(EL302) ELECTRICAL MACHINES I

1. COURSE OBJECTIVES:

This subject enables the student to understand the working principle, construction, performance, control and applications of electrical machines such as DC Generator, DC motor & Transformers. The students get familiarized with the classification & operation of these machines.

2. TEACHING AND EXAMINATION SCHEME

Semester	**III**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EL302) Electrical Machines I		L	T	P	H	TH	TM	TW	PR/OR	
		4	-	2	6	75	25	25	-	125

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

EL302.CO1: Explain construction, operation and classification of DC machines and transformers
EL302.CO2: Demonstrate starting and speed control methods of DC motors, parallel operation and testing methods for transformers
EL302.CO3: Categorize losses in DC machines and Transformers and analyze performance of transformers
EL302.CO4: Determine voltage regulation and efficiency of Transformer using suitable method.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
EL302.CO1	2	-	2	3	-	3	2
EL302.CO2	2	2	2	3	2	3	2
EL302.CO3	3	3	-	3	-	3	3
EL302.CO4	3	3	1	3	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
EL302.CO1	2	2
EL302.CO2	3	3
EL302.CO3	2	2
EL302.CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1 DC GENERATOR			**15**	**13**	**CO1,CO2, CO3**
1.1 Construction and working of a simple loop DC Generator (including action of split ring and brushes) Constructional details and material used for parts (yoke, pole-core, pole shoe, field winding, armature core, armature winding, commutator, brushes) & their functions, lap and wave winding-basic diagram and comparison Definitions: back pitch, front pitch, pole pitch, resultant pitch and commutator pitch Expression for generated EMF (no derivation) & factors on which it depends					
1.2 Classification of DC generators w. r. t i) Excitation system ii) connection of field & armature winding. Voltage & power equations of these various types. Process and necessary conditions for voltage build up in DC Shunt generator Losses and types of efficiencies					
2 DC MOTORS			**15**	**13**	**CO 1, CO2**
2.1 Principle of operation, concept of back emf & its importance, Development of torque and types of torques in a motor. Classification of DC motors based on connection of field & armature winding, their voltage & power equations.					
2.2 Speed equation & factors on which speed depends methods of speed control (DC shunt-armature control, field control, ward leonard control) (DC series- armature control (armature diverter), field control(all methods) & voltage control) methods and their comparison. Characteristics of DC shunt, series & cumulative compound motors: 1. speed v/s armature current 2. torque v/s armature current 3. speed v/s torque, Applications of the various types of DC motors. Starting of DC motors – Necessity of a starter, three point & four point starters (diagram & working) Construction and working of brushless DC motor					
3 WORKING & CONSTRUCTION OF TRANSFORMERS			**15**	**13**	**CO1, CO3**

3.1 Definition and working principle of a transformer, Concept of ideal & practical transformer. Terms related to transformer: primary & secondary, H.V & L.V, step up, & step down . Construction: Simple diagram of transformer and labelling of parts List & functions of: core, windings, conservator, breather, buchholz relay, explosion vent, bushings Concept of leakage flux and its importance Concept & comparison of core type & shell type transformers (with diagrams), Various types of insulation used in transformers: inter turn, winding to winding, winding to core.			
3.2 Cooling system: necessity of cooling & brief description of different types of cooling methods Working & construction of tap changer: ON load & OFF load tap changer EMF equation of a transformer (No Derivation) Transformation ratio-voltage ratio, current ratio & turns ratio (numerical)			
4 PERFORMANCE & PARALLEL OPERATION OF TRANSFORMERS	**21**	**19**	**CO1, CO2, CO3, CO4**
4.1 Operation: No load and on load operation of a transformer with phasor Diagram (practical transformer for inductive load only). Final Equivalent circuit and transfer of its parameters referred to either side (numerical) Procedure of O.C & S.C test with diagrams (numerical).			
4.2 Performance : Concept & significance of voltage regulation, expression and calculation of approximate voltage regulation condition for minimum regulation.(no derivation) Losses and efficiency (calculation of commercial & all day efficiency) of a transformer			
4.3 Salient features of a power & distribution transformer (three phase). Conditions to be satisfied for parallel operation of transformers (Diagrams for single phase & three phase) and their connections			
5 AUTOTRANSFORMERS & SPECIAL TRANSFORMERS	**09**	**06**	**CO 1**
5.1 Construction & principle of operation of an autotransformer, its advantages & disadvantages over two winding transformer Special transformers (constructional features):welding transformer , High frequency transformer.			
Total	**75**	**64**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	DC GENERATORS	13	15
2	DC MOTORS	13	15
3	WORKING & CONSTRUCTION OF TRANSFORMERS	13	15
4	PERFORMANCE & PARALLEL OPERATION OF TRANSFORMERS	19	21
5	AUTOTRANSFORMERS & SPECIAL TRANSFORMERS	6	9
	Total	64	75

