

1. The major goal of the course is to allow computers to learn (potentially complex) patterns from data, and then make decisions based on these patterns.
2. To provide strong foundation for data science and application area related to it.
3. To provide the underlying core concepts and emerging technologies in data science.
4. A data scientist requires an integrated skill set spanning mathematics, probability and statistics, optimization, and branches of computer science like databases, machine learning etc.

Course Content

1. **Introduction to Data Science:** What is Data Science? Linear algebra for datascience:- algebraic and geometric view, Data Representation & Statistical Inference:- Data objects and attribute types, Types of Data, descriptive statistics, notion of probability, distributions, mean, variance, covariance, Understanding univariate and multivariate normal distributions.
2. **Data Analysis:** Probability and Random Variables, Correlation, Regression, Attribute Transformation, Sampling, Feature subset selection, Similarity measures, High-dimensional Data: - Curse of Dimensionality, Dimensionality reduction: PCA, SVD, etc.
3. **Data Visualization, Bayesian Learning& Evaluating Hypotheses:** Basic principles, Scalar, Vector, & Tensor Visualization, Multivariate Data Visualization, Text Data Visualization, Network Data Visualization, Visualization Techniques, Bayesian Approach, Bayes' Theorem, Evaluating Hypotheses- Z-test, T-test, Chi-square Test.
4. **Machine Learning (Supervised & Unsupervised Learning):** Basic concepts of Classification, k-Nearest Neighbor, Decision Tree classification, Naïve Bayes' Classifier, Linear Regression Models, Logistics Regression, Basic concepts of Clustering, K-means, Hierarchical Clustering, DBSCAN.

Text Books:

1. U Dinesh Kumar and Manaranjan Pradhan, Machine Learning using Python, John Wiley & Sons,2020.
2. Cathy O 'Neil and Rachel Schutt., Doing Data Science, Straight Talk From The Frontline, O 'Reilly. 2014.
3. Ethem Alpaydin, Introduction to Machine Learning, Second Edition, PHI, 2010.

Reference Books:

1. T. Hastie, R. Tibshirani and J. Friedman., The Elements of Statistical Learning, Second Edition, Springer, 2009.
2. Christopher M. Bishop F.R.Eng., Pattern Recognition and Machine Learning, Springer, 2006.
3. J. Grus., Data Science from Scratch, Second Edition,O'Reilly. 2019.
4. Douglas C. Montgomery, George C. Runger., Applied Statistics and Probability for Engineers, Third Edition, John Wiley & Sons, Inc., 2003.
5. Tom M.Mitchell, Machine Learning, McGraw-Hill International Edition, 1997.

Course Outcomes

1. Explore the fundamental concepts of data science and machine learning.
2. Understand the processes of data science - identifying the problem to be solved, data collection, preparation, evaluation and visualization.
3. Understand data analysis techniques for applications handling large data.
4. Visualize and present the inference using various tools.
5. Understand various machine learning algorithms used in data science process.

Program Core (Semester III)

ELECTRICAL ENGINEERING DEPARTMENT

EEPC201 AC MACHINES

Pre-requisite: PHIC12

L	T	P	Credits	Total contact hours
3	**0**	**0**	**3**	**42**

Brief description:
Aims to give a basic understanding of AC machines fundamentals, machine parts and helps to gain the skills for operating AC machines. This course also equips students with ability to understand and analyze single-phase transformer and induction motor and three-phase transform and induction motor along with their applications.

Course Content

(12)

Unit – I
Single-Phase Transformer: Transformer construction, Ideal and practical trans former, exact and approximate equivalent circuits, no load and on load operation, phasor diagrams, power and energy efficiency, voltage regulation, parallel operation, effect of load on power factor, Per Unit system, excitation phenomenon in transformers, switching transients, Auto transformers, Variable frequency transformer, voltage and current transformers, welding transformers, Pulse transformer and applications.

(10)

UNIT-II
Three-Phase Transformer: Three Phase Transformers Constructional features of three phase transformers, cooling methodology, Standard and special transformer connections, Phase conversion, Parallel operation of three phase transformers, three winding transformers and its equivalent circuit, On load tap changing of transformers, Modern trends in transformers, Type and routine tests, Standards.

(12)

UNIT-III
Three-Phase Induction Machines: Types of induction motor, flux and mmf waves, development of circuit model, power across air gap, torque and power output, OC and SC tests, circle diagram, starting methods, cogging and crawling, speed control, deep bar/ double cage rotor, induction generator, induction machine dynamics, high efficiency induction motors.

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UNIT-IV **(8)**

Single-Phase Induction Machines: Introduction, single phase induction motors, double revolving field theory, circuit model of single phase induction motor, determination of circuit parameters and case study of MATLAB based problems of Electrical Machines.

References/Textbooks:

1. Arthur Eugene Fitzgerald and Charles Kingsley, 'Electric Machinery', Tata McGraw Hill Education Publications
2. Miller, T.J.E., 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press.
3. P.S. Bhimbra, 'Electrical Machinery', Khanna Publications.
4. Nagrath, I.J. and Kothari, D.P., 'Electrical Machines', Tata McGraw Hill Education Private Limited Publishing Company Ltd.
5. M. G. Say, 'Performance and Design of Alternating Current Machines', CBS Publishers & Distributors Pvt. Ltd., New Delhi

Course outcomes:

On successful completion of the course, students will be able to

CO1: Analyze the merit of single and three phase transformers with respect to different performance index

CO2: Examine the different operating conditions of single and three phase transformers for standalone and parallel operation

CO3: Recommend a suitable starting and speed control method for a specific polyphaser induction motor

CO4: Compare the merits and demerits of several single-phase and fractional kW machines

ELECTRICAL ENGINEERING DEPARTMENT

EEPC202 ANALOG & DIGITAL ELECTRONICS

Pre-requisite: EEPC101

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief Description: The objectives are to acquire the basic knowledge of analog and digital logic levels and application of knowledge to understand analog and digital electronics circuits. Also to prepare students to perform the analysis and design of various analog and digital electronic circuits.

Course Content

Unit -I **(10)**

BJT BIASING: DC Biasing Voltage divider bias Self bias emitter bias, AC Biasing, R_E model, Amplifiers: Class A, Class B, Class C& Class D, Push Pull amplifier.

UNIT-II **(12)**

OP-AMP: OP-AMP characteristics, Non-Inverting/Inverting Amplifier. Linear and Non-Linear OP-AMP circuits, Regulated power supplies. Oscillators- Barkhausen criteria of oscillations, Wein-bridge, RC oscillator.

UNIT-III **(10)**

Number System, Logic gates, K-map reduction techniques, Introduction combinational circuits, Design of half adder and full adder, Introduction to sequential circuit, Flip-flop (RS JK D &T)

UNIT-IV **(10)**

555 timer: its monostable and astable operation, Schmitt triggers, Sample and hold circuits, A/D and D/A converters, Low pass filter, High pass filter, Counter & Register. Case study of simulation circuits.

References/Textbooks:

1. Millman and Halkias, "Integrated Electronics", Mc Graw Hill. 2nd Edition,2017.
2. R. Boylested and L. Nashelsky, "Electronics Devices and Circuits", Prentice Hall India.10th Edition 2009.
3. Millman and Halkias, "Electronics Devices and Circuits", TMH 4th Edition 2015.

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4. Malcolm Goodge, "Analog Electronics Analysis and Synthesis", TMH Edition.
5. Malvino, "Electronics Principles", TMH 7thEdition 2017
6. AP Malvino and DP Leach, 'Digital Principles and applications' TMH, 8th Edition, 2014
7. Charles Roth, 'Fundamentals of Logic Design'. Wadsworth Publishing, 5th Edition, 2005.

