RV COLLEGE OF ENGINEERING®

(Autonomous Institution Affiliated to VTU, Belagavi)

R.V. Vidyaniketan Post, Mysore Road

Bengaluru – 560 059

Bachelor of Engineering (B.E.)
Scheme and Syllabus of VII & VIII Semesters

2018 SCHEME

ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

Leadership in Quality Technical Education, Interdisciplinary Research & Innovation, with a Focus on Sustainable and Inclusive Technology

MISSION

1. To deliver outcome based Quality education, emphasizing on experiential learning with the state of the art infrastructure.
2. To create a conducive environment for interdisciplinary research and innovation.
3. To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.
4. To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
5. To focus on technologies that are sustainable and inclusive, benefiting all sections of the society.

QUALITY POLICY

Achieving Excellence in Technical Education, Research and Consulting through an Outcome Based Curriculum focusing on Continuous Improvement and Innovation by Benchmarking against the global Best Practices.

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation

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2018 SCHEME

DEPARTMENT OF
ELECTRICAL & ELECTRONICS ENGINEERING

Department Vision

Attain technical excellence in Electrical and Electronics Engineering through graduate programs and interdisciplinary research related to sustainability in power, energy and allied fields.

Department Mission

- To provide technical education that combines rigorous academic study and the excitement of innovation enabling the students to engage in lifelong learning
- To establish Centre of Excellence in sustainable electrical energy, smart grids and systems
- To establish tie-ups with industries and institutions of repute and to foster building up of a wide knowledge base to keep in tune with upcoming technologies.
- To motivate commitment of faculty and students to collate, generate, disseminate, persevere, knowledge and to work for the benefit of society.
- To develop simple, appropriate and cost effective inclusive technologies which are instrumental in the up-liftment of the rural society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1. To provide a strong foundation in Mathematics, Science and Electrical & Electronics Engineering to comprehend, analyze, design, innovate and develop products for real world applications.

PEO 2. To inculcate ethical attitude, effective communication skills, leadership qualities and team spirit for a successful professional career with concern for society.

PEO 3. To provide a holistic academic environment to foster excellence, entrepreneurship and multidisciplinary approach to inculcate an aptitude for research and lifelong learning

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	Description
PSO1	The B.E. EEE Program must demonstrate knowledge and competence in the application of circuit analysis, control systems, field theory, analog and digital electronics, Power Electronics, microcontrollers , microprocessors, Signal processing and conditioning, computer hardware and software to the design, building , testing, protection and operation of electrical machines, power systems, electrical and electronic systems.
PSO2	The B.E. EEE Program must demonstrate knowledge and competence in the application of basic sciences, rigorous mathematics and project management techniques in the design of complex electrical and electronic systems.
PSO3	The B.E. EEE Program must demonstrate the ability to effectively work in a team, communicate correctly and develop an ethical attitude and concern for society and environment. .

Lead Society: Institute of Electrical and Electronics Engineers (IEEE)

ABBREVIATIONS

Sl. No.	Abbreviation	Meaning
1.	VTU	Visvesvaraya Technological University
2.	BS	Basic Sciences
3.	CIE	Continuous Internal Evaluation
4.	SEE	Semester End Examination
5.	CE	Professional Core Elective
6.	GE	Global Elective
7.	HSS	Humanities and Social Sciences
8.	CV	Civil Engineering
9.	ME	Mechanical Engineering
10.	EE	Electrical & Electronics Engineering
11.	EC	Electronics & Communication Engineering
12.	IM	Industrial Engineering & Management
13.	EI	Electronics & Instrumentation Engineering
14.	CH	Chemical Engineering
15.	CS	Computer Science & Engineering
16.	ET	Telecommunication Engineering
17.	IS	Information Science & Engineering
18.	BT	Biotechnology
19.	AS	Aerospace Engineering
20.	PY	Physics
21.	CY	Chemistry
22.	MA	Mathematics

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RV Educational Institutions ®
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Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

Go, change the world

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Bachelor of Engineering (B.E.)
Scheme and Syllabus of
VII & VIII Semesters

2018 SCHEME

ELECTRICAL & ELECTRONICS ENGINEERING

(2021-2022)

RV COLLEGE OF ENGINEERING®

(Autonomous Institution Affiliated to VTU, Belagavi)

ELECTRICAL & ELECTRONICS ENGINEERING

SEVENTH SEMESTER CREDIT SCHEME

Sl. No.	Course Code	Course Title	BoS	Credit Allocation			Total Credits
				L	T	P	
1.	18HS71	Constitution of India and Professional Ethics	HSS	3	0	0	3
2.	18EE72	Power System Analysis –II	EE	3	1	1	5
3.	18EE73	Switchgear & Protection	EE	3	0	1	4
4.	18EE74	Internship *	EE	0	0	2	2
5.	18EE7FX	Elective F (PE)	EE	3	0	0	3
6.	18EE7GX	Elective G (PE)	EE	3	0	0	3
7.	18G7HXX	Elective H (GE) **	Res. BOS	3	0	0	3
Total Number of Credits				18	1	4	**23**
Total number of Hours/Week				**18**	**2**	**10**	

Note: * Internship (6 weeks) is to be carried during the vacation after 6th semester and evaluation shall be conducted during 7th semester for 2 credits.

** Students should take other department Global Elective courses.

EIGHTH SEMESTER CREDIT SCHEME

Sl. No.	Course Code	Course Title	BoS	Credit Allocation			Total Credits
				L	T	P	
1.	18EEP81	Major Project	EE	0	0	16	16
Total Number of Credits				**0**	**0**	**16**	**16**
Total number of Hours/Week						**32**	

VII Semester			
PROFESSIONAL ELECTIVES (GROUP F)			
Sl. No.	**Course Code**	**Course Title**	**Credits**
1.	18EE7F1	Computer Communication and Networking	3
2.	18EE7F2	Advanced Power Electronics	3
3.	18EE7F3	Smart Grid Technology	3
4.	18EE7F4	Digital Protection of Power Systems	3
5.	18EE7F5	Discrete Control Systems	3

VII Semester			
PROFESSIONAL ELECTIVES (GROUP G)			
Sl. No.	**Course Code**	**Course Title**	**Credits**
1.	18EE7G1	Industrial Drives and Applications	3
2.	18EE7G2	Electrical Installation Estimation and Costing	3
3.	18EE7G3	Object Oriented Modeling and Design	3
4.	18EE7G4	Power System Operation and Control	3
5.	18EE7G5	ASIC Design	3

VII Semester				
GLOBAL ELECTIVES (GROUP H)				
Sl. No.	**Host Dept**	**Course Code**	**Course Title**	**Credits**
1	AS	18G7H01	Unmanned Aerial Vehicles	3
2	BT	18G7H02	Bioinformatics	3
3	CH	18G7H03	Industrial Safety and Risk Management	3
4	CS	18G7H04	Web Programming	3
5	CV	18G7H05	Solid Waste Management and Statutory Rules	3
6	EC	18G7H06	Image Processing and Machine Learning	3
7	EE	18G7H07	Renewable Energy Sources and Storage System	3
8	EI	18G7H08	MEMS & Applications	3
9	IM	18G7H09	Project Management	3
10	IS	18G7H10	Cyber Forensics and Digital Investigations	3
11	ME	18G7H11	Robotics and Automation	3
12	TE	18G7H12	Space Technology and Applications	3
13	PY	18G7H13	Introduction to Astrophysics	3
14	CY	18G7H14	Materials for Advanced Technology and Spectroscopic Characterization	3
15	HSS	18G7H15	Applied Psychology for Engineers	3
16	HSS	18G7H16	Advanced Course in Entrepreneurship	3

Semester: VII						
CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS (Theory) (Common to All Programs)						
Course Code	**:**	**18HS71**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Apply the knowledge of the constitutional literacy to become aware of the fundamental rights and duties in their role as Engineers.
2	Understanding of ethical and legal aspects of advertising, consumer problems and their redressal mechanism related to product and service standards.
3	Discuss the knowledge of substantive Labor law and to develop skills for legal reasoning and statutory interpretations.
4	Evaluate individual role, responsibilities and emphasize on professional/ engineering ethics in shaping professions.

Unit - I	**10 Hrs**
Indian Constitution- Salient features of Indian Constitution ,Preamble to the Constitution of India; Provisions Relating to Citizenship in India- at the Commencement of the Constitution and Later with latest amendments, Modes of Acquisition and Termination of Citizenship of India. Scope & Extent of Fundamental Rights-Articles 14-32 with case studies; Right to Information Act, 2005 with Case studies.	
Unit – II	**10 Hrs**
Directive Principles of State Policy- Significance of Directive Principles of State Policy, Fundamental Duties in the Constitution of India; Union Executive- President and State Executive- Governor; Parliament & State Legislature; Council of Ministers; Anti-defection law; Union and State Judiciary; Emergency provisions; Elections, Administrative tribunals. Human Rights & Human Rights Commission.	
Unit –III	**06 Hrs**
Consumer Protection Law - Definition and Need of Consumer Protection; Consumer Rights under the Consumer Protection Act, 2019; Unfair Trade Practice, Defect in goods, Deficiency in services; Product liability and Penal Consequences, False and Misleading Advertisement, E-Commerce**,** Alternate dispute Redress mechanism**;** Redresses Mechanisms under the Consumer Protection Act, 2019. **An overview of Indian Penal Code 1860 (Law Of Crimes)**	
Unit – IV	**06 Hrs**
Introduction to Labour Legislations - Industrial Relation, Labour Problem and Labour Policy in India; Labour Welfare and Social Security- Factories Act, 1948, Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013; the Child Labour (Prohibition and Regulation) Act, 1986, Maternity Benefit (Amendment) Act, 2017; Industrial Dispute Act, 1947, Reference of Disputes to Boards, Courts or Tribunals.	
Unit –V	**07 Hrs**
Scope and aims of engineering ethics (NSPE Code of Ethics), Responsibility of Engineers, Impediments to responsibility. Honesty, Integrity and reliability, Risks, Safety and Liability in Engineering. Corporate Social Responsibility. Statutory Provision regarding prohibition and prevention of Ragging.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Demonstrate the citizen's fundamental Rights, duties & consumer responsibility capability and to take affirmative action as a responsible citizen.
CO2	Identify the conflict management in legal perspective and judicial systems pertaining to professional environment, strengthen the ability to contribute to the resolve of human rights & Ragging issues and problems through investigative and analytical skills.
CO3	Understanding process of ethical and moral analysis in decision making scenarios and inculcate ethical behavior as a trait for professional development.
CO4	Apply the knowledge to solve practical problems with regard to personal issues & business Enterprises.

Reference Books	
1	Dr. J. N Pandey, Constitutional Law of India, Central Law Agency, 2020 edition
2	Avtar Singh: Law of Consumer Protection: Principles and Practice, Eastern Book Company, 5th Edition, 2015, ISBN -13:978-9351452461
3	S.C. Srivastava: Industrial Relation and Labour Laws, Vikas Publishing House, 6th Edition, 2012, ISBN: 9789325955400
4	Jr. Charles E Harris, Michael. S. Pritchard and Michael J Rabins, Engineering Ethics, Wadsworth Cengage Learning, 5th Edition, 2009, ISBN-978-0495502791

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20. **Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.**

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	1	-	1
CO2	3	2	2	1	-	-	-	-	-	1	-	1
CO3	3	3	2	2	-	-	-	-	-	1	-	1
CO4	3	3	3	3	-	-	-	-	-	1	-	1

High-3: Medium-2 : Low-1

Semester: VII						
POWER SYSTEM ANALYSIS II (Theory and Practice)						
Course Code	**:**	18EE72		**CIE**	**:**	**100+50 Marks**
Credits: L:T:P	**:**	3:1:1		**SEE**	**:**	**100+50 Marks**
Total Hours	**:**	40L +26T+32P		**SEE Duration**	**:**	**3.00+3.00 Hours**

Course Learning Objectives: The students will be able to

1	Understand different techniques of formation of Y_{bus}, Z_{bus} and their applications.
2	Analyse different techniques of load flows and apply suitable technique for a given system.
3	Compute load flows and generation schedule for optimal operation.
4	Solve for the stability of the system using different numerical techniques.
5	Prepare data and analyse the entire power system for its performance.

UNIT-I	**08 Hrs**
Formation of Network Admittance Matrix: Introduction, Elementary graph theory- oriented graph, tree, co-tree, basic cut-sets, basic loops; Element-node and bus incidence matrices; Primitive network- impedance form and admittance form ; Formation of Y_{BUS}- by method of inspection (including transformer off-nominal tap setting), by method of singular transformation with and without mutual coupling.	
UNIT II	**09 Hrs**
Formation of Network Impedance Matrix: Formation of Bus impedance matrix (Z_{BUS}) by step by step building algorithm, Modification of Z_{BUS}. Fault current calculation using Z_{BUS}. **Load Flow Studies:** Introduction, Power flow equations, Classification of buses, Operating constraints, Data for load flow, Gauss-Siedal method- Algorithm and flow chart for PQ and PV buses, Acceleration of convergence.	
UNIT III	**09 Hrs**
Load Flow Studies: Newton Raphson Method – Algorithm & flow chart for NR method in polar coordinates (numerical problem for one iteration only); Algorithm for Fast Decoupled load flow method; Comparison of load flow methods. Bus currents, Line flows, Bus injections.	
UNIT IV	**07 Hrs**
Optimal System Operation: Introduction, Optimal operation of generators on a Bus Bar, Optimal unit commitment, Reliability considerations, Optimal generation scheduling, Optimal load flow solutions.	
UNIT V	**07 Hrs**
Transient Stability Studies: Steady state and transient stability, Power angle equation for non-salient pole machines, Rotor dynamics and the swing equation Equal-area criterion for transient stability evaluation and its applications. Numerical solution of Swing equation – Point-by-Point method, Modified Euler's method, Runge-Kutta method.	

LABORATORY EXPERIMENTS	
1.	Formation of Y-BUS with off-nominal turns ratio by inspection method.
2.	Formation of Y Bus for power systems by singular transformation method with & without mutual coupling.
3.	Program to perform load flow analysis using different methods through MATLAB and software packages like Mi Power and Electrical Transient Analyser Program (Etap).

4.	Determination of bus currents, bus power and line flows for a specified system voltage (bus) profile.
5.	To determine fault currents and fault MVA for various faults.
6.	Transient Stability Studies using Mi Power software package.
7.	Solution of swing curve with Modified Euler's method and Runge - Kutta method.
8.	Economical generator scheduling for thermal power plants with and without losses.
9.	Study of Load frequency analysis of single area system and two area system MATLAB Simulink.
10.	Modelling of PV module using MATLAB Simulink (extra program on Renewable power System).

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand and Apply the fundamental concepts of power system networks and models of various components to analyse and solve the problems.
CO2	Apply numerical techniques to evaluate the power flows and stability of power systems.
CO3	Analyse the performance of the system under various operating conditions.
CO4	Use MATLAB and power system software packages for system studies.

Reference Books	
1.	Modern Power System Analysis, Nagrath, I.J and Kothari D.P.,TMH, fourth edition, 2011, ISBN : 978-0-07-107775-0.
2.	Computer Techniques and Models in Power Systems, K. Uma Rao, I.K.International publishing House Pvt.Ltd, Second edition, 2014, ISBN : 9789382332312
3.	Computer Methods in Power System Analysis, Stag, G.W and EI-Abiad A H, McGraw Hill International Student Edition, 2006,ISBN: 978-0070606586
4.	Computer Techniques in Power System Analysis, Pai,M.A, TMH, 2nd edition, 2006, ISBN : 007096551X, 9780070965515.