Course Outcomes

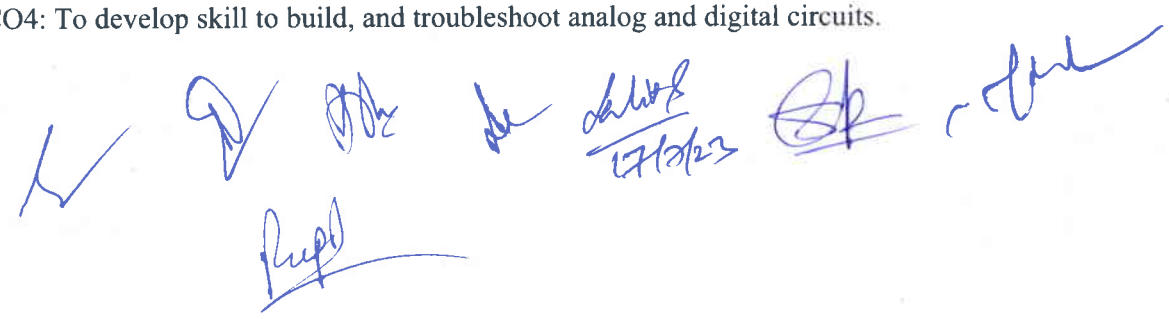
On successful completion of the course, students will be able to

CO1: Have a thorough understanding of the fundamental concepts and techniques used in analog and digital electronics.

CO2: To understand and examine the structure of various number systems and its application in digital design.

CO3: The ability to understand, analyze and design various combinational and sequential circuits.

CO4: To develop skill to build, and troubleshoot analog and digital circuits.



ELECTRICAL ENGINEERING DEPARTMENT

EEPC203 GENERATION, TRANSMISSION AND DISTRIBUTION

Pre-requisite: EEPC101

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief Description:
The course aims to provide fundamental knowledge about the power system, generation, transmission, and distribution.

Course Content

Unit-I: Introduction to Power System **(12)**

Layout of an Electrical Power System, Present Energy resources in India, Single Phase Transmission, Three-Phase Transmission, Complex Power, AC power flow analysis, active and reactive power flow, Per Unit System, Types and Characteristics of loads, Connected load, Maximum demand, Demand factor, Diversity factor, Load Duration Curve, Choice and Sizing and Number of Generating Units, Effect of load variation of power plant operation, Base load and peak load plants, Cost of Electrical Energy: Fixed cost, Cost of energy, and Consumer cost.
Uses, Principle, main parts, operation and control of Hydro Power stations, Steam Power Plants, Nuclear Power Plants, Geothermal Power Plants and Gas Turbine Power Plants
Coordination of Hydroelectric, Steam Stations, Run Off Plant, Pumped Storage Plant (in combinations)

Unit-II: Power Generation and Transmission System Performance **(14)**

Generic Structure of Transmission Tower, Resistance, Inductance calculation: Two wire transmission line, GMD, GMR calculations, Composite conductor, double circuit lines, bundled conductors, conductor Transposition, capacitance calculations in one wire, three phase, and double circuit line, Effect of earth on capacitance, Skin and Proximity Effect, Performance evaluation of Short, Medium and Long Transmission Lines, voltage regulation and efficiency, Ferranti Effect. Sag and tension calculation in levelled and unlevelled span, Dampers, Effects of wind and ice loading. disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Disadvantages of corona, interference between power and Communication lines.

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Unit-III: Architecture of Distribution System **(7)**

Radial Network, Ring Network, Mesh network, A.C and D.C. distribution system, AC distribution system: Three phase three wire, three phase four wire system, DC System: DC two wire and three wire system.

Unit-IV: Overhead Line Insulators and Insulated Cables **(9)**

Types of Insulators, Potential Distribution in suspension insulators, Methods of equalizing the potential, Types of cables, insulation resistance, potential gradient, capacitance of single core and three core cables, Impedance of under-ground lines, concentric and tape shielded cables, shunt admittance of overhead and underground distribution lines.

Application of software for calculation of transmission line electrical and mechanical parameters, distribution system calculations and cable performance evaluation

References/Textbooks:

1. C.L. Wadhwa, Electrical Power Systems, 7th Edition, New Age International, 2016.
2. J. D. Glover, M. S. Sarma, T. Overbye Power System Analysis and Design, Cenage Learning, 2022
3. D.P. Kothari and I.J. Nagrath, Power System Engineering-- Tata McGraw-Hill Pub. Co., New Delhi, 3rd Edition, 2019.
4. M.V. Deshpande, Elements of Electrical Power Station Design, Third Edition, Wheeler Pub.2001
5. Singh, Sri N. Electric power generation: transmission and distribution. PHI Learning Pvt. Ltd., 2008.
6. W. D. Stevenson, Elements of Power System Analysis, Fourth Edition (Indian edition), McGraw Hill, 2002.
7. C.L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, 3rd Edition, New Age International, 2015.
8. B. R. Gupta, Generation of electrical energy. S. Chand Publishing, 2017.
9. https://nptel.ac.in/courses/108/102/108102047/
10. https://nptel.ac.in/courses/108/107/108107112/

Course Outcomes

On successful completion of the course, students will be able to

CO1 Understand the basics of power generation systems, concept of active and reactive power, and per unit system

CO2 Determine the electrical and mechanical parameters of transmission lines and study the effect of corona

CO3 Understand the basic operation and architecture of power distribution system

CO4 Examine line insulators and Underground Cables.

ELECTRICAL ENGINEERING DEPARTMENT

EEPC204 SIGNALS AND SYSTEMS

Prerequisites Courses: MAIC11, MAIC12, EEPC101

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief Description:
This course is a fundamental course for Electrical Engineers to acquire the skills to handle the ever-increasing automation in the different domains of Electrical Engineering. This course includes an introduction to analog and digital signals and systems that forms an integral part of engineering systems in many diverse areas of Engineering. The course presents and integrates the basic concepts for both continuous-time and discrete-time signals and systems for both time and frequency domains along with their applications in sustainable technologies with the help of several case studies from Indian knowledge system.

Course Contents:

Unit-I **(10)**

Basic definitions and terminology, Classification of signals and systems, Continuous-time and discrete-time signals, Signal operations: shifting, scaling, and reversal, System properties: linearity, time-invariance, causality, stability

Unit -II **(10)**

Continuous and discrete time LTI systems: response using convolution integral/sum, Properties of LTI systems, Modeling of continuous and discrete time LTI systems.

Fourier series: representation of continuous and discrete time periodic signals, convergence, properties, Application to LTI systems, Fourier transform: introduction, representation of continuous and discrete time aperiodic and periodic signals, convergence, properties, Application to LTI systems.

Unit -III **(12)**

Laplace transform and its inverse, region of convergence, relation with Fourier transform, properties, Application to LTI systems, their interconnections and block diagram.

Z-transform and its inverse, region of convergence, relation with Fourier transform, properties, Application to LTI systems, their interconnections and block diagram.

Unit -IV **(10)**

Sampling of continuous time signals; sampling theorem, reconstruction, effect of under sampling.

Applications of Signals and Systems in various sustainable technologies, case studies from the Indian knowledge system.

References/Textbooks:

1. Alan V. Oppenheim, S. Hamid and Alan S. Willsky, Signals and Systems, PHI/Pearson.
2. M. J. Roberts, Signals and Systems, TMH
3. A. Papoulis, Circuits and Systems: A Modern Approach, Oxford Univ. Press
4. R.F. Ziemer, W.H. Tranter and D.R. Fannin, Signals and Systems: Continuous and Discrete, Pearson
5. Simon Haykins and Barry Van Veen, Signals and Systems, Wiley
6. Fred J. Taylor, Principles of Signals and Systems, TMH

Course Outcomes:

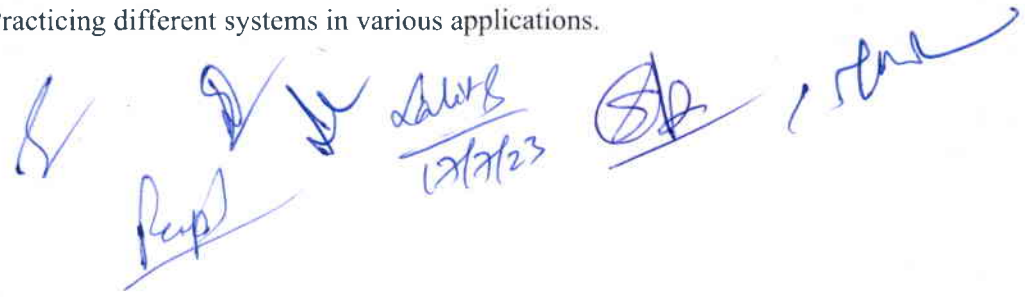
On successful completion of the course, students will be able to

CO1 Characterize and analyze the properties of CT and DT signals and systems

CO2 Represent CT and DT systems in the Frequency domain using Fourier analysis tools like CTFS, CTFT, DTFS and DTFT.

CO3 Analyze CT and DT systems using Laplace transforms and Z Transforms.

CO4 Practicing different systems in various applications.



ELECTRICALENGINEERING DEPARTMENT

EEPC205 NETWORK SYNTHESIS & FILTERS

Pre-requisite: EEPC101

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief Description:
The course has two parts Synthesis and filters. In the synthesis part, the students will learn to obtain a network from a given network function. And in the filter part, the students will learn the basic concepts & design of constant K, m derived & active filters. They will also use these concepts in solving some real-world Engineering problems.

Course Contents:

Unit I **(8)**
Fundamental concepts: Network functions, Positive real functions, Hurwitz polynomials, Basic synthesis technique.

Unit II **(12)**
Synthesis of one port network functions with two kinds of elements – Foster and Cauer forms for LC, RC & RL immittance functions. Certain RLC function realizations. Fundamental of two port synthesis.

Unit III **(12)**
Passive filters: Analysis and design of constant k and m derived low pass, high pass, band pass, and band stop filters.

Unit IV **(10)**
Theory of active filters, filter functions definitions & specifications, the realization of active low pass & high pass filters. Maximally flat filters. Cascading of filters – Butterworth and Chebyshev filters. Frequency transformations.

Case study and simulations.

References/Textbooks:
1. Van Valkenburg M.E., —Introduction to Modern Network Synthesis, Wiley Eastern, 1960 (reprint 1986).

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2. Van Valkenburg M.E, Network Analysis, Prentice Hall India, 2014.
3. Abhijit Chakraborti, "Circuit theory: Analysis and synthesis", Dhanpat Rai & Company, 2007.
4. F. F. Kuo, "Network analysis and Synthesis," Wiley International Edition, 2008
5. Steve Winder, "Analog & Digital filter design,"2nd Edition, Newnes, Elsevier Science, 2002

Course Outcome:

On successful completion of the course, students will be able to

CO1 Determine whether the given driving function can be synthesized or not

CO2 Obtain one/two-port networks from the given network function

CO3 Understand & design different passive filters

CO4 Understand and design active filters and implement the course contents in real-life problems.

ELECTRICAL ENGINEERING DEPARTMENT

EEPC206 LINEAR SYSTEM THEORY

Pre-requisite: MAIC11, PHIC11, MAIC12, PHIC12, EEPC101

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief Description:
The course aims to introduce conceptualization of linear systems as natural extension to system of simultaneous linear equations. The course provides applications of linear algebra results to describe, analyze and manipulate linear systems via state space representation. Introduces ways to convert nonlinear systems into an approximate linear behavior.

Course Contents:

Unit I **(10)**
Linear systems as set of linear equations / linear differential equations, Matrices as linear systems, Gaussian algorithm, Vector spaces and subspaces, linear combinations and linear independence, basis and dimensions, linear transformations, kernel and image, Eigenvalues and Eigenvectors, characteristic equation, diagonalization, complex eigenvalues, applications to image transformations.

Unit II **(12)**
Inner products spaces and concept of orthogonality, orthogonal projections, Gram-Schmidt procedure, least square problems and applications to linear systems, systems as operators, introduction to norms, signals and systems norms, Symmetric matrices, diagonalization, quadratic forms and constrained optimization problems, application to system examples.

Unit III **(10)**
Linear system properties, stability, LTI systems, state space representation of LTI systems, linearizing nonlinear systems, linear parameter varying systems, state space representation of simple electric circuits, state space realization of LTI systems, similarity transformations, Jordan form, non-uniqueness of state space representation, free and forced response, Cayley-Hamilton theorem.

Unit IV **(10)**

Program Core Labs (Semester III)

ELECTRICAL ENGINEERING DEPARTMENT

EEPC207 COMPUTATIONAL TECHNIQUES LAB

Pre-requisite:

L	T	P	Credits	Total contact hours
0	0	3	1	42

Laboratory experiments will be based upon the corresponding theory course CSIC13, EEPC101. Updated list of experiments will be floated by the course coordinator before the beginning of each semester.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1 Understand the MATLAB software syntax and will be able to use it for solving various Engineering problems.

CO2 Understand the numerical methods to compute the roots of nonlinear algebraic equations.

CO3 Solve the differential equations using various numerical methods.

CO4 Able to simulate linear systems and implement various kinds of operational amplifiers.

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Evaluation criterion for NCC Cadets

Following criterion is proposed to be adopted for the evaluation of NCC cadets for the practical course of NCC/NSS/Yoga

A: Internal Evaluation (During semester):

(i) Attendance:	20 marks (for 90 % attendance full marks)
(ii) Discipline:	10 Marks
(iii) Drill performance & Body bearing:	10 marks
(iv) Participation in social activities:	10 marks
(v) Domain knowledge:	10 marks (Through oral viva)

B: End sem evaluation: (At the end of the semester)

(i) Discipline:	10 Marks
(ii) Drill performance & Body bearing:	15 marks
(iv) Domain knowledge:	15 marks (Through oral viva)

C: After end of the 6^{th} semester: Bonus marks 10 for each B & C certificate is proposed to be added in final marks subject to total marks does not exceed 100

NATIONAL CADET CORPS

INSTITUTIONAL TRAINING SYLLABUS

INTRODUCTION

1. Institutional Training being conducted in the Colleges and Schools is the principal means of training in the NCC. The aim of the training is to nurture core values, enhance awareness and give exposure to basic military skills and knowledge. Emphasis will be on practical training. Case studies, wherever possible will be used to facilitate active participation and better assimilation. Examples from India's freedom struggle and wars fought by India, post-independence, should supplement relevant subjects to generate secular and patriotic fervor. The instructors and the cadets must grasp the importance of this training and participate actively.

2. **Principles of Training:** In keeping with the changing environment, the principles of NCC Training are:
   (a) Junior Division (JD)/Junior Wing (JW) to be for two years while Senior Division (SD)/Senior Wing (SW) will be for three years.
   (b) Separate syllabi for JD/JW and SD/SW.
   (c) Modified, syllabus for professional educational institutes of repute to encourage enrolment of cadets.
   (d) Revised curriculum for training in a military environment with greater emphasis on soft skill development, awareness of social responsibilities and adventure and sports.
   (e) Uniformity in syllabus for boys and girls.
   (f) Common syllabus for all three wings to be approximately 60 to 70% and Specialised Service Syllabus training will be 30 to 40%.
   (g) Emphasis on practical training.
   (h) Conduct of periodic composite training ensuring continuity for better learning assimilation and its application.

3. Common subjects will comprise about 70% of the periods and Specilalised Service Subjects will be 30%. The breakdown of periods are as under:-

Sr. No.	Subject	No. of Periods			
		First Year	Second Year	Third Year	Total
Senior Division/Wing					
(a)	Common Subject	66	72	72	210
(b)	Specilised Subject	24	33	33	90
	Total	**90**	**105**	**105**	**300**

Junior Division/Wing

(c)	Common Subject	85	85		170
				--NA—	
(d)	Specialised Subject	35	35		70
	Total	**120**	**120**		**240**

4. In addition to this syllabus, **State Directorates** will conduct Social Service Activities in the form of rallies of any nature to carry social messages in the form of posters, street plays, placards etc.