CIE is executed by way of quizzes tests and Assignment. A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 60. The marks component for assignment is 10. The total marks of CIE are 100.
Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Laboratory- 50 Marks
The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 10 marks. Total marks for the laboratory is 50.
Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)
SEE for 100 marks is executed by means of an examination. The Question paper contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I,

IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

CO-PO Mapping												
CO/ PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**	**1**	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO2	**2**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**1**
CO3	**2**	**3**	**3**	**2**	**3**	**-**	**-**	**1**	**1**	**-**	**-**	**1**
CO4	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**1**	**1**	**-**	**-**	**1**

High-3: Medium-2: Low-1

SWITCHGEAR AND PROTECTION (Theory and Practice)					
Course Code	**:**	**18EE73**		**CIE:**	**100+50 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE :**	**100+50 Marks**
Hours	**:**	**40L+20P**		**SEE Duration:**	**03+03Hrs**

Course Learning Objectives: The students will be able to

1	Understand the operation of Fuse, Circuit breaker and Relays, analyze the arc characteristic.
2	Calculate the re-striking and recovery voltages during Circuit breaking
3	Analyse current chopping phenomenon and determine the circuit Breaker ratings
4	Explain and Analyze the principle and operation of Different types of circuit breakers relays and test the characteristics in the Laboratory
5	Analyze the Digitalization and New Technologies in CB And Protective Relays

UNIT-I	**08 Hrs**
Fuses: Introduction, Definition, Classification, HRC fuse, Selection of Fuses, characteristics **Circuit Breakers theory:** Arc characteristics, Theories of current interruption, Recovery, Restriking Voltage and Recovery voltages. Re-striking Phenomenon, Average and Max. RRRV, Numerical Problems - Current Chopping and Resistance Switching, Interruption of Capacitive Current Examples.	
UNIT-II	**08 Hrs**
Circuit Breakers: Air break CB, Air Blast CB, SF_6CB: construction, operation, application and merits, Vacuum CB construction, operation, application and merits, CB ratings and Specifications: Types and Numerical Problems. auto-reclosing - definitions & features. **DC Circuit Breaker:** Introduction, DC Breaking, General design and construction. **Types of Switchgear:** AIS, GIS, Hybrid CB, Integrated CB, SMART CB, Dead & Live Tank CBs, Modern trends in Power System Protection.	
UNIT-III	**08 Hrs**
Introduction to Relays: Principles and need for protective schemes –Relay terminology, definitions, Zones of protection and essential qualities of protection, relay classification, Relay design considerations. **Relay Operating Principles, construction and Characteristics:** Current, Voltage & IDMT Characteristics, Directional features, Impedance protection, Differential Protection, Protection Schemes, Protection Coordination. **Electromechanical relays**: over current: directional and non-directional, differential relays. Universal torque equation Illustrative examples **Static relays:** Introduction, Advantages and Disadvantages –IDMT static relays(Block diagram) **Numerical relays:** Introduction Block diagram of a numerical relay, Advantages of Numerical Technology, Flow Chart, IEDs, Bay Control & Protection, IEC61850 & Process Bus Technology& Digitization, Integrated Control & Protection, HMI, Parallel Redundancy Protocol, Disturbance & Event Recorder, Phasor Measurement.	
UNIT-IV	**08 Hrs**
Transformer Protection: Differential protection of power transformer, Biased differential Protection Buchhloz relay for incipient faults, Hormonic restraint relay - Illustrative examples **Generator protection:** Introduction to stator and rotor side protection, differential protection Illustrative examples **Bus bar protection**: Differential protection of bus bars, Low Impedance & High Impedance Differential Protection, Centralized & Distributed concepts.	
UNIT-V	**08 Hrs**
Protection of Transmission lines: Distance Protection of Transmission lines: Impedance, reactance and admittance characteristics with torque equations, relay settings for 3-zone protection, numerical relays for transmission line protection Numerical impedance relay (block diagram) and Flow chart, Effect of Arc Resistance on the Performance of Distance Relays, Reach and Effect of Power Surges (Power Swings), Effect of Line Length and Source Impedance on Performance of Distance Relays.	

Pilot Protection of Transmission Lines: Introduction, communication channels, tripping v/s blocking, Directional comparison blocking, Directional comparison unblocking, under reaching transfer trip. Protection against Over-voltages, Lightning phenomena, Protection against Travelling Waves, Insulation Coordination, Basic Impulse Insulation (BIL). Fault Location, Travelling wave principle, Protection of Series Compensated lines, Full scheme distance protection.

LABORATORY EXPERIMENTS	
1.	Operating characteristics of Electro- Mechanical type Over-current relay.
2.	Current-time characteristics of fuses.
3.	Breakdown strength of transformer oil using oil-testing kit.
4.	Operating characteristics of micro – processor based (numeric) over current relay .
5.	Operating characteristics of microprocessor based (numeric) over-voltage relay.
6.	Measurement of AC high voltage and DC high voltage using standard spheres.
7.	Field mapping using electrolytic tank for co-axial cable and parallel plate capacitor.
8.	Generator protection: Merz-Price protection scheme.
9.	Spark-over characteristics of i) plane-plane and ii) point-plane electrodes subjected to HVAC in air.
10.	a) Generation of standard lightning impulse and determination of voltage η and energy rating of impulse generator. b) Determination of 50% flashover voltage for air insulation subjected to Impulse voltage in point-plane electrodes.
11.	Experiment using PSCAD/EMTDC software:- simulation of IEEE std bus system for with protection equipments and fault analysis study
12.	Experiment using PSCAD/EMTDC software:-continuation of simulation analysis for relay coordination and breaker operations

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain and understand the operation of different types of relays, circuit Breakers and fuses in power systems.
CO2	Analyze and compare the performance of different protection relays, circuit breakers and fuses.
CO3	Evaluate the settings of various types of relays for equipment protection and ratings of circuit breakers.
CO4	Apply the advanced relaying techniques with pilot communication and modern circuit breakers in harmony with the present and future power system and practice to realise the numerical relaying schemes.

Reference Books	
1.	Power System Protection and Switchgear ,BadriRam, 3rd Edition, 2011, TataMc-Graw Hill Pub, ISBN: 9780071077743, 9780071077743.
2.	Fundamentals of Power System Protection, Y.G. Paithankar and S.R. Bhide, 2nd Edition, 2003, Prentice Hall of India Pvt. Ltd., New Delhi, ISBN-13 : 978-8120341234.
3.	Power system relaying, Staley H.Horowitz&ArunG.Padke, 3rd Edition, 2008, John Wiley & Sons Inc., ISBN: 978-0-470-75878-6.
4.	A Text Book on PowerSystem Engineering, M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A. Chakrabarti , 2nd edition, 1998, DhanpatRai & Co. ISBN-13 : 978-8177000207. .

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may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 60. The marks component for assignment is 10. The total marks of CIE are 100.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Laboratory- 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 10 marks. Total marks for the laboratory is 50.

Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	1	-	1	-	1	-	-	1
CO2	2	2	2	1	-	1	1	-	2	1	-	1
CO3	2	3	3	2	2	2	3	1	2	2	-	1
CO4	3	3	3	3	1	2	2	1	2	2	1	2

High-3: Medium-2: Low-1

SEMESTER : VII						
INTERNSHIP						
Course Code	**:**	**18IN74**		**CIE Marks**	**:**	**50**
Credit L:T:P	**:**	**0:0:2**		**SEE Marks**	**:**	**50**
Hours/week	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

GUIDELINES

1) The duration of the internship shall be for a period of 6/8 weeks on full time basis after IV semester final exams and before the commencement of VII semester.
2) The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.
3) Internship must be related to the field of specialization of the respective UG programme in which the student has enrolled.
4) Students undergoing internship training are advised to report their progress and submit periodic progress reports to their respective guides.
5) Students have to present the internship activities carried out to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final internship report. However, interim or periodic reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry /organizations.
6) The reports shall be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be Ivory color for UG circuit Programs and Light Blue for Non-Circuit Programs.
7) The broad format of the internship final report shall be as follows
    - Cover Page
    - Certificate from College
    - Certificate from Industry / Organization
    - Acknowledgement
    - Synopsis
    - Table of Contents
    - Chapter 1 - Profile of the Organization: Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices,
    - Chapter 2 - Activities of the Department
    - Chapter 3 - Tasks Performed: summaries the tasks performed during 8-week period
    - Chapter 4 – Reflections: Highlight specific technical and soft skills that you acquired during internship
    - References & Annexure

Course Outcomes:

After going through the internship the student will be able to:

CO1: Apply engineering and management principles
CO2: Analyze real-time problems and suggest alternate solutions
CO3: Communicate effectively and work in teams
CO4: Imbibe the practice of professional ethics and need for lifelong learning.

Scheme of Continuous Internal Evaluation (CIE):

The evaluation committee shall consist of Guide, Professor/Associate Professor and Assistant Professor. The committee shall assess the presentation and the progress reports in two reviews.

The evaluation criteria shall be as per the rubrics given below:

Reviews	Activity	Weightage
Review-I	Explanation of the application of engineering knowledge in industries, ability to comprehend the functioning of the organization/ departments,	45%
Review-II	Importance of resource management, environment and sustainability presentation skills and report writing	55%

Scheme for Semester End Evaluation (SEE):
The SEE examination shall be conducted by an external examiner (domain expert) and an internal examiner. Evaluation shall be done in batches, not exceeding 6 students per batch.

Semester: VII						
COMPUTER COMMUNICATION AND NETWORKING (Group F: Elective)						
Course Code	:	**18EE7F1**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	:	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	:	**40L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Understand the fundamental principles of networking and data communication
2	Understand the layering concepts in computer networks
3	Understand the functions of each layer
4	Have knowledge in different applications that use computer networks
5	Understand different standard protocols used in communication

Unit-I	**08 Hrs**
OVERVIEW OF COMPUTER NETWORKS: **Data communication:** Components, data flow, physical structures and categories of networks. **Network models:** Need of layered architecture, layers in the OSI model and TCP/IP protocol suite.	
Unit – II	**08 Hrs**
PHYSICAL LAYER AND MEDIA: **Data and signals:** Analog and digital signals, data rate limits and performance. Analog-to-digital and Digital-to-analog conversions, multiplexing, spread spectrum and Transmission media.	
Unit –III	**08 Hrs**
DATA LINK LAYER : **Error detection and correction:** Types of errors, parity check, cyclic redundancy check, checksum and Hamming code procedure. Data link control – Framing, ARQ protocols, HDLC and Point-to-point protocol. Multiple Access communication, Wired LANs- Ethernet, Token ring and FDDI. Wireless LAN – IEEE 802.11 and Bluetooth. Connecting devices- Hubs, Repeaters, Bridges, Switches and Routers.	
Unit –IV	**08 Hrs**
NETWORK LAYER: **Logical addressing:** IPv4 Addresses- classful and classless addressing, Network address translation and Subnetting, IPv6 addresses. Internet Protocol – IPv4 datagram and fragmentation, IPv6 advantages and packet format and extension headers.	
Unit –V	**08 Hrs**
TRANSPORT AND APPLICATION LAYERS: Process-to-process delivery, User datagram protocol and its operation, TCP – services and features, segment, TCP connection, flow control and error control. Congestion control and Quality of Service. Email:- SMTP, MIME, POP3, IMAP – HTTP – DNS- SNMP – Telnet.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand and describe the basic concept of Intranet, LAN, WAN, MAN, different topologies
CO2:	Evaluate the performance of different topologies, common networking protocols and algorithms
CO3:	Analyze the performance of different network protocols.
CO4:	Design and implement different network protocols.

Reference Books	
1	Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, 2009, Tata McGraw Hill, ISBN-13: 978-0-07-125442-7

2	Data Communications, Computer Networks and Open systems Fred Halsall, 4th Edition, 2005, Pearson Education, ISBN-13: 9780201422931
3	Data and Computer Communications, William Stallings, Eighth Edition, 2007, Pearson Education, **ISBN**: 0-13-243310-9
4	Computer Networking, A Top-Down Approach Featuring the Internet, James F. Kurose, Keith W. Ross, Third Edition, 2005, Addison Wesley, ISBN-10 : 0321269764

CIE is executed by way of quizzes tests and Assignment. A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 60. The marks component for assignment is 10. The total marks of CIE are 100.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	-	-	-	-	-	-	-	1	-	1
CO2	3	3	2	1	-	-	-	-	-	1	-	1
CO3	3	2	2	2	-	-	-	-	-	1	-	1
CO4	2	3	2	3	-	-	-	-	-	1	-	1

High-3: Medium-2 : Low-1

Semester: VII						
ADVANCED POWER ELECTRONICS (Group F: Elective)						
Course Code	**:**	**18EE7F2**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to	
1	Analyze the operation of DC-DC converters, multi pulse converters, multilevel inverters.
2	Design of converters and inverters for a given specification.
3	Design of high frequency magnetic components.
4	Design of controllers for the converters.

Unit-I	**07 Hrs**
Switching Voltage Regulators: Introduction, Detailed analysis and design of Non-isolated and isolated dc-dc voltage regulator configurations: Buck, Boost, Buck-Boost converters for continuous and discontinuous conduction mode.	
Unit – II	**09 Hrs**
Analysis and Design of isolated dc-dc voltage regulators: Flyback converter, Forward converter, Half bridge, Full bridge and Push-pull converter, Design criteria for SMPS; Multi-output switch mode regulator and interleaved converters.	
Unit –III	**09 Hrs**
Resonant Converters: Introduction, Need of resonant converters, Analysis and design of Resonant switch converters, zero voltage switching dc-dc converters, zero current switching dc-dc converters, Load resonant converters: series loaded and parallel resonant converter. Design of magnetic components of regulators.	
Unit –IV	**08 Hrs**
Multilevel Inverters: Introduction, Topologies for multi-level: Diode Clamped, Flying capacitor and Cascaded H-bridge multilevel Converters configurations. **Concept of multi-pulse converters:** Configurations for m-pulse (m=12, 18, 24) converters, Different phase shifting transformer (Y-Δ1, Y-Δ2, Y-Z1 and Y-Z2) configurations for multi-pulse converters.	
Unit –V	**07 Hrs**
Control of DC-DC converters: Voltage control, current control, Design of type 2 and type 3 error amplifiers. Description of PWM IC's for control of converters.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Evaluate different dc-dc voltage regulators.
CO2:	Simulate and Analyse resonant converters.
CO3:	Select appropriate phase shifting converter for a multi-pulse converter.
CO4:	Evaluate various multi-level inverter configurations and multiphase converter.

Reference Books	
1	Power Electronics – Converters, Applications and Design, Ned Mohan, Tore M. Undeland and William P. Robbins,3rd ed., 2003, John Willey & sons, Inc., ISBN: 978-0-471-22693-2.
2	Power Electronics - Circuits, Devices and Applications, Muhammad H. Rashid, 3rd ed., 2009, Prentice Hall of India, ISBN-13: 9780131011403.
3	Fundamentals of power Electronics, Daniel Hart, 3rd ed, 2016, McGraw Hill Education, ISBN-13: 978-0071321204.
4	Power Electronics Essentials and Applications, L. Umanand, Wiley India Ltd., 1st edition, Wiley India Pvt, 2009 , ISBN-9788126519453.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	2	1	2	1	2	1	3	1	1	3
CO2	3	2	2	1	3	2	1	2	2	2	1	3
CO3	3	2	2	2	3	3	2	2	3	2	2	3
CO4	3	2	2	1	3	2	2	1	1	2	2	3

High-3: Medium-2: Low-1

Semester: VII						
SMART GRID TECHNOLOGY (Group F: Elective)						
Course Code	**:**	**18EE7F3**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Explain the concept of a smart grid and understand the need for a smart grid.
2	Analyse the components of a smart grid and propose the infrastructure for smart meters.
3	Design a WAM system for a given grid.
4	Compare various storage technologies and select a suitable one for a system.
5	Evaluate the cyber risks and the solutions for security.