Legend	
Abbreviation	Type
L	Lecture
D	Demonstration
DI	Discussion
P	Practice
V	Video

BLOCK SYLLABUS

COMMON SUBJECTS: SD/SW (ALL WINGS)

Sr. No.	Subject	1st Year	2nd Year	3rd Year	Total Periods
1.	The NCC	03	00	00	03
2.	National Integration and Awareness	06	06	06	18
3.	Drill	16	19	08	43
4.	Weapon Training	12	10	10	32
5.	Personality Development & Leadership	10	15	20	45
6.	Disaster Management	03	03	04	10
7.	Social Awareness & Community Development	05	05	06	16
8.	Health & Hygiene	05	04	07	16
9.	Adventure	02	06	07	15
10.	Environment Awareness and Conservation	02	02	02	06
11.	Obstacle Training	02	02	02	06
Total		**66**	**72**	**72**	**210**

BLOCK SYLLABUS

SPECIALISED SUBJECTS: SD/SW (ARMY)

Sr. No.	Subject	1st Year	2nd Year	3rd Year	Total Periods
1.	Armed Forces	04	04	02	10
2.	Map Reading	07	08	09	24
3.	Field Craft & Battle Craft	05	07	09	21
4.	Introduction to infantry Weapons & Equipment	02	04	05	11
5.	Military History	03	05	05	13
6.	Communication	03	05	03	11
Total		**24**	**33**	**33**	**90**

BLOCK SYLLABUS

SPECIALISED SUBJECTS: SD/SW (AIR)

Sr. No.	Subject	1st Year	2nd Year	3rd Year	Total Periods
1.	General Service Knowledge	02	02	02	06
2.	Air Compaigns	00	02	04	06
3.	Aircraft Recognition	00	04	00	04
4.	Modern Trends	00	00	02	02
5.	Principles of Flight	03	04	03	10
6.	Airmanship	06	02	02	10
7.	Navigation	00	03	02	05
8.	Meteorology	00	01	04	05
9.	Aero-Engines	01	04	01	06
10.	Airframes	02	02	02	06
11.	Instruments	02	03	02	07
12.	Aircraft Particulars	02	00	00	02
13.	Aeromodelling	06	06	09	21
Total		**24**	**33**	**33**	**90**

BLOCK SYLLABUS

SPECIALISED SUBJECTS: SD/SW (NAVY)

Sr. No.	Subject	1st Year	2nd Year	3rd Year	Total Periods
1.	Naval Orientation	08	06	03	17
2.	Naval Warfare and its Components	00	04	03	07
3.	Naval Communication	03	04	01	08
4.	Navigation	00	06	03	09
5.	Searmanship				
	(a) Anchor Work	01	01	00	02
	(b) Rigging	03	00	00	03
	(c) Boat Work	04	05	01	10
6.	Fire Fighting, Flodding and Damage Control	00	02	02	04
7.	Ship and Boat Modelling	02	03	14	19
8.	Search and Rescue	01	00	01	02
9.	Swimming	01	03	05	09
Total		**24**	**33**	**33**	**90**

Syllabus and Evaluation Scheme of Physical Education & Sports
Compulsory for up to B.Tech 6th Semester Students

Course Code: SWNC101	**L**	**T/P**	**C**
Course Title: Sports	**0**	**4**	**2**

Course Objective

Physical Education and Sports develop confidence, contributing to academic performance and mental health. Physical activity is a great way to relieve stress, promoting positive physical and mental health and enhanced learning aptitude. The class duration of 90 minutes will be divided into 02 segments comprising of Units 1 and 2.

- First 30 minutes of the class will be an interactive session where the students will be oriented and introduced to the different aspects of Physical Education and Sports.
- In the next 60 minutes of the class every students shall practice different skills and techniques of Athletics comprising of Track and Field events or any other specific games/sports of their choice.

Syllabus

Unit 1

Introduction to Physical Education

- Meaning & definition of Physical Education
- Aims & Objectives of Physical Education

Sports awards and honours

- Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)

Olympic Movement

- Ancient & Modern Olympics (Summer & Winter)
- Olympic Symbols, Ideals, Objectives & Values

Physical Fitness, Wellness & Lifestyle

- Meaning & Importance of Physical Fitness
- Components of Physical fitness
- Components of Health related fitness Meaning & Importance of Wellness, Components of wellness
- Preventing Health Threats through Lifestyle Change
- Concept of Positive Lifestyle: Importance of Balance Diet etc.

Fundamentals of Anatomy & Physiology in Physical Education and Sports

- Define Anatomy, Physiology & Its Importance
- Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.)

Kinesiology, Biomechanics & Sports

- Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports
- Biomechanical principles & its application in sports. (Laws of motion, Friction, Projectile etc.)

Postures

- Meaning and Concept of Postures.
- Causes of Bad Posture.
- Advantages & disadvantages of weight training.
- Concept & advantages of Correct Posture. Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis, Corrective Measures for Postural Deformities

Training and Planning In Sports

- Meaning of Training
- Warming up and limbering down
- Skill, Technique & Style

Psychology & Sports

- Definition & Importance of Psychology in Physical Edu. & Sports
- Define & Differentiate Between Growth & Development
- Adolescent Problems & Their Management
- Emotion: Concept, Type & Controlling of emotions
- Meaning, Concept & Types of Aggressions in Sports.

Doping

- Meaning and Concept of Doping
- Prohibited Substances & Methods
- Side Effects of Prohibited Substances

Sports Medicine

- First Aid – Definition, Aims & Objectives.
- Sports injuries: Classification, Causes & Prevention and Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries

Unit-2

(Practical-Sports Specific) Each student has to compulsorily opt for one game/sport so that he/she can be assessed on their performance in the same accordingly for all the 03 years.

Each student will be given practical knowledge about the basic fundamentals of various games and sports and Athletic Events be it Track or Field thereby developing the skill.

Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball etc.

1. History of the Game/Sport.
2. Latest General Rules of the Game/Sport.
3. Specifications of Play Fields and Related Sports Equipment.
4. Important Tournaments and Venues.
5. Sports Personalities.
6. Proper Sports Gear and its Importance

REFERENCE BOOKS:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Health and Physical Education – NCERT

Distribution of Marks: Total 100 (10+30+20+40)

1. Class Attendance / Punctuality –	10 marks
2. Active Participation Sports Related Activities - (CITIUS, RUN FOR Unity, Prabhat Pheri etc.)	30 marks
3. Viva/Subject Knowledge-	20 marks
4. Practical Exam at the end of 6th Sem (Modified Fitness Test)-	40 marks

Note – PWD Students will be exempted from taking part in physical activities and the Modified Physical Fitness Test.

Syllabus and Evaluation Scheme of Yog
Compulsory for up to B.Tech 6th Semester Students

Course Code: SWNC101	**L**	**T/P**	**C**
Course Title: Yoga	**0**	**4**	**2**

Introduction: Yog education in Institute can immensely contribute to health of children by disseminating knowledge and awareness about the value of health, inculcating and nurturing health promoting habits and life style.

Objectives of the course:

- To enable the student to have good physical and mental health.
- To improve cognitive ability.
- To improve the level of consciousness.

UNIT-I

Introduction to Yog

- Brief introduction to origin of Yog, Psychological aspects leading to origin of Yog, HinduMythological concepts about origin of Yog
- History and Development of Yog
- Etymology and Definitions of Yog, Aim and Objectives of Yog, Misconceptions about Yog, TrueNature of Yog
- General Introduction to Schools of Yog
- Principles of Yog, Yog Practices for Health and Harmony

UNIT-II

Yog and You

- **Concept of Health-** Aahaar, Nidra, Bharmacharaya, Viyayaam.
- **Aarogya -** Prevention, Cure and Remedies.
- Life Management and Development.

UNIT-III

Yog for Health Promotion –

- Brief introduction to human body
- Role of yog for health promotion
- Yogic attitudes and practices
- Holistic approach of yog towards the health and diseases
- Introduction to yog diet and its relevance and importance in yog Sadhana
- Dincharya and Ritucharya with respect of yogic lifestyle

UNIT-IV

Yog as Preventive measure for Lifestyle Disease

- **Obesity:** Procedure, Benefits & Contraindications for Tadasana, Katichakrasana, Pavanmuktasana, Matsayasana, Halasana, Pachimottansana, Ardha – Matsyendrasana, Dhanurasana, Ushtrasana, Suryabedhan pranayama.

- **Diabetes:** Procedure, Benefits & Contraindications for Katichakrasana, Pavanmuktasana,Bhujangasana, Shalabhasana, Dhanurasana, Supta-vajarasana, Paschimottanasana, Ardha-Mastendrasana, Mandukasana, Gomukasana, Yogmudra, Ushtrasana, Kapalabhati.
- **Asthma:** Procedure, Benefits & Contraindications for Tadasana, Urdhwahastottansana, UttanMandukasana, Bhujangasana, Dhanurasana, Ushtrasana, Vakrasana, Kapalbhati, Gomukhasana Matsyaasana, Anuloma-Viloma.
- **Hypertension:** Procedure, Benefits & Contraindications for Tadasana, Katichakransan, Uttanpadasana, Ardha Halasana, Sarala Matyasana, Gomukhasana, UttanMandukasana, Vakrasana, Bhujangasana, Makarasana, Shavasana, Nadishodhanapranayam, Sitlipranayam.

UNIT-V (Yogic Practice)

1. YOGIC SUKSMA VYAYAMA

Uccharana-sthalatatha Vishudha-chakra-shuddhi (for throat and voice)
Prarthana (Prayer)
Buddhi-tatha-dhritishakti-vikasaka (for developing will power)
Smaranashakti-vikasaka (for improving the memory)
Medhashakti-vikasaka (for improving the intellect and memory)
Netrashakti-vikasaka (for the eyes)
Kapolashakti-vardhaka (for the cheeks)
Karnashakti-vardhaka (for the ears)
Grivashakti-vikasaka (for the Neck)
Grivashakti-vikasaka (for the Neck)
Grivashakti-vikasaka (for the Neck)
Skandha-tatha-bahu-mulashakti-vikasaka (for the shoulders)
Bhuja-bandhashakti-vikasaka
Kohinishakti-vikasaka
Bhuja-vallishakti-vikasaka
Purna-bhujashakti-vikasaka (for the arms)
Mani-bandhashakti-vikasaka
Kara-prsthashakti-vikasaka
Kara-talashakti-vikasaka
Anguli-mulashakti-vikasaka (for the fingers)
Anguli- shakti-vikasaka (for the fingers)
Vaksa-sthalashakti-vikasaka (for the chest)
Vaksa-sthalashakti-vikasaka (for the chest)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarasakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)

Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Kati shakti-vikasaka (for the waist)
Kati shakti-vikasaka (for the waist)
Kati shakti-vikasaka (for the waist)
Kati shakti-vikasaka (for the waist)
Kati shakti-vikasaka (for the waist)
Muladhara-chakra-suddhi (for the rectum)
Upasthatatha-svadhisthana-chakra-suddhi (for the genital organs)
Kundalinishakti-vikasaka (for the kundalini)
Janghashakti-vikasaka (for the thighs)
Janghashakti-vikasaka (for the thighs)
Janushakti-vikasaka (for the knees)
Pindalishakti-vikasaka (for the calves)
Pada-mulashakti-vikasaka
Gulpha-pada-pristha-pada-tala-shakti-vikasaka (for the ankles and the feet)
Padangulishakti-vikasaka (for the toes)

2. YOGSANA (Sitting Postures)
Dandasana, Swastikasana, Padmasana,Vajrasana, Supta Vajrasana**,** Kagasana, Utkatasana, Gomukhasana,Ushtrasana, Shashankasana, Janusirasana, Paschimottanasana, Bhramacharyasana, Mandukasana, Utthana Mandukasana, Vakrasana, Ardha Matsyendrasana, Marichayasana, Simhasana

3. YOGSANA (Supine lying Postures)
Pavanamuktasan, Utthana-padasana, Ardha Halasana, Halasana, Setubandha Sarvangasana, Sarvangasana, Matsyasana, Chakrasana, Shavasana

4. YOGSANA (Prone lying Postures)
Makarasana, Bhujangasana, Shalabhasana, Dhanurasana, Kapotasana, Raja Kapotasana

5. PRANAYAMA (with Antar & Bahya Kumbhaka)
Surya-bhedi and Chandra-bhedi Pranayama, Ujjayi Pranayama, Sheetali Pranayama, Shitkari Pranayama, Bhastrika Pranayama

6. BANDHA
Jivha Bandha, Jalandhara Bandha, Uddiyana Bandha, Mula Bandha, Maha Bandha, Tri Bandha

7. PRACTICES LEADING TO MEDITATION
Ajapa Dharana, Yog Nidra, Practices leading to Breath Meditation, Practices leading to Om Meditation

8. YOGSANA

Siddhasana, Bhadrasana, Baddha Padmasana, Uttitha Padmasana, Bhunamanasana, Hanumanasana, Bakasana, Kukkutasana, Garbhasana, Matsyendrasana, Marjariasana, Padangusthasana, Hastapadangusthasana, Garudasana, Vatayanasana, Natarajasana, Mayurasana, Padma Mayurasana, Sirshasana and its variations, Ekapada and Dwipada Kandarasana

9. **MUDRAS**

Yog Mudra, Maha Mudra, Shanmukhi Mudra, Shambhavi Mudra, Kaki Mudra, Tadagi Mudra, Vipareet Karni Mudra, Simha Mudra

Distribution of Marks: Total 100 (10+30+20+40)

1. Class Attendance / Punctuality –	**10 marks**
2. Active Participation in Sports Related Activities -	**30 marks**
3. Viva/Subject Knowledge-	**20 marks**
4. End Semester Practical Exam (Yogic Practice)-	**40 marks**

National Service Scheme (NSS)

Course Title: NSS/CLUBS/TECHNICAL SOCITIES Course Code: SWNC102;

LTP: 004 Credit: 2 (Semester 1 to 6)

Overall Objective:

Development of Student's personality through community service.

Aims & Objective of NSS:

i. To understand the community in which they work.

ii. To understand themselves in relation to their community.

iii. To identify the needs and problems of the community and involve them in a problem-solving process.

iv. To develop among themselves a sense of social and civic responsibility.

v. To utilize their knowledge in finding practical solutions to individual and community problems.

vi. To develop the competence required for group living and sharing responsibilities.

vii. To gain skills in mobilizing community participation.

viii. To acquire leadership qualities and a democratic attitude.

ix. To develop capacity to meet emergencies and natural disasters.

Joining NSS:

Simply by enrolling/registering yourself in the NSS unit through the NSS Programme Coordinator/Officer concerned.

Guidelines for Evaluating NSS Students

Curriculum's 1-credit Course (Semester 1 to 6)

For the curriculum's credit award to students under NSS, the following procedure will be adopted:

Students should engage in various NSS activities (listed in Annexure-1) for at least 240 hours in three years (minimum 40 Hrs/semester).

The attendance records of students will be maintained by their unit's respective Programme Officer.

A student who participates in different activities of NSS during the 1st to 6th semester then he/she will earn certain hours per activity depending upon his/her role and responsibilities carried out by the volunteer as per the following rules:

S.No.	Role	No. of Hours
1	Audience	Upto 5 Hours
2	Active Participation	Upto 7 Hours
3	Organizer	Upto 10 Hours

Distribution of Marks: Total 100 (20+20+20+40)

Class Attendance: 20

Discipline & Punctuality: 20

Event Knowledge: 20

Comprehensive Viva (for all activities held during the entire semester): 40

Annexure-1 (**Tentative NSS Activities Planned for an Academic Year**)

Activities
Vanmohotsava Week (5-7 days) (Environment Enrichment & Tree Plantation) (Nearby places like public institutions, adopted villages/slum areas, and wasteland and other such activities)
Disaster Management (Workshops, awareness camps for Relief and rescue work inoculation and immunization, distribution of medicines, essential goods)
Adopted village (visiting some nearby villages and deciding 2-3 villages to be adopted for literacy promotion and basic facilities like drinking water, pucca/kutchha road, school shed/buildings, cooperative/self-employment scheme, etc.)
Independence Day (Participation in the college celebration)
Literacy Week (Pledge-taking ceremony, Visit to adopted village/slum to organize dialogue and discussion, Putting up hoardings and banners at prominent places in the local area)
Health Service & Awareness (Integrated Child Development Programme, Health Education, HIV/AIDS Awareness Programme, Motivating parents to send children to school and other such activities)
"**Annual NSS Day Celebrations**" of NSS
Digital Transactions Awareness Programs ("Startup India – Stand up India")
Blood Donation Camp in collaboration with NITKAA
Autumn Camp (**4-6 days)** in a nearby village (Youth for Sustainable Development with a focus on Watershed Management & Wasteland Development or some other theme)
Gandhi Jayanti (Quiz competition, Speech, Communal Harmony DAY, and other such activities)
Quami Ekta Week (National Integration Day, Welfare of Minorities Day, Cultural Unity Day, Women's Day, Conservation Day)
Swachhta Pakhwada (various activities like cleanliness campaigns in campus, locality, road safety, and other such activities engaging GOI Ministries/Departments initiatives)