Unit-I	**08 Hrs**
Introduction to Smart grid What is smart gird?; Conventional gird Vs smart gird; early smart grid initiatives; technologies required for smart grid; core applications of smart grid; demand response and demand side integration; representative architecture for smart grid; functions of various smart grid components.	
Unit – II	**08 Hrs**
Measurements and monitoring in smart grid **Smart Meters:** Evolution of smart meters; signal acquisition and conditioning; communication infrastructure for smart grid; Meter data management **Wide area monitoring:** Phasor Measurement Unit; Data acquisition, delivery and processing; overview of WAM applications; Implementation of WAMS	
Unit –III	**08 Hrs**
Communication technologies for smart grid **Wireless technologies:** WPANs, LAN, Wireless metropolitan area network, cellular network, satellite communication, Zigbee, Bluetooth, LAN, NAN **Wireline communication:** Phone line technology, powerline technology, coaxial cable technology; Optical communication **TCP/IP networks**	
Unit –IV	**08 Hrs**
Energy Storage for smart grid Penetration and variability issues associated with renewable energy, batteries, flow batteries, fuel cell and hydrogen electrolyser, Superconducting magnetic storage systems, supercapacitor, selection of storage technology.	
Unit –V	**08 Hrs**
Cyber security and Standards Interoperability; Cyber security requirements of smart grid, encryption and decryption for security, authentication, digital signatures, cyber security standards, cyber security risks.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the fundamental concepts of a smart grid and discuss the technologies needed for it.
CO2:	Design a WAM system for the grid, including the metering and communication infrastructure.
CO3:	Select suitable energy storage devices for a given grid.
CO4:	Asses the cyber risks of the smart grid and propose security measures.

Reference Books	
1	Smart Grid: Technology and Applications , Janaka Ekanayake, Kitsiri Liyanage and Jiangzhou Wu, John Wiley & Sons , 2015, ISBN : 9781119968696.
2	Smart Grid: Applications, Communications, and Security, Lars Torsten Berger and Krzysztof Iniewski, First Edition, John Wiley & Sons , 2012, ISBN : 9781118004395.
3	Smart Grid: Fundamentals of Design and Analysis, James Momoh, First edition, John Wiley - IEEE Press , 2015, ISBN : 9788126558124.
4	Smart grid systems, Edited by N. Ramesh Babu, CRC Press, 2018, ISBN : 9781771886253.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	1	-	1	-	-	-	1	-	-	-
CO2	2	2	2	1	2	-	-	-	1	-	-	1
CO3	2	3	3	2	2	-	-	1	1	-	-	1
CO4	3	3	3	3	2	-	-	1	1	-	-	1

High-3: Medium-2 : Low-1

Semester: VII						
DIGITAL PROTECTION OF POWER SYSTEMS (Group F: Elective)						
Course Code	**:**	**18EE7F4**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Describe the basic concept and principles of digital protection of power systems and understand the advance technology used in power system relaying.
2	Analyze the developments in the protection schemes with monitoring and control understand the role of PMU and WAMS in modern grid systems.
3	Evaluate the settings numerical relays for equipment protection in power systems.
4	Design the protection of typical equipment in harmony with the smart grid Analyse the different modern protection their characteristics.
5	Describe the basic concept and principles of digital protection of power systems and understand the advance technology used in power system relaying.

Unit-I	**08 Hrs**
Relay Operating Principles: Introduction, detection of faults, elements of protection systems, relay design considerations, International practices. **Introduction to Digital Protection:** Development of Digital Protection, Historical background, Expected benefits of computer Relaying, Computer Relay Architecture, Advantages and disadvantages of digital protection, components, control circuits, applications, Logical Structures for digital Protection, Design of Digital protection and Control Devices. Digital filtering techniques.	
Unit – II	**09 Hrs**
Digital Relaying Algorithms: Discrete Fourier Transform Technique, Removal DC offset, Microprocessor implementation of Digital Distance Relaying Algorithms. **Microprocessor based Protective Relays:** Over current Relays, Impedance Relay, Directional Relay, Reactance Relay, Generalised mathematical expression for Distance Relays. Measurement of R and X Mho and offset Mho Relays, Quadrilateral Relay, Generalised interface for distance relaying.	
Unit –III	**08 Hrs**
Digital Relays for Synchronous Generators Protection: Introduction, multifunction protection scheme, differential protection of stator windings, negative sequence protection, under impedance protection, out of set generator protection, over-fluxing detection algorithm.	
Unit –IV	**08 Hrs**
Adaptive Relaying: Introduction, Adaptive Relaying. The Main Approaches to Design and control, case studies. IEC 61850,104 **Introduction to-** Phasor measurement units, Wide area monitoring and control, protection of Distribution systems and micro grids.	
Unit –V	**07 Hrs**
Developments in new relaying principles: Introduction, travelling waves on single phase lines and three phase lines, differential Relaying with phasors. **Introduction** to substation automation and control, Literature Study, Case Studies.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Explain the fundamentals of Digital protection, microprocessor based and Adaptive relays.
CO2:	Analyze the operation of digital relays, microprocessor based and Adaptive relays.
CO3:	Evaluate the performance of different types of digital protection.
CO4:	Apply and develop the advanced and new techniques for protection system.

Reference Books	
1	Fundamentals of power system protection, PaithenkarY.G.& BhideS.R, first edition, 2004, Prentice Hall India, ISBN-10 : 8120321944
2	Digital Protection of Power Systems K.Parthasarathy, ISTE WPLP Learning Material Series, 2006, Indian Society for Technical Education, Bangalore, **ISBN**-10 : 8120321944
3	Computer Relaying for power system , Arun G Padke& James Thorp, 2nd edition, 1995, John Wiley & Sons, ISBN: 978-0-470-05713-1
4	Digital power system protection, S R Bhide, Eastern Economical Edition,2014, Pentice Hall India, ISBN-10 : 8120349792

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	2	2	2	2	2	1	-	1	-	3
CO2	2	2	2	2	2	2	2	1	-	1	-	3
CO3	2	2	2	3	2	2	3	1	1	1	-	2
CO4	3	2	1	1	3	2	2	1	1	1	1	2

High-3: Medium-2 : Low-1

Semester: VII						
DISCRETE CONTROL SYSTEMS **(Group F: Professional Core Elective, Theory)**						
Course Code	**:**	**18EE7F5**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.00 Hrs**
Course Learning Objectives: The students will be able to						
1	Represent discrete systems using difference equations, transfer functions and state-space models.					
2	Apply sampling and reconstruction processes to signals and systems and Design and synthesis digital controllers using both classical methods and state space methods.					
3	Represent the realization of digital filters /controllers/compensators using the direct and standard programming methods.					
4	Perform analysis for transient and steady-state responses, and for stability of open-loop and closed-loop linear time-invariant, discrete-time control systems using both classical & state space methods.					

Unit-I	**07 Hrs**
Discrete-Time System Representations: Signal representation, Starred transform, use of convolution integral in obtaining the Z-transform. Impulse Sampling and data hold. Modelling discrete-time systems by linear difference equations and pulse transfer functions. Discrete time model of its subsystems, reconstruction the original signals from sampled signals, realization of digital controllers and digital filters.	
Unit – II	**09 Hrs**
Mapping between the s-plane and the z-plane, transient and steady state response analysis of digital control systems, Dead beat response at sampling instants, stability analysis of closed loop systems in the z-plane, Jury's stability test, Use of bilinear transformation and extension of Routh-Hurwitz criterion for stability.	
Unit –III	**09 Hrs**
Root locus plot. Digital PID controller design based on root locus, Frequency response of discrete time system, Bode plots, and frequency response based design of compensators, analytical design method, Implementation.	
Unit –IV	**08 Hrs**
State Space Analysis: State space representation of discrete time systems, Different types of state models of discrete time systems, solution of discrete time state space equations, pulse transfer functions matrix, discretization of continuous time state space equations, Liapunov stability analysis, Use of Liapunov's stability theorems for stability analysis of discrete data control systems.	
Unit –V	**07 Hrs**
Pole Placement Design of Controllers and Observers: Controllability, observability, useful transformations in state space analysis and design, design of state feedback controllers via pole placement, design of full and reduced order state observers and design of servo systems using pole placement technique.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Obtain models (both transfer and function state space) of discrete-time systems and to analyze the resulting models.
CO2:	Identify, formulate and solve discrete control engineering problems, use the techniques, tools and skills related to discrete signals, computer, science and modern discrete control engineering in engineering practice
CO3:	Design digital filters (compensators) for SISO systems based upon root-locus and frequency domain methods.

CO4:	Apply modern controller design methodologies including state feedback for the design of controllers and observers.

Reference Books	
1	Discrete-Time Control Systems, Kutsuhiko Ogata ,2nd Edition, 2003, Pearson Education, .ISBN-10: 0130342815 • ISBN-13: 9780130342812.
2	Digital Control and State Variable Methods, M. Gopal , 4th Edition, 2012 TMH
3	Modern Control System, Richard C. Dorf, Robert H. Bishop, 11th Edition, 2008, Pearson Education, ISBN 13: 9780132270298
4	Digital Control of Dynamic Systems, Franklin G F, Powell J D and Workman M L, 3rd Edition, 1998 Addison Wesley, ISBN-13: 978-0201820546

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	1	3	-	-	-	-	-	-	1	2
CO2	2	2	-	-	-	-	-	-	1	1	1	2
CO3	2	3	3	2	-	-	-	-	1	1	1	2
CO4	3	3	3	-	-	-	-	-	1	1	1	2

High-3: Medium-2: Low-1

Semester: VII						
INDUSTRIAL DRIVES AND APPLICATIONS (Group G: Elective)						
Course Code	**:**	**18EE7G1**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Understand the concepts , principle of operation and performance of AC and DC Electric Drives
2	Analyze the power electronics controlling techniques of Induction motor
3	Analyze to study the performance and control of stepper motors, and their applications.
4	To know the theory of operation and control of switched reluctance motor
5	To distinguish between various operating characteristics of AC and DC Drives

Unit-I	**08 Hrs**
Introduction: Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of DC and AC Drives. **Speed Control of DC Motors:** Basic characteristics of DC motors, Operating modes, Motor performance parameters, 1ϕ converter drives for separately excited & series DC motors for continuous & discontinuous operations, Chopper fed DC drives, Comparison of converter fed drive & chopper fed drive, Open loop & closed loop control of dc drives, Dynamic and regenerative breaking of DC motors.	
Unit – II	**08 Hrs**
Induction Motor Drives: Induction motor characteristics-Control strategies like stator voltage control- v/f control, rotor resistance control- Variable frequency square wave VSI Drives-Variable frequency SPWM VSI Drives- Variable frequency CSI Drives-Open loop & closed loop control of 3 phase induction motor drive- Vector Control (Field oriented Control): Basic principle of vector control- Direct & Indirect vector control, Breaking of induction motor.	
Unit –III	**08 Hrs**
Synchronous Motor Drives: Operation from fixed frequency supply-starting, synchronous motor. Self-controlled synchronous motor drive employing load commutated inverter. **Permanent Magnet Synchronous Motors** Principle of operation – EMF and Torque equations - Phasor diagram - Power controllers –Torque speed characteristics – Digital controllers – Constructional features, operating principle and characteristics of synchronous reluctance motor.	
Unit –IV	**08 Hrs**
Permanent Magnet Brushless DC Motors Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Characteristics & Applications and open loop and closed loop Control.	
Unit –V	**08 Hrs**
Switched Reluctance Motors Constructional features –Principle of operation- Torque prediction–Characteristics Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications **Stepper Motors** Constructional features –Principle of operation –Types- Permanent magnet stepper motor, Variable reluctance stepper motor, Hybrid synchronous stepper motor–Torque predictions – Linear and Non-linear analysis – Characteristics – Drive circuits – Closed loop control –Applications Torque Versus Stepping rate Characteristics, Drive Circuits for Stepper Motor. Selection of drives and control schemes for Steel rolling mills, Paper mills, Lifts and Cranes.	

Course Outcomes: After completing the course, the students will be able to

CO1:	Understand and describe the basic concept of different types of AC, DC and industrial Drives
CO2:	Evaluate the performance of AC and DC drives for speed control ,breaking and energy conservation
CO3:	Analyze the performance and control of stepper motors, BLDC motor, switched reluctance motor and their applications
CO4:	Design and implement a suitable control strategy for optimum operation.

Reference Books	
1	Fundamentals of Electrical Drives, G.K Dubey, 2nd Edition, 5th reprint Narosa Publishing House, Chennai, 2002. ISBN-10: 8173194289
2	Electric Motors and drives, Austin Hughes, 3rd Edition 2006 ,Elsevier publication ,ISBN : 13: 978-0-7506-4718-2
3	Permanent Magnet Synhronous and Brushless DC motors Drives, R.Krishnan, CRC PRESS,2009 ISBN:0824753844
4	Stepper Motors: Fundamentals, Applications, and Design, VV Athani, 1st Edition, 1997, New Age International, ISBN-13 : 978-8122410068.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	-	-	-	-	-	-	-	1	-	1
CO2	3	3	2	1	-	-	-	-	-	1	-	1
CO3	3	2	2	2	-	-	-	-	-	1	-	1
CO4	2	3	2	3	-	-	-	-	-	1	-	1

High-3: Medium-2: Low-1

Semester: VII						
ELECTRICAL INSTALLATION ESTIMATION AND COSTING (Group G: Elective)						
Course Code	**:**	**18EE7G2**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	To have knowledge of estimation and costing in residential, industrial wiring, substation, transmission and distribution system.
2	To know the process involved in detailed estimation, tender process, issuing purchase order and testing of installations.
3	To give an insight into issues involved during installation and the coordination from other engineering fields during execution of the project.
4	To know the Indian Electrical Standards related to wiring and substation design.

Unit-I	**07 Hrs**

General Principles of Estimation:

Purpose of Estimating and costing, electrical schedule, catalogues, market survey, recording of estimates, determination of required quantity of material, labour conditions. Determination of cost of material and labour, contingencies, overhead charges, profit, purchase system, purchase enquiry and selection of appropriate purchase mode. Comparative statements, Purchase order, payment of bills. Tender form.

Unit – II	**09 Hrs**

Wiring System:

Introduction, distribution board, methods of wiring, Insulating materials, types of cables used in internal wiring, multi strand cable. Conduit accessories and fittings.

Residential building electrification:

Circuits and sub circuits, types of lighting circuits. General rules guidelines for wiring of residential installation and positioning of equipments. Determination of total load, procedure of designing the circuits and deciding the sub circuits. Determination of size of conductor, single line diagram. Sequence to be followed to prepare estimate, preparation of detailed estimates and costing of residential installation.

Inspection and testing of installations:

Inspection of internal wiring, of new installation. Testing of wiring installation. Reason for excess recording of energy consumption by energy meter.

General idea about IE rules, major applicable IE rules.

Unit –III	**09 Hrs**

Electrification of commercial installation:

Difference between electrification of residential and commercial installation. Fundamental considerations for planning o an electrical installation system for commercial building. Design considerations of electrical installation system for commercial building. Load calculation and selection of service connection and nature of supply. Deciding the size of the cables, bus bar and bus bar chambers, mounting arrangements and positioning of switch boards, distribution boards main switch etc. Earthing of the electrical installation, wiring system and layout. Sequence to be followed to prepare estimate. Preparation of detailed estimate and costing of commercial installation.

Electrical wiring and installation for power circuits:

Motor installation. Determination of input power, input current to motors. Determination of cables. Determination of rating of fuse. Determination of size of conduit, distribution board, main switch and starter. Estimation of power circuits.

Unit –IV	**08 Hrs**

Design and Estimation of overhead transmission and distribution:

Introduction, typical AC electrical power system main components of overhead lines, line supports. Factors governing height of pole, conductor material, determination of size of conductor, cross arms, ole brackets and clamps, guys and stays. Conductors configuration, spacing and clearances, span

lengths, overhead line insulators, insulator materials, types of insulators. Lightning arresters, phase plates, danger plates, ant climbing devices bird guards etc. Erection of supports, fixing of cross arms, insulators, conductor erection. Dear end clamps. Earthing of transmission lines. Guarding of overhead lines.

Unit –V	**07 Hrs**

Design and estimation of substations:
Introduction, classification of substations, indoor substations, outdoor substations, selection and location of site for substation. Main electrical connections, graphical symbols for various types of apparatus and circuit elements, key diagrams of typical substations. Equipment for substations and switchgear installations, axillaries supply. Substation earthing.
Concept of Internal Rate of Return(IRR)

Course Outcomes: After completing the course, the students will be able to	
CO1:	Involve in estimating, costing and tender.
CO2:	Apply the technical knowledge in estimating the quantity of materials required for domestic and industrial electrification process.
CO3:	Design the circuits and sub circuits required for electrifying the commercial and power installation.
CO4:	Design and estimate the transmission lines and substation.

Reference Books	
1	Electrical installation estimating and costing, J.B.Gupta, , 8th Edition, S.K Kataria and sons, New Delhi, 2013, ISBN : 9788188458998.
2	Electrical Design Estimating and costing, K. Raina, S.K Bhattacharya, New age international, First Edition, 2005, ISBN : 81-224-0363-8,
3	Electrical Wiring Estimating and Costing, Uppal, Khanna Publishers, Delhi. I.E Rules and Act Manuals, First Edition, 2012, ISBN : 8174092404, 9788174092403
4	Electrical Design Estimating and Costing, K .B. Raina, Bhatyachar, 2nd Edition, 2017, New Age International Private Limited, ISBN-13 : 978-8122443585

Continuous Internal Evaluation (CIE); Theory (100 Marks)
CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.
Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.
Semester End Evaluation (SEE); Theory (100 Marks)
SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	-	-	-	-	-	-	-	1	-	1
CO2	3	2	1	1	-	-	-	-	-	1	-	1
CO3	3	3	2	2	-	-	-	-	-	1	-	1
CO4	3	3	3	3	-	-	-	-	-	1	-	1

High-3: Medium-2: Low-1

Semester: VII						
OBJECT ORIENTED MODELLING AND DESIGN (Group G: Elective)						
Course Code	**:**	**18EE7G3**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to	
1	Understand the operation of an object in a software application.
2	Design of an object by satisfying its requirements in the design stage.
3	Interpreting various UML Diagrams for implementation of software application.
4	Converting Legacy Systems to a programmable mode before Implementation.

Unit-I	**08 Hrs**
INTRODUCTION, MODELING CONCEPTS, CLASS MODELLING: Object Model: Evolution, Foundations, Elements of object model, Applying the object model, usefulness of OO development; OO modelling history. Modelling as Design Technique: Modelling; abstraction; Class Modelling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model.	
Unit – II	**08 Hrs**
ADVANCED CLASS MODELING, STATE MODELLING: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; State Modelling: Events, States, Transitions and Conditions; State diagrams; State diagram behaviour;	
Unit –III	**08Hrs**
ADVANCED STATE MODELLING, INTERACTION MODELLING: Advanced State Modelling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips. Interaction Modelling: Use case models; Sequence models; Activity models. Use case relationships; sequence models.	
Unit –IV	**08 Hrs**
PROCESS OVERVIEW, SYSTEM CONCEPTION, AND DOMAIN ANALYSIS: Process Overview: Development stages; Development life cycle. System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.	
Unit –V	**08 Hrs**
CLASS DESIGN AND IMPLEMENTATION MODELLING : Class Design: Overview of class design; Bridging the gap; Realizing use cases; Refactoring; Adjustment of inheritance; Organizing a class design; ATM example. Implementation Modelling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; realizing associations.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand existing models used in software application in terms of unified modelling language.
CO2:	Analyse the different working models to implement the software application.
CO3:	Evaluate the operation of legacy systems into implementable system.
CO4:	Design working software models.

Reference Books	
1	Object-Oriented Analysis and Design with Applications, Grady Booch et al:, 3rd Edition, 2007, Pearson Education, ISBN 9780132797.
2	Object-Oriented Analysis, Design, and Implementation, Brahma Dathan, Sarnath Ramnath, 2nd edition 2015, Springer Nature. ISBN-13 : 978-3319242781.

3	UML 2 Toolkit, Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, 2nd Edition, 2004 John Wiley & Sons; ISBN-13 : 978-0471463610.
4	Object-Oriented Systems Analysis and Design Using UML, Simon Bennett, Steve McRobb and Ray Farmer, 2nd Edition, 2002, Tata McGraw-Hill, ISBN 77094972.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	1	-	1	-	2	-	-	-	-	1
CO2	2	2	2	1	-	1	1	-	-	1	-	1
CO3	2	2	2	2	2	2	2	1	1	1	-	1
CO4	2	2	2	2	1	2	2	1	1	1	-	2

High-3: Medium-2: Low-1

Semester: VII					
Power System Operation and control (Group G, Elective, Theory)					
Course Code	**:**	**18EE7G4**		**CIE**	**100 Marks**
Credits L:T:P	**:**	**3:0:0**		**SEE**	**100 Marks**
Hours	**:**	**40L**		**SEE Duration:**	**03 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand and explain the fundamental principles of operation and control of the power system for reliable operation.
2	Explain the components of SCADA and challenges in applying it to power systems
3	Compare and evaluate the different algorithms for unit commitment and hydro-thermal scheduling
4	Study the effect of tie-line control and frequency bias factors on AGC and develop the state space model for frequency analysis
5	Perform a complete contingency analysis and rank the contingencies

UNIT-I	**08 Hrs**
Introduction and SCADA in modern power systems : Operating states of the power system, objectives of control, key concepts of reliable operation, reliable operation, preventive and emergency controls, modern energy management centres, SCADA and its components, SCADA users in power systems, RTUs for power system SCADA, communication channels, challenges of application of SCADA, PMUs	
UNIT II	**09 Hrs**
Unit Commitment and hydro-thermal scheduling.: Problem of unit commitment, constraints, enumeration and priority list method, Dynamic programming, Scheduling of hydro-thermal systems scheduling from energy available, scheduling using penalty factors	
UNIT III	**09 Hrs**
Load Forecasting: Time series data, forecasting using moving average, smoothing methods, simple regression, ARIMA, Kalman filter. Challenges in load forecasting.	
UNIT IV	**07 Hrs**
Voltage and Reactive Power Control: Reactive power, voltage control methods, cost saving, voltage control by reactive power injection, voltage control using transformers, voltage stability, voltage strength and voltage collapse.	
UNIT V	**07 Hrs**
Power system reliability and security : Security levels, adequacy indices, reliability indices, functions of system security, contingency analysis, contingency selection and ranking	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the different operating states and the respective control actions available in each of them and the SCADA systems in use.
CO2	Analyse and apply suitable technique for unit commitment and hydro-thermal scheduling under different operating constraints.
CO3	Provide solutions for voltage control of a power system under specified operating conditions
CO4	Perform a contingency analysis and provide solutions to stabilize system under different contingencies.

Reference Books	
1.	Power System Stability and Control, P. Kundur, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, ISBN : 2010, 9780070635159

2.	Power System Operation and Control, Uma Rao K, Wiley India, 2012, ISBN : 9788126534418
3.	Power Generation Operation and Control, A. J. Wood, B. F. Woolenberg, John Wiley and Sons, ISBN : 9780471790556
4.	Electric Power Systems, John Wiley and Sons, 1988, ISBN : 9789971513207

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	1	-	-	-	1	-	-	-
CO2	2	2	2	1	2	-	-	-	1	-	-	1
CO3	2	3	3	2	2	-	-	1	1	-	-	1
CO4	3	3	3	3	2	-	-	1	1	-	-	1

High-3: Medium-2 : Low-1

Semester: VII						
ASIC DESIGN **(Group G: Elective, Theory)**						
Course Code	**:**	**18EE7G5**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**03 Hours**

Course Learning Objectives: The students will be able to

1	Understand the fundamentals of ASIC and its design methods
2	Differentiate between ASICs and FPGAs, standard cells, cell libraries, IPs.
3	Gain knowledge on programmable architectures for ASICs.
4	Analysing the steps involved in physical design of ASIC including floor planning, placement, and Routing.
5	Design a digital system from specifications to GDSII.

Unit-I	**07Hrs**
Introduction to ASIC: Types of ASICs: Full Custom ASIC, Semi-custom based ASICS, Standard Cell based ASIC, Gate array based ASIC, Channeled gate array, Channel less gate array, Structured gate array, Programmable logic devices, FPGA. Design flow, CMOS Logic.	
Unit – II	**09Hrs**
Combinational logic cells Sequential logic cells: Latch, flipflop, clocked inverter, Data logic cells: Data Path Elements, Adders, Multipliers, Arithmetic operator, I/O Cell, Cell Compilers ASIC Library Design. **Logical effort:** predicting delay, logical area and logical efficiency, logical paths, multistage cells, optimum delay, optimum no. of stages, Library cell design.	
Unit –III	**09 Hrs**
Programmable ASICS: The Antifuse, Static RAM, EPROM and EEPROM technology. Programmable ASICs logic cells. **Actel ACT:** ACT1 logic module, Shannon's expansion theorem, Multiplexer logic as function generators, Timing models and critical path, speed gating, worst case timing. Low-Level Design Entry: Schematic Entry: Hierarchical design. The cell library, Names, Schematic, Icons & Symbols, Nets, schematic entry for ASIC'S, connections, vectored instances, and buses, Edit in place attributes, Netlist, screener, Back annotation.	
Unit –IV	**07 Hrs**
ASIC Construction: Physical Design, CAD Tools, System Partitioning, Estimating ASIC size, Power Dissipation, FPGA Partitioning, Partitioning methods: The Kernighan Lin Algorithm, The Ratio Cut Algorithm. Floor planning tools, I/O and power planning, clock planning.	
Unit –V	**08 Hrs**
Floor Planning and Placement: Floor Planning, Placement, Placement Terms and Definitions, Goals and Objectives, Placement algorithms, iterative placement improvement, Time driven placement methods. Physical Design flow. **Routing:** Global Routing, Local Routing, Detail Routing, Circuit Extraction and DRC.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand different ASIC design techniques and Data path logic cells.
CO2:	Analyze the design of Combinational and Sequential logic cells and optimizing Library cells with respect to speed and area.
CO3:	Apply and analyze the algorithmic concepts for the physical design of ASICs and Programmable logic cells.
CO4:	Apply the back-end physical design flow for placement, and Routing techniques to meet the timing constraints.

Reference Books	
1	Application - Specific Integrated Circuits, M.J.S .Smith,3rd Edition, 2003, Pearson Education, ISBN:978-817758-408-0.
2	"Advanced ASIC Chip Synthesis Using Synopsys Design Compiler Physical Compiler and PrimeTime", H. Bhatnagar, 2nd edition, 2001, ISBN:0792385373
3	Logic Synthesis Using Synopsys" ,P. Kurup, T. Abbasi, 2nd Edition, 1997, ISBN 0-7923-9582-4
4	From ASICs to SOCs: A Practical Approach, Farzad Nekoogar and Faranak Nekoogar, 1st Edition, 2003, Prentice Hall PTR, ISBN-13: 978-0130338570

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes conducted may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**
CO2	**3**	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**1**	**-**	**1**
CO3	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**-**	**1**	**-**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**1**	**3**

High-3: Medium-2 : Low-1

Semester: VII						
UNMANNED AERIAL VEHICLES (Group H: Global Elective)						
Course Code	**:**	**18G7H01**		**CIE**	**:**	**100 Marks**
Credits: L:T:P:S	**:**	**3:0:0:0**		**SEE**	**:**	**100 Marks**
Hours	**:**	**39L**		**SEE Duration:**	**:**	**3Hrs**

Course Learning Objectives: The students will be able to	
1	Get an overview of the history of UAV systems
2	Understand the importance of aerodynamics, propulsion, structures and avionics in the design of UAV
3	Demonstrate ability to address the various mission payloads - on-board & off-board, propulsion systems, integration with manned systems
4	Comprehend the importance of guidance and navigation of a UAV

Unit-I	**07 Hrs**
Overview of Unmanned Aerial Vehicles and Systems: History of UAVs, Need of unmanned aerial systems, Overview of UAV Systems-System Composition, Classification of UAVs based on size, range and endurance, Basic working of fixed, rotary and flapping UAVs, Applications of UAVs.	
Unit – II	**08 Hrs**
Aerodynamics of Unmanned Aerial Vehicles: Airfoil nomenclature and its characteristics, Basic aerodynamics equations, Aircraft polar, Types of drag, Aerodynamics of rotary and flapping wings, Airframe configurations-HTOL, VTOL and Hybrids.	
Unit -III	**08 Hrs**
Structures of UAV: Mechanic loading, Load calculation, Materials used for UAV (general introduction), Selection criteria for structure, Types of structural elements used in UAV their significance and characteristics. **UAV Propulsion Systems:** Thrust Generation, Powered Lift, Sources of Power for UAVs- Piston, Rotary, Gas turbine engines, electric or battery powered UAVs.	
Unit -IV	**08 Hrs**
Payloads of UAVs : Non-dispensable Payloads- Electro-optic Payload Systems, Radar Imaging Payloads, Electronic Warfare Payloads, Dispensable Payloads and other payloads. **Launch and Recovery Systems for UAVs:** UAV Launch Methods for Fixed-Wing Vehicles- Rail Launchers, Pneumatic Launchers, Hydraulic/Pneumatic Launchers, Zero Length RATO Launch of UAVs, UAV Recovery Systems-Conventional Landings, Vertical Net Systems, Parachute Recovery, VTOL UAVs, Mid-Air Retrieval, Shipboard Recovery.	
Unit -V	**08 Hrs**
UAV Navigation and Guidance Systems Navigation, Dead Reckoning, Inertial, Radio Navigation, Satellite–Way point Navigation, UAV Guidance, Types of guidance, UAV communication systems, Ground control station, Telemetry, UAS future.	