Legal Literacy-Social Justice (Lecture by relevant person and other activities
World AIDS Day (creating awareness among school and college-going students, organizing lectures, public discussions, film shows, rallies and street plays)
Energy Conservation Day (awareness programme and other activities
National Youth Week (Lectures/Symposia on the philosophy and teaching of Swami Vivekanand, Mahatma Gandhi; Debate on the role of youth in the contemporary situation; Essay/drawing competitions amongst youth)
Republic Day (Participation in the college celebration)
Nasha Mukti Abhiyan (Awareness on the part of Tobacco Free Society; campaigns, posters, programmes in Hostels)
Women's Week (Special programmes regarding the significant role of women and girl child; Prominent women leaders lectures; awareness programmes and other such activities)
National Safety Day/ Week (Activities based on a theme provided by National Safety Council (GOI))
Life Skills and Vocational Training Programmes (Industry professional for lectures, competitions and other such activities)
Career Guidance (For college students through prominent speakers; NSS volunteers going to schools to provide guidance to 9-12th students and other such activities)
Environment Enrichment & Climate Change (Special programmes like lectures, campaigns, posters and other such activities)
World Bicycle Day Celebration
Other Activities: Activities suggested by Institute, State NSS Unit, MHRD, GOI Ministries etc.

Guidelines for evaluation of student activities under Students Clubs

(1st to 6th Semester: 02 credit)

The Students Clubs provide facilities and the right environment to develop extra-curricular skills in the students, in addition to the academic knowledge imparted by the Institute. Twelve (12) different clubs are working under Students Clubs which organized various events (workshops, guest lecturers etc.) and competitions, to instil the spirit of healthy competition among students, throughout the year. A national level mega cultural festival under the name CONFLUENCE is organized every year. Students can earn course credit by participating in various events organised by the student's club and assisting in coordinating these events as a member of these clubs.

For the credit award to students under students club, following is recommended:

1. Students must engage in club activities for 240 hours in three years (40 hours in one semester).
2. The evaluation criterion and activity hours will be calculated as follows:

SNo	Evaluation Criterion	Number of hours credited	Distribution of Max Marks 100 (Weightage 80%)
1.	Participation as an Audience	0.5 hour* number of event hours	--
2.	Participation as an Performer	(a) 06 hours for full day activity (b) 03 hours for half day activity	10 05
3.	Prize/Award/Recognition (intra - college events)	05 hours	20
4.	Prize/Award/Recognition (inter - college events)	10 hours	30
5.	Organization of event	(a) 12 hours for full day activity (b) 06 hours for half day activity	20 10
6.	Sponsorship Note: Number of hours will be equally divided among students involved where minimum Rs. 25,000/- per students must be ensured.	(a) 15 hours for sponsorship upto 01 Lakh (b) 30 hours for sponsorship upto 05 Lakh (c) 40 hours for sponsorship more than 05 Lakh	(a) 15 (b) 30 (c) 40 Note: Marks will be divided equally in team members, if any

3. The comprehensive viva-voce (**Weightage 20%**) will be conducted at the end of every semester.
4. Documents required as proof:

a. **Participation**: A certificate of participation duly signed by the organizing club's faculty-in-charge. All clubs will maintain a record of certificates issued for verification.
b. **Prize/Reward/Recognition**: A Certificate of Merit/Letter of Appreciation duly signed by Head of the Institute/Dean (SW)/Professor-in-charge of Students Club.
c. **Organization**: A Certificate of Appreciation mentioning event's name and committee's name in which the student contributed.
d. **Sponsorship**: A letter of sponsorship from sponsoring organization mention amount and list of students involved in sponsorship effort. The amount will be equally divided among the students for award of hours and marks as per criterion 6.

Note:

1. Faculty in charges of the individual clubs must ensure at least 40 hours of activities per semester and must keep the record of number of hours for each and every student involved/ registered for clubs.
2. Further, workload of two (02) hours per week should be included as teaching load for faculty in-charges (FIC) and Professor In-charges (PIC) in order to ensure smooth conduct of activities of the clubs.
3. It is recommended to make provision for earned leave for organising events in non-working days.

Guidelines for evaluation of student activities under Technical Societies
(Semester 1st to 6th: 240 hrs.: 1 credit)

There are 12 societies/clubs currently under technical societies which conduct various events (competitions, workshops, guest lectures, meetings etc.) throughout the year and one major event TECHSPARDHA, the annual technical festival is conducted once a year. Each of this society/club is headed by a team of students usually from final year of their programme under the guidance of a faculty-in-charge.

Under new curriculum for B. Tech students, the activities of all technical societies/clubs are to be considered as an audit course. The credit for this course will be awarded at the end of 6th semester.

Students can earn course credit by participating in various events organised by the technical societies and help in coordinating these events as a member of these societies/clubs. The selected heads of societies/clubs under supervision of faculty-in-charge will ensure that each member is engaged in the activities of society/club for at least 40 hours in each semester (240 hours in 6 semesters) to fulfil the requirement of award of credits

At the end of sixth semester the evaluation of student will be carried by a committee of faculty-in-charges of the technical societies. They will be awarded points on following criterion:

Sr. No.	Criterion	Semester I and II (max 20 marks)	Semester III and IV (max 30 marks)	Semester V and VI (max 50 marks)
1.	Participation	1/event	1.5/event	2/event
2.	Prize/Award/ Recognition (intra-college events)	2/event	3/event	4/event
3.	Prize/Award/ Recognition (inter-college events)	4/event	6/event	8/event
4.	Organization	4/event	6/event	8/event
5.	Sponsorship	4/ (Rs10K worth of sponsorship individually)	6/ (Rs20K worth of sponsorship individually)	8/ (Rs40K worth of sponsorship individually)

The committee will duly verify the credentials of each candidate and award marks on above criterion. Student will be awarded a grade as per institute norms.

Documents required as proof:

a. Participation: A certificate of participation duly signed by the organizing club's faculty-in-charge. All societies/clubs to maintain a record of certificates issued for verification.
b. Prize/Reward/Recognition: A Certificate of Merit/Letter of Appreciation duly signed by Head of the Institute/Dean(R&C)/Professor-in-charge of Technical Societies.
c. Organization: A Certificate of Appreciation mentioning event's name and committee's name in which the student contributed, duly signed by the faculty-in-charge of the organizing club.
d. Sponsorship: A letter of sponsorship from sponsoring organization mention amount and list of students involved in sponsorship effort. The amount will be equally divided among the students for award of marks as per criterion 5.

Bearing in mind that the activities of clubs/societies are a part of curriculum now, following recommendation may kindly be considered:

1. Adequate space may be allocated to each society/club for conducting meeting, storing materials and equipment and keeping records.
2. Adequate staff and office space be provided to professor-in-charge (Technical Societies) keep track of purchases, maintain accounts and records and secretarial assistance.
3. An engagement of one hour per week in the load of faculty-in-charge be shown in timetable to compensate for time devoted to the activities of club/societies.

Course Code MAIC 203	Numerical and Statistical Methods (For EE)	L - T - P - C 3 - 0 - 0 - 3

Pre-Requisites: MAIC 102 Course Objectives:

1. To cover certain basics and importance of numerical analysisfor analyzing problems that arises in engineering and physical sciences.
2. To give the students deeper knowledge about Probability and Distributions.
3. To study the topics of discrete mathematics with engineering applications.
4. To learn about Statistical Methods and Testing Hypothesis.

Unit 1: **9L**

Linear and Nonlinear Algebraic Equations: Numerical solution of algebraic and transcendental equations: Regula - Falsi method and Newton-Raphson method, Solution of linear system of equations: Ja- cobi and Gauss - Seidel iteration method and convergence (without proof). Calculation of dominant eigenvalue by iteration method.

Unit 2: **9L**

Function Approximation: Introduction to Newton's forward and backward interpolation, Lagrange interpolation, Finite Differences, Numerical integration by Trapezoidal and Simpson's 1/3 rule, Rombergintegration and Gaussian quadrature rule.

Unit 3: **9L**

Ordinary Differential Equations: Taylor series method, Picard's method, Euler's method, Modified Euler's method, Runge-Kutta method of 2nd and 4th orders, Predictor Corrector methods, Milne's method, Convergence criteria, Finite difference method for Bound-ary value problem.