Course Outcomes: At the end of this course the student will be able to :	
CO1	Appraise the evolution of UAVs and understand the current potential benefits of UAVs
CO2	Apply the principles of Aerospace Engineering in design and development of UAVs
CO3	Determine and evaluate the performance of UAV designed for various Missions and applications
CO4	Appreciate the guidance and navigation systems for enabling the versatility of UAV systems

Reference Books	
1	Unmanned Aircraft Systems UAV design, development and deployment, Reg Austin, 1st Edition, 2010, Wiley, ISBN 9780470058190.
2	Introduction to UAV Systems, Paul G Fahlstrom, Thomas J Gleason, 4th Edition, 2012, Wiley, ISBN: 978-1-119-97866-4
3	Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy, Kimon P. Valavanis, 1st Edition,2007, Springer ISBN 9781402061141
4	Flight Stability and Automatic Control, Robert C. Nelson, 2nd Edition, October 1, 1997, McGraw-Hill, Inc, ISBN 978-0070462731.
5	Design of Unmanned Air Vehicle Systems, Dr. Armand J. Chaput, 3rd Edition, 2001, Lockheed Martin Aeronautics Company, ISBN: 978-1-60086-843-6

Continuous Internal Evaluation (CIE); Theory (100 Marks)
CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20. **Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.**

Semester End Evaluation (SEE); Theory (100 Marks)
SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	1	1	3	2	2	-	-	-	1
CO2	2	3	3	3	1	1	1	1	-	-	-	2
CO3	1		3	3	-	-	-	-	-	-	-	2
CO4	3	3	3	3	-	2	1	2	-	-	-	2

High-3 : Medium-2 : Low-1

Semester: VII						
BIOINFORMATICS (Group H: Global Elective)						
Course Code	**:**	**18G7H02**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Acquire the knowledge of biological database and its role in insilico research
2	Understand the essential algorithms behind the biological data analysis such as Dynamic programming, Dot plotting, Evolutionary and Clustering algorithms along with their implementation.
3	Use various tools and techniques for the prediction of linear & non-linear structures of both macro and micro molecules and study the dynamics of macromolecules and High Throughput Virtual Studies.
4	Perform annotation of unknown DNA and Protein sequences and explore the principles of molecular modelling
5	Apply the knowledge towards analyzing the sequences using programming languages and Drug development

Unit-I	**08 Hrs**
Biomolecules and Introduction to Bioinformatics: Introduction to Biomolecules. Structure, Types and Functions of Carbohydrates, Lipids, Nucleic Acids and Proteins. Genetic code, Codon degeneracy, Genes and Genomes. Introduction to Bioinformatics, Goals, Scope, Applications in biological science and medicine. Biological databases – Sequence, structure, Special Databases and applications - Genome, Microarray.	
Unit – II	**08 Hrs**
Sequence analysis: Introduction, Types of sequence alignments, Pairwise sequence alignment, Multiple sequence alignment, Alignment algorithms Needleman & Wunch, Smith & Waterman and Progressive global alignment, Database Similarity Searching- Scoring matrices – BLOSSUM and PAM, Basic Local Alignment Search Tool (BLAST), and FASTA. Next Generation Sequencing – Alignment and Assembly. **Molecular Phylogenetics:** Introduction, Terminology, Forms of Tree Representation. Phylogenetic Tree Construction Methods - Distance-Based, Character-Based Methods and Phylogenetic Tree evaluation	
Unit –III	**09 Hrs**
Predictive and structural bioinformatics: Gene prediction programs – ab initio and homology based approaches. ORFs for gene prediction. Detection of functional sites and codon bias in the DNA. Predicting RNA secondary structure, Protein structure basics, structure visualization, comparison and classification. Protein structure predictive methods using protein sequence, Protein identity based on composition. Structure prediction - Prediction of secondary structure.	
Unit –IV	**07 Hrs**
PERL: Introduction to Perl, writing and executing a Perl program, Operators, Variables and Special variables. Object Oriented Programming in Perl–Class and object, Polymorphism, inheritance and encapsulation. Data Types – Scalar, Array and Associative array. Regular Expressions (REGEX), Components of REGEX - Operators, Metacharacters and Modifiers.	
Unit –V	**07 Hrs**
BioPERL: Introduction to BioPerl, BioPerl Modules, Applications of BioPerl – Sequence retrieval from Database and submission of sequence to online Database, Indexing and accessing local databases, Sequence alignments BioPerl and Sequence Analysis - Pair wise and Multiple sequence alignment, Parsing BLAST and FASTA results.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Demonstrate the knowledge of retrieval of the biological data in the essential formats and its analysis.
CO2:	Analyse the gene, protein and RNA data to find the degree of similarities and identifying the patterns
CO3:	Apply the drug designing methods for screening and inventing the new targets and drugs
CO4:	Predict the structure of a compound and design the molecule.

Reference Books	
1.	Essential Bioinformatics, Jin Xiong, 2006, Cambridge University Press, ISBN: 978-05-216-00828.
2.	Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins; D. Andreas Baxevanis and B. F; Francis Ouellette. 2009; Wiley-IEEE; 3rd edn; ISBN: 978-81-265-21920.
3	Bioinformatics: Sequence and Genome Analysis; D W Mount; 2014; CSHL Press; 2nd edn; ISBN: 9780879697129.
4	Computational Systems Biology; A Kriete and R Eils; 2006; Academic Press; Illustrated edn; ISBN: 978-01-208-87866.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20. **Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.**

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	1	-	1
CO2	3	2	2	1	-	-	-	-	-	1	-	1
CO3	3	3	2	2	-	-	-	-	-	1	-	1
CO4	3	3	3	3	-	-	-	-	-	1	-	1

High-3: Medium-2: Low-1

Semester: VII						
INDUSTRIAL SAFETY AND RISK MANAGEMENT (Group H: Global Elective)						
Course Code	**:**	**18G7H03**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to	
1	Select appropriate risk assessment techniques.
2	Analyze public and individual perception of risk.
3	Relate safety, ergonomics and human factors.
4	Carry out risk assessment in process industries

Unit-I	**08 Hrs**
Introduction: Introduction to industrial safety engineering, major industrial accidents, safety and health issues, key concepts and terminologies, Hazard theory, Hazard triangle, Hazard actuation, Actuation transition, Causal factors, Hazard recognition.	
Unit – II	**08 Hrs**
Risk assessment and control: Individual and societal risks, Risk assessment, Risk perception, Acceptable risk, ALARP, Prevention through design. **Hazard Identification Methods:** Preliminary Hazard List (PHL): Overview, methodology, worksheets, case study. Preliminary Hazard Analysis (PHA): Overview, methodology, worksheets, risk index, example.	
Unit –III	**08 Hrs**
Hazard analysis: Hazard and Operability Study (HAZOP): Definition, Process parameters, Guide words, HAZOP matrix, Procedure, Example. Failure Modes and Effects Analysis (FMEA): Introduction, system breakdown concept, methodology, example.	
Unit –IV	**08 Hrs**
Application of Hazard Identification Techniques: Case of pressure tank, system breakdown structure, safety ontology, Accident paths, HAZOP application, risk adjusted discounted rate method, probability distribution, Hiller's model	
Unit –V	**07 Hrs**
Safety in process industries and case studies: Personnel Protection Equipment (PPE): Safety glasses, face shields, welding helmets, absorptive lenses, hard hats, types of hand PPE, types of foot PPE, types of body PPE. Bhopal gas tragedy, Chernobyl nuclear disaster, Chemical plant explosion and fire.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Recall risk assessment techniques used in process industry.
CO2:	Interpret the various risk assessment tools.
CO3:	Use hazard identification tools for safety management.
CO4:	Analyze tools and safety procedures for protection in process industries.

Reference Books	
1	Functional Safety in the Process Industry: A Handbook of practical Guidance in the application of IEC61511 and ANSI/ISA-84, Kirkcaldy K.J.D Chauhan, 2012, North corolina, Lulu publication, ISBN:1291187235
2	Safety Instrumented Systems Verification Practical probabilistic calculations, Goble

	and William M., 2005, Pensulvania ISA publication, ISBN:155617909X
3	Industrial safety and risk Management, Laird Wilson and Doug Mc Cutche, 1st Edition, 2003, The University of alberta press,Canada, ISBN: 0888643942.
4	Industrial Safety, Health and Environment Management Systems, R K Jain, Sunil S Rao, 4th Edition, 2005, Khanna Publishers, New Delhi, ISBN: 8174092102

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20. **Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.**

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	1	-	1	1	1	-	-	1	-
CO2	2	3	1	-	1	1	-	-	-	-	-	-
CO3	3	2	1	1	2	-	1	-	-	1	1	-
CO4	3	-	1	-	-	-	-	-	1	-	1	-

High-3; Medium-2; Low-1

Semester: VII						
WEB PROGRAMMING (Group H: Global Elective)						
Course Code	**:**	**18G7H04**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Understand the standard structure of HTML/XHTML and its differences.
2	Adapt HTML and CSS syntax & semantics to build web pages.
3	Learn the definitions and syntax of different web programming tools such as JavaScript, XML and Ajax to design web pages.
4	Design and develop interactive, client-side, server-side executable web applications using different techniques such as CSS, JavaScript, XML and Ajax.

Unit-I	**07 Hrs**
Introduction to Web, HTML and XHTML: Fundamentals of Web(Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, the Web Programmers Toolbox), XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links, Lists, Tables, Forms, Frames. **HTML 5:** Core HTML attributes, headings, paragraphs and breaks, quotations, preformatted text, lists, horizontal rules, block-level elements, text-level elements The audio Element; The video Element; Organization Elements; The time Element, Syntactic Differences between HTML and XHTML.	
Unit – II	**08 Hrs**
CSS (Cascading Style Sheet) Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution. **The Basics of JavaScript:** Overview of JavaScript; Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements.	
Unit –III	**09 Hrs**
JavaScript (continued): Object creation and modification; Arrays; Functions; Constructor; Pattern matching using regular expressions; Errors in scripts. **JavaScript and HTML Documents:** The JavaScript execution environment; The Document Object Model; Element access in JavaScript; Events and event handling; Handling events from the Body elements, Button elements, Text box and Password elements; The DOM 2 event model; The navigator object.	
Unit –IV	**08 Hrs**
Dynamic Documents with JavaScript: Introduction to dynamic documents; Positioning elements; Moving elements; Element visibility; Changing colors and fonts; Dynamic content; Stacking elements; Locating the mouse cursor; Reacting to a mouse click; Slow movement of elements; Dragging and dropping elements. **Introduction to PHP:** Origins and uses of PHP; overview of PHP; General syntactic characteristics; Primitives, Operations and Expressions; Output; Control statements; Arrays; Functions; Pattern Matching; Form Handling;Cookies; Session Tracking.	
Unit –V	**07 Hrs**
XML: Introduction; Syntax; Document structure; Document Type definitions; Namespaces; XML schemas; Displaying raw XML documents; Displaying XML documents with CSS; XSLT style sheets. **Ajax:** Overview of Ajax; Basics of Ajax: The Application; The Form Document; The Request Phase; The Response Document; The Receiver Phase.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the basic syntax and semantics of HTML/XHTML.
CO2:	Apply HTML/XHTML tags for designing static web pages and forms using Cascading Style Sheet.
CO3:	Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP and utilize the concepts of XML & Ajax to design dynamic web pages.
CO4:	Develop web based applications using PHP, XML and Ajax.

Reference Books	
1	Programming the World Wide Web – Robert W. Sebesta, 7th Edition, Pearson Education, 2013, ISBN-13:978-0132665810.
2	Web Programming Building Internet Applications – Chris Bates, 3rd Edition, Wiley India, 2006, ISBN: 978-81-265-1290-4.
3	Internet & World Wide Web How to H program – M. Deitel, P.J. Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004, ISBN-10: 0-130-89550-4
4	The Complete Reference to HTML and XHTML- Thomas A Powell, 4th Edition, Tata McGraw Hill, 2003, ISBN: 978-0-07-222942-4.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marksis executed by means of an examination. The Question paper for the course contains two parts, Part A and Part B. Part A consists of objective type questions for 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**	**-**	**2**	**-**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**1**
CO2	**-**	**-**	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**2**
CO4	**-**	**-**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**2**

High-3: **Medium-2:** **Low-1**

Semester: VII						
SOLID WASTE MANAGEMENT AND STATUTORY RULES (Group H: Global Elective)						
Course Code	**:**	**18G7H05**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Impart the knowledge of present methods of solid waste management system and to analyze the drawbacks.
2	Understand various waste management statutory rules for the present system.
3	Analyze different elements of solid waste management and design and develop recycling options for biodegradable waste by composting.
4	Identify hazardous waste, e-waste, plastic waste and bio medical waste and their management systems.

Unit-I	**08 Hrs**
Introduction: Present solid waste disposal methods. Merits and demerits of open dumping, incineration, pyrolysis, composting, sanitary landfill. Scope and importance of solid waste management. Definition and functional elements of solid waste management. **Sources**: Sources of Solid waste, types of solid waste, composition of municipal solid waste, generation rate, Problems. **Collection and transportation of municipal solid waste:** Collection of solid waste- services and systems, Municipal Solid waste (Management and Handling) 2016 rules with amendments. Site visit to collection system.	
Unit – II	**08 Hrs**
Composting Aerobic and anaerobic composting - process description, process microbiology, Vermicomposting, Site visit to compost plant, Numerical problems. **Sanitary land filling**: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Site visit to landfill site.	
Unit –III	**08 Hrs**
Hazardous waste management: Definitions, Identification of hazardous waste, Classification of hazardous waste, onsite storage, collection, transfer and transport, processing, disposal, Hazardous and other wastes (Management and Transboundary Movement) Rules, 2016 with amendments. Site visit to hazardous landfill site	
Unit –IV	**08 Hrs**
Bio medical waste management: Classification of bio medical waste, collection, transportation, disposal of bio medical waste, Biomedical waste management (Management & Handling Rules) 2016 with amendments. Site visit to hospital to observe biomedical waste collection and transportation system and visit to biomedical waste incineration plant.	
Unit –V	**07 Hrs**
E-waste management: Definition, Components, Materials used in manufacturing electronic goads, Recycling and recovery integrated approach. e-waste (Management) Rules 2016 and amendments. Site visit to e- waste treatment plant. **Plastic waste management:** Manufacturing of plastic with norms. Plastic waste management. Plastic manufacture, sale & usage rules 2009 with amendments.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the current solid waste management system and statutory rules.
CO2:	Analyse drawbacks in the present system and provide recycling and disposal options for each type of waste in compliance to rules.
CO3:	Distinguish Hazardous waste, Biomedical waste, E waste and to provide scientific management system.
CO4:	Evaluate and monitor the Biomedical waste, Hazardous waste, E waste, Plastic and Municipal waste management as per the rules laid by Ministry of Environment, Forest and Climate change.

Reference Books :	
1	Integrated Solid Waste Management, George.C. Tchobanoglous, International edition ,1993, McGraw hill publication. ISBN 978-0070632370
2	Electronic waste management, R.E. Hester, Roy M Harrison, , Cambridge, UK, 2009, RSC Publication, ISBN 9780854041121
3	Solid Waste Management Rules 2016 , Ministry of Environment, Forest and Climate Change Notification, New Delhi, 8th April 2016
4	Hazardous and other wastes (Management and Transboundary Movement) Rules, 2016, Ministry of Environment, Forest and Climate Change Notification, New Delhi, 04th April, 2016.
5	Biomedical waste management (Management & Handling Rules) 2016,. Ministry of Environment & Forest Notification, New Delhi, amendment on 28th March, 2016.
6	E-waste (Management) Rules 2016, Ministry of Environment, Forest and Climate Change Notification, New Delhi, 23rd March , 2016.
7	Plastic Waste (Management and Handling) Rules, 2011 as amended in 2018, Ministry of Environment, Forest and Climate Change Notification, New Delhi, 27th March , 2018

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by the way of Tests (T), Quizzes (Q),) and Experiential Learning (EL). Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. Minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The marks component for experiential learning is 20.