Unit 4: **9L**

Discrete Probability and Statistical Methods: Definitions, Axioms of Probability, Set Theory, Probability Space, Conditional Probability, Combined Experiments, Bernoulli Trials, Bernoulli's The-orem and Games of Chance, Problems. Large sample tests- Procedure of testing hypothesis, Small sample tests, Student's T-test, Chi-Square test, Independence of attributes and goodness of fit.

Text Books:

1. K. Sankara Rao, Numerical Methods for Scientists and Engi- neers, 3rd Edition, PHI Learning Private Limited, 2012.
2. Paras Ram, Engineering Mathematics through Applications, 2nd Edition, CBS Publishers, 2015.
3. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Key- ing Ye, Probability and Statistics for Engineers and Scientists, 9th Edition, 2012.

Reference Books:

1. M.K. Jain, S.R.K. lyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5th Edition, 2010.

2. Steven C. Chapra and R. P. Canale, Numerical Methods for Engineers with Programming and Software Applications, 3rd Edition, Tata McGraw Hill, 2001.

Course Outcomes:

By the end of the course, students should be able

CO1	To give numerical solution to Algebraic and Transcendental equations.
CO2	To numerically integrate functions of one and two variables.
CO3	To provide numerical solution of Ordinary Differential Equations using one step and multi-step methods.
CO4	To use discrete and continuous probability distributions in practical problems.
CO5	To apply the different testing tools like Student's T-test, Chi-square test, etc. to analyse the relevant real-life problems.

Program Core (Semester IV)

ELECTRICAL ENGINEERING DEPARTMENT

EEPC208 CONTROL SYSTEMS

Pre-requisite: EEPC101, EEPC204, EEPC205, EEPC206

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief description:
This course aims to provide fundamental concepts of control system problems and their solution possibilities, mathematical modelling of the various physical systems, analysis of the systems in time and frequency domain, stability analysis, controller and compensator design specifications.

Course Contents:

Unit-I: **(10)**

Basics of control system: control systems elements, concept of open-loop and closed-loop systems with applications.

Mathematical modeling: electrical systems, mechanical systems, electro-mechanical systems, pneumatic and thermal systems, electrical analogues of dynamical systems.
Model simplification using block diagram reduction and signal flow methods, sensitivity analysis.

Control system components: concept of AC & DC servomotor, synchro, stepper motor and tachometer, etc.

Unit-II: **(10)**

Time domain analysis: transient response analysis, first order systems, initial condition response, time response specifications of second order system for typical test signals.

Response of higher order systems: steady state error and error constants, dynamic error constants. Routh-Hurwitz Stability Criterion, System analysis and compensator design using Root-locus techniques.

Unit-III: **(10)**

17/7/23

Frequency Domain Analysis: Sinusoidal transfer functions, Frequency response specifications, Polar plot, Nyquist plot, and Bode plot for stability analysis, Concept of gain margin & phase margin, relative stability, Nichols chart, M-N circle.

Unit-IV: **(12)**

Conventional Controller: Basic idea of feedback control systems, Concept of PID controller, Effect of P, PI, PD and PID controllers on system.

Case Studies and Numerical Simulations in MATLAB/SCILAB/LABVIEW, etc.

References/Textbooks:

1. Richard C. Dorf, Robert H. Bishop, "Modern Control Systems", Pearson, 13th Edition, 2016.
2. Kuo B.C., Automatic Control Systems, Prentice-Hall of India Pvt. Ltd., New Delhi, 6th Edition, 1991.
3. Ogata K., Modern Control Engineering, Prentice-Hall of India Pvt Ltd., New Delhi, 3rd edition, 2000.
4. M. Gopal, "Control System Principles and Design", McGraw Hill, 4th Edition, 2012.
5. William J. Palm III, Control Systems Engineering, John Wiley & Sons Inc., 1986
6. Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, "Control Systems", 3rd Edition, McGraw Hill, Special Indian Edition, 2010. (Schaums Outlines Series)
7. J. Nagrath & M. Gopal, "Control System Engineering", 6th Ed. New Age International Publishers, 4th Edition 2018.
8. Norman S. Nise, "Control Systems Engineering", 5th Ed., Wiley, 2009.

Course outcomes:

On successful completion of the course, students will be able to

CO1: Fundamental knowledge of control system, mathematical modelling of various physical systems

CO2: Determine the response of systems for various inputs, and transient and steady-state analysis of open-loop and closed-loop systems

CO3: Analyze the stability of the linear systems in time-domain and frequency-domain

CO4: Design and implementation of PID controller and various compensators

ELECTRICAL ENGINEERING DEPARTMENT

EEPC209 POWER SYSTEM ANALYSIS

Pre-requisite: EEPC203

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief Description:
This course provides modelling of various power system components, carry out load flow analysis, fault analysis and stability analysis of a power system network along

Course Content

Unit - I Introduction **(4)**
Review of per unit system. Modeling of power system components, Single line impedance and reactance diagram, incidence matrices using graph theory, Bus admittance and impedance matrix using graph theory. Y bus formulation with phase shifter and transformers.

Unit – II Load Flow Analysis **(9)**
Introduction, Bus classification, Nodal admittance matrix, Gauss Seidel Methods, Newton-Raphson Method, Fast Decoupled method, algorithms, flow charts, Merits and demerits of the above methods.

Unit – III Fault Analysis **(16)**
Symmetrical fault analysis-Transient on a transmission line, Three-phase short-circuit on a synchronous machine, Algorithm for Z-bus formulation, Analysis through impedance matrix, Current limiting Reactors.
Symmetrical components- Symmetrical components transformation, Sequence impedance and Sequence networks of power system components.
Unsymmetrical fault analysis- LG, LL, LLG using transformation matrix method, Analysis through impedance matrix.

Unit – IV Stability analysis and Computer methods in power systems **(13)**
Power System Stability- Steady-state, transient and dynamic stability, Rotor dynamics and the swing equation, Equal area criterion and its applications, Step-by-step solution of swing equation, Factors affecting transient stability, Methods to improve steady state and Transient stability, Introduction to voltage stability.

Computer methods in power systems-Simulation of various load flow methods, Simulation of various faults in power system network, Transient stability algorithm using modified Euler's method and fourth order Runge-Kutta method.

References/Textbooks:

1. J.J. Grainger & W.D. Stevenson, "Power System Analysis", McGraw Hill Education, 1st Edition 2003.
2. D.P. Kothari and I.J. Nagrath, "Modern Power System Analysis", Tata McGraw Hill Education, 4th Edition, 2011.
3. H. Saadat, "Power System Analysis", Tata McGraw Hill Education, 2nd Edition, 2002.
4. G.W. Stagg and A.H. El-Abiad, "Computer Methods in Power Systems Analysis", McGraw Hill ISE, 1986.
5. https://nptel.ac.in/courses/108105067
6. https://nptel.ac.in/courses/108107127

Course Outcomes:

On successful completion of the course, students will be able to

CO 1 Understand the graph theory approach for formulation of Ybus and Zbus and application of p.u. system

CO 2 Apply Gauss –Siedel and Newton Raphson techniques for load flow analysis

CO 3 Analyze symmetrical and unsymmetrical faults using symmetrical component theory.

CO 4 Investigate stability of a power system under small-signal and large-signal disturbances

ELECTRICAL ENGINEERING DEPARTMENT

EEPC210 POWER ELECTRONICS-I

Pre-requisite: EEPC101, EEPC202

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief Description: The objectives are to know about power devices, methods of turning ON and OFF, and their connections in circuits to control and convert power.

Course Content

Unit I **(12)**

Modern Power Electronics Devices: Principle of operation of SCR, dynamic characteristic of SCR during turn ON and turn OFF, Two transistor analogy, Protection of SCR, Snubber circuit, Commutation circuits, SCR ratings, Triggering Methods, Series and Parallel operation of SCR. Principle of operation of, IGBT, GTO, MCT, DAIC, TRAIC, IGCT, their operating characteristics

Unit II **(10)**

Single-Phase Converter: Half-wave converter, 2-pulse midpoint converter, half-controlled and fully-controlled bridge converters, input current and output voltage waveforms, effect of load and source impedance, expressions for input power factor, displacement factor, harmonic factor and output voltage, effect of free-wheeling diode, triggering circuits, Dual converter.