Total CIE is 50 (T) +30 (Q) +20 (EL) = 100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	-	-	-	-	2	2	1	-	1	-	2
CO2	2	2	2	2	-	1	2	1	-	-	-	-
CO3	1	-	2	2	-	1	2	1	-	1	-	-
CO4	2	-	-	3	-	1	2	1	-	-	-	1

High-3: Medium-2: Low-1

Semester: VII						
IMAGE PROCESSING AND MACHINE LEARNING (Group H: Global Elective)						
Course Code	**:**	**18G7H06**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to	
1	Understand the major concepts and techniques in image processing and Machine Learning
2	To explore, manipulate and analyze image processing techniques
3	To become familiar with regression methods, classification methods, clustering methods.
4	Demonstrate image processing and Machine Learning knowledge by designing and implementing algorithms to solve practical problems

Unit-I	**08 Hrs**
Introduction to image processing: Introduction to image processing, Applications of image processing, Components of an image processing system, Fundamental steps in image processing, Image formation and representation, Color imagery, basic definitions, Pixels, Image resolution, PPI and DPI, Bitmap images, Lossless and lossy compression, Image file formats, Color spaces, Bezier curve, Ellipsoid, Gamma correction, Examples of zooming and shrinking in image processing Advanced image concepts.	
Unit – II	**08 Hrs**
Basics of Python, Scikit image & Advanced Image Processing using Open CV: Basics of python, variables & data types, data structures, control flow & conditional statements, uploading & viewing an image, Image resolution, gamma correction, determining structural similarities.	
Unit –III	**08 Hrs**
Advanced Image processing using Open CV Blending Two Images, Changing Contrast and Brightness Adding Text to Images Smoothing Images, Median Filter, Gaussian Filter, Bilateral Filter, Changing the Shape of Images, Effecting Image Thresholding, Calculating Gradients, Performing Histogram Equalization	
Unit –IV	**08 Hrs**
Image Processing using Machine Learning Feature mapping using SIFT algorithm, Image registration using the RANSAC algorithm, Image classification using Artificial Neural Networks, Image classification using CNNs, Image classification using machine learning Approaches.	
Unit –V	**08 Hrs**
Real time use CASES Exhaustive vs. Stochastic Search, Shapes, Contours, and Appearance Models. Mean-shift tracking; Contour-based models, finding palm lines, Face Detection / Recognition, Tracking movements.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Gain knowledge about basic concepts of Image Processing
CO2:	Identify machine learning techniques suitable for a given problem
CO3:	Write programs for specific applications in image processing

CO4:	Apply different techniques for various applications using machine learning techniques.

Reference Books	
1	Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods Pearson Education, 3rd Edition, ISBN 978-81-317-2695-2.
2	Practical Machine Learning and Image Processing: For Facial Recognition, Object Detection, and Pattern Recognition Using Python, Himanshu Singh, 1st Edition, Apress, ISBN:978-1-4842-4149-3
3	Pattern Recognition and Machine Learning, Christopher Bishop, 1st Edition Springer, 2008, ISBN: 978-0387-31073-2
4	Computer Vision: A modern Approach, David Forsyth and Jean Ponce, 2nd Edition, Prentice Hall India 2004, ISBN: 978-0136085928

Continuous Internal Evaluation (CIE); Theory (100 Marks)
CIE is executed by way of quizzes (Q), tests (T) and Assignment. A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for assignment is 20. The total marks of CIE are 100.
Total CIE is 30(Q)+50(T)+20(EL)=100Marks

Semester End Evaluation (SEE); Theory (100 Marks)
SEE for 100 marks is executed by means of an examination. The Question paper for each course contains two parts, Part A and Part B. Part A consists of objective type questions for 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO 1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**-**	**3**	**-**	**1**	**2**	**-**	**-**	**1**	**2**	**-**	**-**	**1**
CO3	**3**	**-**	**2**	**1**	**3**	**-**	**-**	**1**	**1**	**1**	**-**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**1**	**1**	**1**	**-**	**1**

High-3; Medium-2; Low-1

Semester: VII						
RENEWABLE ENERGY SOURCES AND STORAGE SYSTEM (Group H: Global Elective)						
Course Code	**:**	**18G7H07**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Understand Concepts of nonconventional energy sources and allied technology required for energy conversion.
2	Analyse the Basics of battery working and sizing of battery for a given application.
3	Design aspects of solar and wind power systems.
4	Energy storage techniques

UNIT-I	**08 Hrs**

Basics of Renewable Energy: Energy balance of the earth, Solar radiation, wind energy, geothermal energy.

Geothermal Energy – principles, technical description, heat supply by hydro-geothermal systems, heat supply by deep wells, geothermal generation, economic and environmental analysis.

Biomass Energy: Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Updraft, Downdraft and Cross-draft Gasifiers, Applications of Biomass Gasifier.

Tidal Energy: Introduction, Tidal Energy Resource, Tidal Power Basin, Advantages and Disadvantages of Tidal Power.

Unit – II	**08 Hrs**

Photo Voltaic Systems: PV Cell, Module and array; Equivalent electrical circuit, Open –circuit voltage and short circuit current, I-V and P-V curves, Array design, Peak power Tracking, System Components,

Grid Connected Solar PV Power System: Introduction to grid connected PV system, Configuration of Grid-connected solar PV system, Components of Grid –connected solar PV systems, Grid connected PV system Design for small power Applications, Grid- connected PV system design for power plants.

Unit -III	**08 Hrs**

Wind Power: Introduction, site selection, Advantages and Disadvantages, Wind power installations in the world.

Wind Speed and Energy: Speed and Power Relations, Power Extracted from the wind. Rotor-Swept Area, Air Density, Global Wind Patterns, Wind Speed Distribution, Weibull Probability, Distribution, Mode and Mean Speeds, Root Mean Cube Speed, Mode, Mean, and RMC Speeds, Energy Distribution, Digital Data Processing, Effect of Hub Height, Importance of Reliable Data, Wind Speed Prediction, Wind Energy Resource Maps.

Wind Power Systems: System Components, Tower, Turbine, Blades, Speed Control, Turbine Rating, Power vs Speed and TSR.

Unit –IV	**08 Hrs**

Wind Power Systems: Maximum Energy Capture, Maximum Power Operation Constant-TSR Scheme, Peak-Power-Tracking scheme, System-Design Trade-offs, Turbine Towers and Spacing, Number of Blades, Rotor Upwind or Downwind, Horizontal vs. Vertical Axis.

System Control Requirements: Speed Control, Rate Control.

Environmental Aspects: Audible Noise, Electromagnetic Interference (EMI), Effects on Birds.

Unit –V	07 Hrs
Energy storage **Batteries:** Different types of batteries, Equivalent Electrical Circuit, Battery charging, Battery management **Flywheels**: Energy Relations, Components, Benefits over battery **Other Storage devices:** Superconducting magnetic energy storage, Compressed air, Pumped storage hydropower, Hydrogen Energy storage	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the concepts of power generation from various renewable sources.
CO2:	Design the Size of the battery required for solar PV applications.
CO3:	Design main components of solar and wind power systems.
CO4:	Execute projects in renewable power generation.

Reference Books	
1	Renewable energy: Technology, Economics and Environment, Martin Kaltschmitt, Wolfgang Streicher Andreas Wiese, Springer Publication, 2007, ISBN 978-3-540-70947-3
2	Solar photo voltaic Technology and systems, Chetan Singh Solanki, third edition(2013), PHI , Learning private limited New Delhi ISBN: 978-81-203-4711-3
3	Wind and solar power system design, Analysis and operation, Mukund R. Patel, 2nd Edition. CRC Group ,Taylor and Francis group, New Delhi ,ISBN 978-0-8493-1570-1
4	Power System Energy Storage Technologies, Paul Breeze, Academic Press, 2018, ISBN 978-0-12-812902-9

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	3	2	-	-	-	-	-	1	-	1
CO2	3	3	2	1	1	2	-	-	-	1	-	1
CO3	3	2	2	2	2	2	2	1	-	1	-	1
CO4	3	3	3	3	2	3	1	1	1	3	1	3

High-3: Medium-2: Low-1

Semester: VII						
MEMS AND APPLICATIONS (Group H: Global Elective)						
Course Code	**:**	**18G7H08**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Understand the rudiments of Micro fabrication techniques.
2	Identify and associate the various sensors and actuators to applications.
3	Analyze different materials used for MEMS.
4	Design applications of MEMS to disciplines.

Unit-I	**06 Hrs**
Overview of MEMS & Microsystems: MEMS and Microsystems, Typical MEMS and micro system products, Evolution of micro fabrication, Microsystems and microelectronics, Multidisciplinary nature of Microsystems, Design and manufacture, Applications of Microsystems in automotive, healthcare, aerospace and other industries. **Working Principle of Microsystems**: Biomedical and biosensors. Micro sensors: Acoustic, Chemical, Optical, Pressure, Thermal.	
Unit – II	**09 Hrs**
Micro actuation: Using thermal forces, shape memory alloys, Piezoelectric crystals and electrostatic forces. MEMS with micro actuators: Microgrippers, micromotors, microvalves and micropumps, microaccelerometers, microfluidics**.** **Introduction to Scaling:** Scaling in Geometry, Scaling in Rigid body dynamics, Scaling in Electrostatic forces, scaling in electromagnetic forces and scaling in fluid mechanics.	
Unit –III	**09 Hrs**
Materials for MEMS and Microsystems: Substrates and wafers, Active substrate materials, Silicon as substrate material, Silicon Compounds, Si-Piezoresistors, GaAs, Quartz, Piezoelectric Crystals, Polymers and packaging materials. Three level of Microsystem packaging, Die level packaging, Device level packaging, System level packaging. Interfaces in microsystem packaging. Essential packaging technologies: die preparation, Surface bonding, Wire bonding, Sealing, 3D packaging.	
Unit –IV	**08 Hrs**
Microsystem Fabrication Process: Introduction to microsystems, Photolithography, Ion Implantation, Diffusion, Oxidation, CVD,PVD-Sputtering, Deposition by Epitaxy, Etching, LIGA process: General description, Materials for substrates and photoresists, Electroplating and SLIGA process.	
Unit –V	**07 Hrs**
Micro Sensors, Actuators, Systems and Smart Materials: An Overview Silicon Capacitive Accelerometer, Piezo resistive Pressure sensor, Fibre-optic sensors, Conductometric Gas Sensor, Electrostatic Comb drive, Magnetic Microrelay, Portable blood analyzer, Piezo electric Inkjet Print head, Micromirror array for Video projection, Micro-PCR Systems, Smart materials and systems.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the operation of micro devices, micro systems and their applications.

CO2:	Apply the principle of material science to sensor design.
CO3:	Analyze the materials used for sensor designs.
CO4:	Conceptualize and design micro devices, micro systems.

Reference Books	
1	MEMS & Microsystems Design and Manufacture, Tai-Ran Hsu, 2nd Edition, 2002, Tata McGraw Hill Education, New Delhi, ISBN-13:978-0-07-048709-3.
2	Micro and Smart Systems, G.K. Ananthasuresh, K.J .Vinoy, K.N. Bhat, V.K. Aatre, 2015, Wiley Publications, ISBN-:978-81-265-2715-1.
3	Foundations of MEMS, Chang Liu, 2012, Pearson Education Inc., ISBN-13:978-0-13-249736-7.
4	Smart Material Systems and MEMS, Vijay K Varadan, K. J. Vinoy, S. Gopalakrishnan, 2006, Wiley-INDIA, ISBN-978-81-265-3170-7.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Assignment/Presentation/Project (A). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 60. The marks component for Assignment/Presentation/Project 10.

Total CIE is 30(Q) +60(T) +10(A) = 100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	1	-	1
CO2	3	2	2	1	-	-	-		-	1	-	1
CO3	3	3	2	2	1	-	-		-	1	-	1
CO4	3	3	3	3	1	-	-		1	1	1	1

High-3; **Medium-2;** **Low-1**

Semester: VII						
PROJECT MANAGEMENT (Group H: Global Elective)						
Course Code	**:**	**18G7H09**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L**		**SEE Duration**	**:**	**3.0 Hours**

Course Learning Objectives: The students will be able to

1	To understand the principles and components of project management.
2	To appreciate the integrated approach to managing projects.
3	To explain different process groups and knowledge areas used to manage project.

Unit-I	**07 Hrs**
Introduction: What is project, what is project management, relationships among portfolio management, program management, project management, and organizational project management, relationship between project management, operations management and organizational strategy, business value, role of the project manager, project management body of knowledge.	
Unit – II	**09 Hrs**
Organizational influences & Project life cycle: Organizational influences on project management, project state holders & governance, project team, project life cycle. **Project Integration Management**: Develop project charter, develop project management plan, direct & manage project work, monitor & control project work, perform integrated change control, close project or phase.	
Unit –III	**09 Hrs**
Project Scope Management: Project scope management, collect requirements define scope, create WBS, validate scope, control scope. **Project Time Management**: Plan schedule management, define activities, sequence activities, estimate activity resources, estimate activity durations, develop schedule, control schedule.	
Unit –IV	**07 Hrs**
Project Cost management: Project Cost management, estimate cost, determine budget, control costs. **Project Quality management**: Plan quality management, perform quality assurance, control quality.	
Unit –V	**07 Hrs**
Project Risk Management: Plan risk management, identify risks, perform qualitative risk analysis, perform quantitative risk analysis, plan risk resources, control risk. **Project Procurement Management**: Project Procurement Management, conduct procurements, control procurements, close procurement.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the concepts, tools and techniques for managing large projects.
CO2:	Explain various knowledge areas and process groups in the project management framework.
CO3:	Analyze and evaluate risks in large and complex project environments.
CO4:	Develop project plans for various types of organizations.

Reference Books	
1	A Guide to the Project Management Body of Knowledge(PMBOK Guide), Project Management Institute, 5th Edition, 2013, ISBN: 978-1-935589-67-9
2	Project Planning Analysis Selection Financing Implementation & Review, Prasanna Chandra, 7th Edition, 2010, Tata McGraw Hill Publication, ISBN 0-07-007793-2.
3	Project Management A System approach to Planning Scheduling & Controlling, Harold

	Kerzner, 10th Edition, 2009, CBS Publishers and Distributors, ISBN 047027806.
4	Strategic Project Management Made Simple: Practical Tools for Leaders and Teams, Terry Schmidt, 1st Edition, 2009, John Wiley & Sons, ISBN: 978-0470411582

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20. **Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.**

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2	2	2		1	1							
CO3							1	1				
CO4	2		3		1							

Low-1 Medium-2 High-3

Semester: VII						
CYBER FORENSICS AND DIGITAL INVESTIGATIONS (Group H: Global Elective)						
Course Code	**:**	**18G7H10**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	To provide an understanding Computer forensics fundamentals and comprehend the impact of cybercrime and forensics.
2	Describe the motive and remedial measures for cybercrime, detection and handling.
3	Demonstrate and investigate the use of Tools used in cyber forensics.
4	Analyse areas affected by cybercrime and identify Legal Perspectives in cyber security.

Unit-I	**09 Hrs**
Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. **Cyber offenses: How Criminals Plan Them**: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.	
Unit – II	**08 Hrs**
Cybercrime: Mobile And Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile devices, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.	
Unit –III	**07 Hrs**
Tools And Methods Used In Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. **Phishing and Identity Theft**: Introduction, Phishing, Identity Theft (ID Theft).	
Unit –IV	**08 Hrs**
Understanding Computer Forensics: Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Anti-forensics.	
Unit –V	**07 Hrs**
Cybercrime And Cyber Security: The Legal Perspectives-Introduction, Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Interpret the basic concepts of cyber security, cyber law and their roles.
CO2:	Articulate evidence collection and legal challenges.
CO3:	Discuss tool support for detection of various attacks.
CO4:	Demonstrate through use of proper tools knowledge on the cyber security, Cybercrime and forensics

Reference Books :	
1	Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, Sunit Belapure and Nina Godbole, , Wiley India Pvt Ltd, ISBN: 978-81-265-21791, 2013.
2	Introduction to information security and cyber laws, Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. Dreamtech Press, ISBN: 9789351194736, 2015.
3	Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions, Thomas J. Mowbray, Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 -1-118 84965 -1
4	Cyber Forensics, Technical Publications, I. A. Dhotre, 1st Edition, 2016, ISBN-13: 978-9333211475

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by the way of Tests (T), Quizzes (Q),) and Experiential Learning (EL). Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. Minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The marks component for experiential learning is 20.

Total CIE is 50 (T) +30 (Q) +20 (EL) = 100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marksis executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	-	-	-	-	-	-	3	1	-	-
CO2	1	2	-	2	2	-	-	2	2	3	1	2
CO3	2	3	-	2	2	2	-	2	3	2	-	-
CO4	3	2	3	2	3	1	-	2	3	2	1	1

High-3: Medium-2: Low-1

Semester: VII						
ROBOTICS AND AUTOMATION (Theory)						
Course Code	**:**	**18G7H11**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to	
1	Understand the concepts of robotics and automation.
2	Impart the knowledge of robotic programming and robotic operation control
3	Selection and analysis of robot configuration and kinematics
4	Importance of automation manufacturing techniques and processing industries
5	Development of automation system for manufacturing and processing industries

Unit-I	**06 Hrs**
Introduction - Basics of kinematics, Anatomy of robot, Robot configuration, Robot joints, Sensors and drive system, Control modes, Specification of robots, Robot programming methods.	
Unit – II	**09 Hrs**
Robot Kinematics - Position and orientation of objects, Objects coordinate frame, Rotation matrix, Euler angles roll, pitch and yaw angles coordinate transformations, Joint variables and position of end effector, Homogeneous transformation. **D-H parameters** and conventions, D-H matrix, Direct kinematic and inverse analysis of planar and 3 DoF robots.	
Unit –III	**10 Hrs**
Trajectory planning - Introduction, Path versus trajectory, Joint-space versus Cartesian-space descriptions, Basics of trajectory planning, Joint-space trajectory planning, Third-order and Fifth-order polynomial trajectory planning. **Automation in Production Systems** - Manufacturing support systems, Automation principles and strategies, Levels of Automation, Production Concepts and Mathematical models, Numericals.	
Unit –IV	**08 Hrs**
Machine Vision - Object recognition by features, Basic features used for object identification, Moments, Template matching, Discrete Fourier descriptors, Computed Tomography (CT), Depth measurement with vision systems, Scene analysis versus mapping, Range detection and Depth analysis, Stereo imaging, Scene analysis with shading and sizes, Specialized lighting, Image data compression, Intraframe spatial domain techniques, Interframe coding, Compression techniques, Colour images, Heuristics, Applications of vision systems	
Unit –V	**06 Hrs**
Flexible Manufacturing Systems - Introduction to FMS - concepts, integration in the data processing systems, FMS scheduling. Case studies. Material Handling systems - Conveyors - AGVs – industrial robots in material handling – Automated Storage and retrieval system. Distributed data processing in FMS - Database Management System and their applications in CAD/CAM and FMS – distributed systems in FMS - Integration of CAD and CAM	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the characteristics and working principle of robots.
CO2:	Apply the related mathematical model to formulate the kinematics and trajectory planning of industrial robot.
CO3:	Analyse the machine vision for effective Flexible Manufacturing Systems.
CO4:	Develop model and integrate drives for industrial robots and automation systems.

Reference Books	
1	Mohsen Shahinpoor, "A Robot Engineering Textbook", Harper & Row Publishers, 3rd Edition, New York, ISBN:006045931X
2	John J. Craig, "Introduction to Robotics", Pearson Education International, 3rd Edition, ISBN:109876543, 1-13-123629-6
3	Mikell P Groover, "Automation, Production Systems, and Computer-integrated Manufacturing", Pearson Publishing, 3rd Edition, 2014, ISBN 978 81 203 3418 2
4	Joseph Talavage, "Flexible Manufacturing Systems in Practice Design: Analysis and Simulation", CRC Press, 1987, ISBN 9780824777180

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	-	1	-	-	1	-	-	-	2	-	2
CO2	3	3	1	3	1	1	-	-	-	2	-	2
CO3	2	-	2	-	1	1	-	-	2	-	-	2
CO4	3	3	2	3	1	1	-	2	3	-	3	2

High-3: Medium-2: Low-1

Semester: VII						
SPACE TECHNOLOGY AND APPLICATIONS (GROUP H: GLOBAL ELECTIVE)						
Course Code	**:**	**18G7H12**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3 : 0 : 0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to	
1	Define the earth environment and its behaviour, launching vehicles for satellites and its associated concepts.
2	Analyse satellites in terms of technology, structure and communications.
3	Use satellites for space applications, remote sensing and metrology.
4	Apply the space technology, technology mission and advanced space systems to nation's growth.

UNIT-I	**08 Hrs**
Earth's environment: Atmosphere, ionosphere, Magnetosphere, Van Allen Radiation belts, Interplanetary medium, Solar wind, Solar- Earth Weather Relations. **Launch Vehicles:** Rocketry, Propellants, Propulsion, Combustion, Solid, Liquid and Cryogenic engines, Control and Guidance system, Ion propulsion and Nuclear Propulsion.	
UNIT-II	**07 Hrs**
Satellite Technology: Structural, Mechanical, Thermal, Power control, Telemetry, Telecomm and Quality and Reliability, Payloads, Classification of satellites. **Satellite structure:** Satellite Communications, Transponders, Satellite antennas.	
UNIT-III	**08 Hrs**
Satellite Communications: LEO, MEO and GEO orbits, Altitude and orbit controls, Multiple Access Techniques. **Space applications:** Telephony, V-SAT, DBS system, Satellite Radio and TV, Tele-Education, Tele-medicine, Satellite navigation, GPS.	
UNIT-IV	**08 Hrs**
Remote Sensing: Visual bands, Agricultural, Crop vegetation, Forestry, water Resources, Land use, Land mapping, geology, Urban development resource Management, and image processing techniques. **Metrology:** Weather forecast (Long term and Short term), weather modelling, Cyclone predictions, Disaster and flood warning, rainfall predictions using satellites.	
UNIT-V	**08Hrs**
Space Missions: Technology missions, deep space planetary missions, Lunar missions, zero gravity experiments, space biology and International space Missions. **Advanced space systems:** Remote sensing cameras, planetary payloads, space shuttle, space station, Inter-space communication systems.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain different types of satellites, orbit and associated subsystems.
CO2	Apply the basics of launching vehicles, satellites and sub systems for space applications.
CO3	Analyze the applications of satellite in the area of communication, remote sensing, metrology etc.
CO4	Study technology trends, satellite missions and advanced space systems.

Reference Books	
1	Atmosphere, weather and climate, R G Barry, Routledge publications, 2009, ISBN- 10 :0415465702.
2	Fundamentals of Satellite Communication, K N Raja Rao, PHI, 2012, ISBN: 9788120324015.
3	Satellite Communication, Timothy pratt, John Wiley, 1986 ISBN: 978-0- 471- 37007 -9, ISBN 10: 047137007X.
4	Remote sensing and applications, B C Panda, VIVA books Pvt. Ltd., 2009, ISBN: 108176496308.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by the way of Tests (T), Quizzes (Q) and Experiential Learning (EL). Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. Minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The marks component for experiential learning is 20.
Total CIE is 50 (T) +30 (Q) +20 (EL) = 100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	-	-	-	-	-	-	-	-	1	-
CO2	2	2	1	1	-	-	-	-	-	-	1	-
CO3	2	2	1	-	-	-	-	-	-	-	1	-
CO4	2	2	1	-	-	-	-	-	-	-	1	-

High-3: Medium-2: Low-1

Semester: VII						
INTRODUCTION TO ASTROPHYSICS (Group H: Global Elective)						
Course Code	**:**	**18G7H13**		**CIE**	**:**	**100 Marks**
Credits: L: T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Familiarize with the various celestial bodies and the laws governing their behavior
2	Understand the fundamental concepts of relativity and establish the relation between light and matter
3	Study the methods used to identify and investigate the nature of different stellar bodies
4	Determine the characteristic features of any star by understanding its spectral properties
5	Contemplate the complex system of the milky way galaxy and its components

Unit-I	**07 Hrs**
Fundamental concepts in Astronomy: Origin of the Universe, Major constituents of the universe, Cosmic Microwave Radiation (CMR) background, Geocentric Universe, Retrograde Motion of planets, Brief introduction to the Copernican Revolution, Positions of the Celestial Sphere: Altitude-Azimuth Coordinate System, Equatorial Coordinate System, Solar System, Planets - laws of motion of planets, inner planets, outer planets,	
Unit – II	**08 Hrs**
Theory of Special Relativity: Galilean Transformations, Failure of Galilean Transformations, Lorentz Transformations, Derivation, Time & Space in Special Relativity, Momentum & Energy in Relativity, Doppler Effect for light (Red & Blue Shift), The equivalence principle, the principle of minimal gravitational coupling, Schwarzschild spacetime, Past-Present-Future (Light Cone diagram).	
Unit –III	**08 Hrs**
Stellar Astrophysics: Blackbody radiation, Connection between Color and Temperature, Stellar Parallax, Magnitude Scale, Life cycle of stars (Birth, Life & Death), Hertzsprung-Russel Diagram, Classification of Binary Stars, Mass Determination using Visual Binaries, Eclipsing Spectroscopic Binaries, Formation of Spectral Lines, Schrodinger's time-dependent and independent equations, Boltzmann-Saha Equation, Chandrashekar's Limit, black holes (qualitatively).	
Unit –IV	**08 Hrs**
Light and Matter: Dispersion of light (Prism & Grating), Spectral Lines, de-Broglie's Wavelength and Frequency, Heisenberg's Uncertainty Principle, Broadening of Spectral lines **Spectral Characterization of Stars:** Description of the Radiation Field, Stellar Opacity, Transfer Equation, Profile of Spectral Lines, Optical Telescopes, Radio Telescopes (Case Studies)	
Unit –V	**08 Hrs**
Galaxy Astronomy: The Milky way Galaxy, Counting the Stars, Historical Models, Differential & Integrated Star Counts, Extrasolar planets, Methods of detection of extrasolar planets, Distance to the Galactic Centre, Galactic Coordinate System, Classification of Galaxies, Introduction to Elliptical galaxies, Irregular galaxies, Dwarf galaxies.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Contemplate the nature of our universe by identifying and studying the behavior of celestial bodies.
CO2:	Explain the usefulness of the theory of relativity, light and matter in establishing the fundamental behavior of stellar bodies.
CO3:	Utilize various techniques to discover the components of our universe and conclude their celestial properties.
CO4:	Interpret the spectral properties of any astronomical body to illustrate its properties.
CO5:	Inspect the milky way galaxy to identify the proponents and their characteristic features.

Reference Books	
1	Carroll Bradley W, and Dale A Ostlie, An Introduction to Modern Astrophysics. Reading, 2nd Edition, 1995, MA: Addison-Wesley Pub, ISBN: 9780201547306.
2	Padmanabhan, T, Theoretical Astrophysics, Vols.1-3, 2005, Cambridge University Press, ISBN- 9780521016278.
3	Shu F, The Physical Universe, New Edition, 1982, University of California, ISBN- 978-0935702057.
4	Harwit M, Astrophysical Concepts, 3rd Edition, 2000, Springer-verlag, ISBN- 978-0387949437.
5	Shapiro, Stuart L, and Saul A Teukolsky, Black Holes, White Dwarfs, and Neutron Stars, 1st Edition, 1983, Wiley, ISBN: 9780471873167.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Assignment/Presentation/Project (A). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for Assignment/Presentation/Project 20.

Total CIE is 30(Q) +50(T) +20(A) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	1	2	-	-	1	-	1	-	-	2
CO2	3	2	2	2	-	-	1	-	1	-	-	2
CO3	2	3	1	2	2	1	1	-	2	1	-	2
CO4	3	3	1	2	2	1	2	-	3	3	-	2

High-3, Medium-2, Low-1

Semester: VII						
MATERIALS FOR ADVANCED TECHNOLOGY AND SPECTROSCOPIC CHARACTERIZATION (Group H: Global Elective)						
Course Code	**:**	**18G7H14**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Apply the basic concepts of Chemistry to develop futuristic materials for high-tech applications in the area of Engineering.
2	Impart sound knowledge in the different fields of material chemistry so as to apply it to the problems in engineering field.
3	Develop analytical capabilities of students so that they can characterize, transform and use materials in engineering and apply knowledge gained in solving related engineering problems.

Unit-I	**08 Hrs**

Coating and packaging materials

Surface Coating materials:

Synthesis and applications of Polymer coating materials: Teflon, Silicone films Polyvinyl chloride & its copolymers, Poly vinyl acetate, Poly ethylene-HDPE, LDPE, Polyurethane.

Properties required in a pigment and extenders.

Inorganic pigments-titanium dioxide, zinc oxide, carbon black, chromate pigments, molybdate orange, chrome green, ultramarine blue, iron blue, cadmium red.

Corrosion inhibiting pigments- zinc phosphate, zinc and barium chromate pigments, ceramic pigments, metal flake pigments, extenders.

Developments in new polymers such as dendrimers, biopolymers & biodegradable polymers.

Packaging materials:

Food products: Cellulosic and Polymeric packaging materials and their properties – including barrier properties, strength properties, optical properties. Glass, aluminum, tin, paper, plastics, composites.

Pharmaceutical products: Injectables and tablet packaging materials.

Unit – II	**08 Hrs**

Adhesives

Introduction-Classification of Adhesives-Natural adhesives, synthetic adhesives-drying adhesives, pressure sensitive adhesives, contact adhesives, hot adhesives. One-part adhesives, multi part adhesives. Adhesive Action. Development of Adhesive strength- Physical factors influencing Adhesive Action-surface tension, surface smoothness, thickness of adhesive film, elasticity and tensile strength. Chemical Factors Influencing Adhesive action - presence of polar groups, degree of polymerization, complexity of the adhesive molecules, effect of pH. Adhesive action- specific adhesive action, mechanical adhesive action, fusion adhesion. Development of adhesive strength- adsorption theory and diffusion theory. Preparation, curing and bonding Processes by adhesives-with reference to Epoxy, phenolics, Silicone, Polyurethane, Acrylic adhesives, Poly vinyl alcohol, Polyvinyl acetate.

Unit –III	**08 Hrs**

Optical fibre materials

Fiber Optics, Advantages of optical fiber communication over analog communication, Classification based on refractive index of the core- step index and graded index optical fibres, Classification based on core radius-single mode and multimode optical fibres, Fibre fabrication. -

Methods to manufacture optical glass fibres. Double crucible method and preform methods. Manufacture of perform- Chemical Vapour Deposition (CVD), Modified vapour deposition (MCVD) Plasma activated vapour deposition (PCVD), Outside vapour deposition (OVD)-Vapour-phase axial deposition (VAD). Drawing the fibres from perform, coating and jacketing process.