Unit III **(10)**

Three-Phase Converter: Half wave, full wave, half controlled and fully controlled bridge converters, effect of load and source impedance, expressions for input power factor, displacement factor, harmonic factor and output voltage, Dual Converter.

Unit IV **(10)**

A.C. Converters: Principle of operation of single-phase ac regulator, effect of load inductance, firing pulse requirement. Principle of operation of cyclo-converter, waveforms, control technique. Application of converters in industries.

References/Textbooks:

1. M. Ramamoorthy. Thyristor and their applications, East West Publication, 1991.

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2. PS Bhimbra. Power Electronics, Khanna Publishers, 2015.
3. MD Singh and KB Khanchandani, Power Electronics, TMH Edition, 2007.
4. G.K. Dubey, S. R. Doradla, A. Joshi, and R. M. K. Sinha, "Thyristorised Power Controllers", New Age International Private Ltd.
5. Mohan N., Undeland T. M. and Robbins W. P., "Power Electronics Converters, Applications and Design", 3rd ED, Wiley India.

Course Outcomes

CO 1. Understand fundamental concepts in power electronics.
CO 2. To analyze power converter circuits
CO 3. Identify basic requirements for power electronics-based design and application.
CO 4 To troubleshoot power electronics circuits.

ELECTRICAL ENGINEERING DEPARTMENT

ECPC211 DC AND SYNCHRONOUS MACHINES

Pre-requisite: PHIC12

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief description: aims to give a basic understanding of DC machines fundamentals, machine parts and helps to gain the skills for operating DC Machines and Synchronous Machines. This course also equips students with ability to understand and analyze DC Machines and Synchronous Machines along with their applications.

Course Content

Unit - I **(10)**

ELECTROMAGNTIC ENERGY CONVERSION

Principles Energy in a magnetic system, field energy and mechanical force, energy in singly and multiply excited magnetic systems, determination of magnetic force and torque from energy and co-energy, Forces and torques in magnetic field systems, dynamic equations of electromechanical systems and analytical techniques.

UNIT-II **(15)**

DC MACHINES

Construction of DC machines, armature and field systems of DC machines, working principle of DC generator and motor, types of DC generator and motor, emf and torque equation of DC machine, self- excitation build up, Armature windings and Armature reactions- Demagnetizing and Cross magnetizing mmfs and their estimation, Remedies to overcome the armature reaction Characteristics and applications of DC generator and motor, Commutation process, Causes of bad commutation and remedies. Significance of back emf, Starting of DC Motors, Speed Control, Losses and Efficiency, Braking of DC Motors, Effect of saturation and armature reaction on losses; Applications

UNIT-III **(12)**

SYNCHRONOUS MACHINES

Construction and types of synchronous machines, armature reaction, circuit model of synchronous machine, determination of synchronous reactance, phasor diagram, power angle

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characteristics, parallel operation of synchronous generators, synchronizing to infinite bus bars, synchronous motor operation, characteristic curves, synchronous condenser.

UNIT-IV **(5)**

CASE STUDY Implementation of speed control of DC machine, Implementation of connection of a synchronous generator to infinite bus, Implementation of power factor control of a synchronous motor

References/Textbooks:

1. Arthur Eugene Fitzgerald and Charles Kingsley, 'Electric Machinery', Tata McGraw Hill Education Publications
2. Miller, T.J.E., 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press.
3. P.S. Bhimbra, 'Electrical Machinery', Khanna Publications.
4. Nagrath, I.J. and Kothari, D.P., 'Electrical Machines', Tata McGraw Hill Education Private Limited Publishing Company Ltd.
5. M. G. Say, 'Performance and Design of Alternating Current Machines', CBS Publishers & Distributors Pvt. Ltd., New Delhi

Course outcomes:

On successful completion of the course, students will be able to

CO1: Carry out the energy flow analysis for a given electromechanical structure

CO2: Determine the causes responsible for deterioration in a given DC machine performance

CO3: Examine the performance of a synchronous machine for different operating conditions

CO4: Analyze the nature of power flow from or to a machine connected to an infinite bus

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ELECTRICAL ENGINEERING DEPARTMENT

EEPC212 MEASUREMENT AND INSTRUMENTATION

Pre-requisite: PHIC11, PHIC12

L	T	P	Credits	Total contact hours
3	0	0	3	42

Brief Description:
The course will develop an understanding of the fundamentals of measurements and different types of instruments. The students will study the measurement of various quantities by different types of bridges, analog, and digital instruments, transducers, smart sensors, and instrument transformers. They will also understand the Digital Interfaces used in Measurement Systems & introduce them to Industry 4.0.

Course Contents:

Unit-I **(12)**
Accuracy, precision, resolution, sensitivity, Error Analysis, DC & AC bridges for measurement of resistance, inductance, capacitance, and frequency.

Unit-II **(12)**
Instrument transformers- current and potential transformers, their performance characteristics, Digital Storage Oscilloscope (DSO), Current and Voltage Probes, and Function Generators.

Unit-III **(11)**
Transducers – Classification & selection of transducers, Transducers for measurement of position, force, and temperature. Hall Effect sensors, Ultrasonic sensors, Strain Gauge, Smart sensors.

Unit-IV **(7)**
IEEE-488 instrumentation bus (GPIB), GPIB bus structure and operation, Universal Serial Bus (USB), Introduction to Industry 4.0.

Case study and simulation problems.

References/Textbooks:

1. Baldwin, C.T., "Fundamentals of electrical measurements" – Lyall Book Depot, New Delhi, 1973.

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2. E.W Golding, F.C Widdis "Electrical Measurements and Measuring Instruments", Pitman Publishing, 2011
3. Albert D.Helfrick and William D.Cooper – Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, 2007.
4. B.C. Nakra and K.K. Chaudhary- "Instrumentation Measurement Analysis", Tata Mc- Graw Hill Publishing Company Limited, 2016
5. Sawhney, A. K., and Puneet Sawhney "A course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Company, 2016.

Course Outcomes:

On successful completion of the course, students will be able to

CO1 Use DC & AC bridges to measure resistance, inductance, capacitance & frequency

CO2 Measure voltage, current, power & energy by analog & digital instruments.

CO3 Understand the working principles of various transducers, smart sensors, and their application in the measurement of position, temperature& force.

CO4 Understand the Digital Interfaces used in Measurement Systems& exposure to industry 4.0 standards

Program Core Labs (Semester IV)

ELECTRICAL ENGINEERING DEPARTMENT

EEPC213 ANALOG AND DIGITAL ELECTRONICS LAB

Pre-requisite:

L	T	P	Credits	Total contact hours
0	0	3	1	42

Laboratory experiments will be based upon the corresponding theory course EEPC202. Updated list of experiments will be floated by the course cocrdinator before the beginning of each semester.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1 Have a thorough understanding and identification of the components and devices used in analog and digital electronics.

CO2 The ability to verify, analyze and design of the fundamental device characteristics used in analog and digital electronics.

CO3 To understand and examine the structure of various mathematical operation using OPAMP and its application in design.

CO4 The ability to understand, analyze and design various combinational and sequential circuits.

ELECTRICAL ENGINEERING DEPARTMENT

EEPC214 ELECTRICAL MACHINES LAB-I

Pre-requisite:

L	T	P	Credits	Total contact hours
0	0	3	1	42

Laboratory experiments will be based upon the corresponding theory course EEPC201. Updated list of experiments will be floated by the course coordinator before the beginning of each semester.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1 Parameter evaluation and performance analysis of transformer.
CO2 Parameter evaluation and performance analysis of induction motor 3.
CO3 Parallel operation of transformers.
CO4 Working of Induction machine as induction generator.

ELECTRICAL ENGINEERING DEPARTMENT

EEPC215 MEASUREMENT AND INSTRUMENTATION LAB

Pre-requisite:

L	T	P	Credits	Total contact hours
0	0	3	1	42

Laboratory experiments will be based upon the corresponding theory course EEPC212. Updated list of experiments will be floated by the course coordinator before the beginning of each semester.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1 Parameter evaluation and performance analysis of measuring devices.
CO2 Analysis of static measuring devices.
CO3 Understand the operation of measuring transformers.
CO4 Working of different types of bridges.