Ion exchange resins and membranes

Ion exchange resins-Introduction, Types-cation and anion exchange resins, examples, physical properties, chemical properties-capacity, swelling, kinetics, stability, ion exchange equilibrium, regeneration. Applications of ion exchange resins-softening of water, demineralization of water, advantages and disadvantages of ion exchange resins-calcium sulphate fouling, iron fouling, adsorption of organic matter, bacterial contamination. Ion exchange membranes, Types-anion and cation exchange membranes. Classification of ion exchange membranes based on connection way between charged groups and polymeric matrix-homogeneous and heterogeneous ion exchange membranes, examples. Fabrication of ion exchange cottons- anion exchange cotton and cation exchange cotton. Application of ion exchange membranes in purification of water by electro dialysis method.

Unit –IV	**08 Hrs**

Spectroscopic Characterization of materials:

Electromagnetic radiation, interaction of materials with electromagnetic radiation.

UV- visible spectrophotometry**: Introduction**-Electronic transitions- factors influencing position and intensity of absorption bands-absorption spectra of dienes, polyene and α,β-unsaturated carbonyl compounds, Working of UV-Vis spectrophotometer, Theoretical calculation of λ_{max} by using Woodward-Fieser rules- for cyclic and α,β-unsaturated carbonyl compounds.

IR Spectroscopy: Introduction, principle, molecular vibrations, vibrational frequency, number of fundamental vibrations, factors influencing fundamental vibrations, instrumentation of IR spectrophotometer, sampling techniques, application of IR spectroscopy in characterization of functional groups.

Unit –V	**08 Hrs**

NMR spectroscopy:

H^1 NMR Spectroscopy: Basic concepts- relaxation process. NMR spectrometer-FT NMR-Solvents used in NMR, internal standards-Chemical equivalence -Integrals and Integrations-chemical shift-Factors affecting chemical shifts- shielding and deshielding effects – chemical and magnetic equivalent –magnetic anisotropy-spin-spin splitting rules- Application of NMR on various compounds such as alkanes, alkenes, alkynes, alkyl halides, alcohols, ethers, amines, aldehydes, ketones, carboxylic acids, esters, amides & mono substituted aromatic compounds. Problems on prediction of structure of compounds. Application of NMR in magnetic resonance imaging (MRI).

Course Outcomes: After completing the course, the students will be able to	
CO1:	Identify sustainable engineering materials and understand their properties.
CO2:	Apply the basic concepts of chemistry to develop futuristic materials for high-tech applications in different areas of engineering.
CO3:	Analyze and evaluate the specific application of materials.
CO4:	Design the route for synthesis of material and its characterization.

Reference Books	
1	Materials Science by G.K.Narula, K.S.Narula & V.K.Gupta. 38th Edtion, Tata McGraw-Hill Publishing Company Limited-2015, ISBN: 9780074517963
2	Solar Lighting by Ramachandra Pode and Boucar Diouf, Springer e-book, 2011,

	ISBN: 978-1-4471-2133-6 (Print) 978-1-4471-2134-3 (Online).
3	Spectroscopy of organic compounds by P.S.Kalsi, New Age International (P) ltd, Publisher, 2005, ISBN 13: 9788122415438
4	Food Packaging Materials. Mahadeviah M & Gowramma RV, Tata McGraw Hill Publishing Company Limited, 1996, ISBN :0074622382 9780074622384.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	2	2	-	-	1	-	-
CO3	-	3	-	2	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	1	1	-	-	-	-	1

High-3: Medium-2: Low-1

Semester: VII						
APPLIED PSYCHOLOGY FOR ENGINEERS (Group H: Global Elective)						
Course Code	**:**	**18G7H15**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	To appreciate human behavior and human mind in the context of learner's immediate society and environment.
2	To understand the importance of lifelong learning and personal flexibility to sustain personal and Professional development as the nature of work evolves.
3	To provide students with knowledge and skills for building firm foundation for the suitable engineering professions.
4	To prepare students to function as effective Engineering Psychologists in an Industrial, Governmental or consulting organization.
5	To enable students to use psychological knowledge, skills, and values in occupational pursuits in a variety of settings that meet personal goals and societal needs.

Unit-I	**07 Hrs**
Introduction to Psychology: Definition and goals of Psychology: Role of a Psychologist in the Society: Today's Perspectives (Branches of psychology). Psychodynamic, Behavioristic, Cognitive, Humanistic, Psychological Research and Methods to study Human Behavior: Experimental, Observation, Questionnaire and Clinical Method.	
Unit – II	**09 Hrs**
Intelligence and Aptitude: Concept and definition of Intelligence and Aptitude, Nature of Intelligence. Theories of Intelligence – Spearman, Thurston, Guilford Vernon. Characteristics of Intelligence tests, Types of tests. Measurement of Intelligence and Aptitude, Concept of IQ, Measurement of Multiple Intelligence – Fluid and Crystallized Intelligence.	
Unit –III	**09 Hrs**
Personality: Concept and definition of personality, Approaches of personality- psychoanalytical, Socio- Cultural, Interpersonal and developmental, Humanistic, Behaviorist, Trait and type approaches. Assessment of Personality: Self- report measures of Personality, Questionnaires, Rating Scales and Projective techniques, its Characteristics, advantages & limitations, examples. Behavioral Assessment. Psychological Stress: a. Stress- Definition, Symptoms of Stress, Extreme products of stress v s Burnout, Work Place Trauma. Causes of Stress – Job related causes of stress. Sources of Frustration, Stress and Job Performance, Stress Vulnerability-Stress threshold, perceived control	
Unit –IV	**07 Hrs**
Application of Psychology in Working Environment: The present scenario of information technology, the role of psychologist in the organization, Selection and Training of Psychology Professionals to work in the field of Information Technology. Distance learning, Psychological consequences of recent developments in Information Technology. Type A and Type B Psychological Counseling - Need for Counseling, Types – Directed, Non- Directed, Participative Counseling.	
Unit –V	**07 Hrs**

Learning: Definition, Conditioning – Classical Conditioning, Basics of Classical Conditioning (Pavlov), the process of Extinction, Discrimination and Generalization. Operant Conditioning (Skinner expt). The basics of operant conditioning, Schedules of reinforcement. Cognitive – Social approaches to learning – Latent Learning, Observational Learning, Trial and Error Method, Insightful Learning.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the application of psychology in engineering and technology and develop a route to accomplish goals in their work environment.
CO2:	Define learning and compare and contrast the factors that cognitive, behavioral, and Humanistic theorists believe influence the learning process.
CO3:	Develop understanding of psychological attributes such as intelligence, aptitude, creativity, resulting in their enhancement and apply effective strategies for self-management and self-improvement.
CO4:	Apply the theories into their own and others' lives in order to better understand their personalities and experiences.

Reference Books	
1	Understanding Psychology Feldman R. S, IV edition, (1996) McGraw Hill India
2	Psychology Robert A. Baron, III edition (1995) Prentice Hall India.
3	3. Organizational Behaviour , Stephen P Robbins Pearson Education Publications, 13th Edition, ISBN – 81-317 – 1132 – 3
4	4. Organisational Behaviour : Human Behaviour at Work ,John W.Newstrem and Keith Davis. Tata McGraw Hill India, 10th Edition, ISBN 0-07-046504-5

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and experiential learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	1	-	1
CO2	3	2	2	1	-	-	-	-	-	1	-	1
CO3	3	3	2	2	-	-	-	-	-	1	-	1
CO4	3	3	3	3	-	-	-	-	-	1	-	1

High-3: Medium-2 : Low-1

Semester: VII						
Advanced course in Entrepreneurship (Group H: Global Elective)						
Course Code	**:**	**18G7H16**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39 L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Acquire additional knowledge and skills for developing early customer traction into a repeatable business.
2	Learn the tools and methods for achieving sustainable growth, such as by refining their product or service and business models, building brand strategy, making a sales and financial plan
3	Develop brand strategy and create digital presence, Develop channel strategy for customer outreach.
4	Leverage social media to reach new customers cost effectively, Develop strategies to increase revenues and expand markets

Unit-I	**07 Hrs**
Intro to building Products & Value Proposition: Diagnose: Where are you today on the Product Life Cycle? Assess your Start-up's attractiveness **Competition & testing:** Conduct a Competition Analysis Identify your Competitive Advantage	
Unit – II	**06 Hrs**
Market Validation: Market validation, Customer Usability Interviews, Analyzing Customer feedback **Delivering Value:** Enlist marketing channels, Identify partners for your venture, Create a Sales plan	
Unit –III	**07 Hrs**
Customer acquisition & growth channels: Types of Marketing Channels: Targeting Blogs, Unconventional PR, Search Engine Marketing, Search Engine Optimization, Social ads, display ads and existing platforms, Email Marketing, Viral Marketing, Affiliate programs, Magazines, Newspaper, Radio and TV ads, Offline Ads, Trade Shows	
Unit –IV	**10 Hrs**
Business model: Reiterate and Refine your Business Model Canvas, Choose the right business model for your start-up **Financial Planning:** Forecasting sales and revenue projections, Cash-flow statement	
Unit –V	**09 Hrs**
Pitching: Create your funding plan, Build your pitch deck and compose your pitch.	

Experiential Learning: Student teams will present their practice ventures: business model, business plan, growth achieved, and key learnings to their classmates, faculty, and other entrepreneurs

Course Outcomes: After completing the course, the students will be able to	
CO1:	Develop strategies to increase revenues and expand markets, Explore licensing and franchising for business expansion.
CO2:	Leverage technologies and platforms for growth stage companies, Develop key metrics to track progress.
CO3:	Basics of registering a company, Understanding business regulations and compliances.
CO4:	Advanced concepts of business finance, Financial planning.

Reference Books	
1	Running Lean: Iterate from Plan A to a Plan That Works. O'Reilly Media, Maurya, A., 2012.
2	Entrepreneurship. Roy, R., 2012. Oxford University Press
3	Intellectual Property Law in India. Gupta, T. S., 2011. Kluwer Law International
4	Flow: The Psychology of Optimal Experience. Czikszentmihalyi, M., 2008. Harper Perennial Modern Classics

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of tests (T) and Milestones (M). A minimum of four milestone submission have to be submitted and first three milestones (M1, M2, M3) are evaluated for 10 marks adding up to 30 marks and the final milestone (M4) is evaluated for 20 marks. All milestone submissions are online and as per format and portal prescribed by Wadhwani foundations. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(M1, M2 and M3) +50(T) +20(M4) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	1	-	1
CO2	3	2	2	1	-	-	-	-	-	1	-	1
CO3	3	3	2	2	-	-	-	-	-	1	-	1
CO4	3	3	3	3	-	-	-	-	-	1	-	1

High-3: Medium-2: Low-1

Semester VIII						
MAJOR PROJECT						
Course Code	**:**	**18EEP81**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**0:0:16**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**32**		**SEE Duration**	**:**	**3.00 Hours**
Course Learning Objectives: The students will be able to						
1.	Acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.					
2.	Acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both written and oral forms.					
3.	Acquire collaborative skills through working in a team to achieve common goals.					
4.	Self-learn, reflect on their learning and take appropriate action to improve it.					
5.	Prepare schedules and budgets and keep track of the progress and expenditure.					

Major Project Guidelines:

1. The project topic, title and synopsis have to be finalized and submitted to their respective internal guide(s) before the beginning of the 8th semester.
2. The detailed Synopsis (approved by the department ***Project Review Committee***) has to be submitted during the 1st week after the commencement of 8th semester.

Batch Formation:

- Students are free to choose their project partners from within the program or any other program.
- Each student in the team must contribute towards the successful completion of the project. The project may be carried out In-house / Industry / R & D Institution.
- ***The project work is to be carried out by a team of two to four students , in exceptional cases where a student is placed in a company and offered an internship through the competitive process or student is selected for internship at national or international level through competitive process,*** the student can work independently.
- ***The students are allowed to do either a project for full 5 days in the industry or full 5 days in the college.***
- ***In case the project work is carried out outside Bengaluru, such students must be available during Project Evaluation process scheduled by the respective departments and they must also interact with their guide regularly through Email / Webinar / Skype etc.***

Project Topic Selection:

The topics of the project work must be in the ***field of respective program areas or in line with CoE's(Centre of Excellence) identified by the college*** or **List of project areas as given by industry/Faculty. The projects as far as possible should have societal relevance with focus on sustainability.**

Students can select courses in ***NPTEL*** from the discipline of ***Humanities and Social Sciences, Management, Multidisciplinary and Design Engineering.*** The course chosen could be either of ***4w/8w/12w*** duration. The students need to enrol for a course, register for the exam and submit the e-certificate to the department, as and when it is released by NPTEL. ***The same will be considered as one of the components during project evaluation of phase 2 and phase 5.***

Project Evaluation:

- Continuous monitoring of project work will be carried out and cumulative evaluation will be done.

- The students are required to meet their internal guides once in a week to report their progress in project work.
- **Weekly Activity Report** (WAR) has to be maintained in the form of a diary by the project batch and the same has to be discussed with the Internal Guide regularly.
- In case of ***Industry project***, during the course of project work, the internal guides will have continuous interaction with external guides and will visit the industry at least twice during the project period.
- For CIE assessment the project groups must give a final seminar with the draft copy of the project report.
- The presentation by each group will be for 20-30 minutes and every member of the team needs to justify the contributions to the project.
- The project team is required to submit Hard copies of the detailed Project Report in the prescribed format to the department.
- For CIE 50% weightage should be given to the project guide and 50% weightage to the project evaluation committee.
- Before the final evaluations the project group is required to produce a No dues certificate from Industry, Central Library and Department.

Course Outcomes of Major Project:	
1	Apply knowledge of mathematics, science and engineering to solve respective engineering domain problems.
2	Design, develop, present and document innovative/multidisciplinary modules for a complete engineering system.
3	Use modern engineering tools, software and equipment to solve problem and engage in life-long learning to follow technological developments.
4	Function effectively as an individual, or leader in diverse teams, with the understanding of professional ethics and responsibilities.

CIE Assessment:

The following are the weightings given for the various stages of the project.

1. Selection of the topic and formulation of objectives 10%
2. Design and Development of Project methodology 25%
3. Execution of Project 25%
4. Presentation, Demonstration and Results Discussion 30%
5. Report Writing & Publication 10%

SEE Assessment:

The following are the weightages given during Viva Examination.

1. Written presentation of synopsis 10%
2. Presentation/Demonstration of the project 30%
3. Methodology and Experimental Results & Discussion 30%
4. Report 10%
5. Viva Voce 20%

Calendar of Events for the Project Work:

Week	Event
Beginning of 7th Semester	Formation of group and approval by the department committee.
7th Semester	Problem selection and literature survey
Last two weeks of 7th Semester	Finalization of project and guide allotment
II Week of 8th Semester	Synopsis submission and preliminary seminar

III Week	First visit of the internal guides to industry (In case of project being carried out in industry)
III to VI Week	Design and development of project methodology
VII to IX Week	Implementation of the project
X Week	Submission of draft copy of the project report
XI and XII Week	Second visit by guide to industry for demonstration. Final seminar by Department project Committee and guide for internal assessment. Finalization of CIE.

Evaluation Scheme for CIE and SEE

Scheme of Evaluation for CIE		**Scheme of Evaluation for SEE**	
Particulars	**%Marks**	**Particulars**	**%Marks**
Project Evaluation I	10%	Project Synopsis (Initial Write up)	10%
Project Evaluation II	25%	Project Demo / Presentation	30%
Project Evaluation III	25%	Methodology and Results Discussion	30%
Project Evaluation Phase-IV (Submission of Draft Project Report for Verification**)**	30%	Project Work Report	10%
Project Evaluation Phase-V (Project Final Internal Evaluation**)**	10%	Viva-voce	20%
Total	100	Total	100