8. SPECIFICATION TABLE FOR TERM WORK

No	Practical (Minimum 8)	Marks
1.	To plot the O.C characteristics of a DC shunt generator and find the value of critical field resistance	
2.	To plot the external characteristics of a DC shunt generator.	
3.	Speed control of a DC shunt motor above & below normal speed.	
4.	To plot the sped torque characteristics of a DC shunt generator.	
5.	Starting a DC shunt motor using a starter and reversal of direction of rotation.	
6.	To perform Swinburne's test on a DC shunt motor to determine the various losses and calculate efficiency as a DC motor & generator.	
7.	Study of DC welding generator	
8.	Insulation resistance, polarity, phasing out & ratio test on a three phase transformer.	
9.	O.C & S.C test on a three phase transformer and calculation of equivalent circuit parameters.	
10.	Parallel operation of two single phase transformers and observation of the load sharing.	
11.	To study direct load test on a three phase transformer and measurement of its voltage regulation.	
12.	To perform back to back test on a single phase transformer to determine losses and calculate efficiency and regulation.	
13.	To study a welding transformer w. r. t:- i)construction of core, ii) placement of windings, iii)current controller & iv) cooling system.	
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	BHEL	Transformers	Tata Mcgraw
2	S.K. Bhattacharya	Electrical machinery	Tata Mcgraw
3	J. B. Gupta.	Theory & performance of Electrical Machines	S. K. Kataria & sons
4	B. L. Theraja.	Electrical Technology (Vol II)	S Chand
5	P.S. Bhimbra.	Elementary theory of electrical machines	Khanna Publishers

(EL303) ELECTRICAL MEASUREMENTS & INSTRUMENTS

1. COURSE OBJECTIVES

This subject enables students to understand the basics of measurements and the construction, operation of various electrical measuring instruments. It also enables the students to know the selection and application of electrical measuring instruments for carrying out measurements.

2. TEACHING AND EXAMINATION SCHEME

Semester III									
Course Code & Course Title	**Periods/ Week (In Hours)**			**Total Hours**	**Examination Scheme**				
					Theory Marks		**Practical Marks**		**Total Marks**
(EL303) Electrical Measurements & Instruments	L	T	P	H	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25(P)	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

EL303.CO1: Explain qualities, errors, construction and working of electrical measuring instruments.
EL303.CO2: Apply suitable method of measurement and extend the range of measuring instruments.
EL303.CO3: Compare different electrical measuring instruments.
EL303.CO4: Select the appropriate measuring instrument for a given application.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
EL303.CO1	3	1	2	1	-	2	2
EL303.CO2	3	3	3	3	1	2	2
EL303.CO3	3	3	3	3	-	1	2
EL303.CO4	3	3	3	3	2	2	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
EL303.CO1	2	2
EL303.CO2	3	3
EL303.CO3	2	2
EL303.CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1 FUNDAMENTALS AND PRINCIPLES OF MEASUREMENTS	**15**	**9**	**CO1, CO3, CO4**
1.1Need of measurement & significance of measurement. Qualities of instrument: sensitivity, accuracy, precision, reliability, reproducibility, drift, static error, true value, resolution. Classification of instruments: Absolute & secondary instruments, Indicating, recording & integrating instruments, Based on permissible limits of errors Errors: Gross error, Systematic error & Random errors			
1.2 Various effects of electric current and their use in measurement. Essentials of Indicating instruments: Deflecting torque, Control torque, Damping torque. Various methods of providing control torque & damping torque.			
2 AMMETER & VOLTMETER	**18**	**12**	**CO1, CO2, CO3, CO4**
2.1 Construction & Principle of operation of PMMC instrument, their advantages and disadvantages. Errors in PMMC type instruments. Construction & Principle of operation of moving iron type (attraction &repulsion type) instrument, their advantages and disadvantages. Errors in moving iron type instruments. Rectifier type instrument, its construction & advantages. Loading effect of Voltmeter.			
2.2 Extension of range of Ammeter and Voltmeter using Multiplier & Shunt, CT & PT.			
3 WATTMETER AND ENERGYMETER	**21**	**15**	**CO1, CO2, CO4**
3.1 Dynamometer type wattmeter: Construction & principle of operation Measurement of power: Three phase, 3 wire circuit by two wattmeter method, Phasor diagram, 3 phase, 4 wire circuits by 3 wattmeter method, Variation of wattmeter readings with load power factor. Errors in wattmeters and compensation. Extension of range of Wattmeter using CT and PT for single phase and three phase (using 2 wattmeter method).			
3.2 Induction type energy meter: Construction & principle of operation.(single phase) Extension of range of energymeter (single phase and three phase) using CT and PT. Concept & block diagram of Electronics energy meter.			
4. RESISTANCE MEASUREMENT	**9**	**6**	**CO1,CO2, CO3, CO4**
4.1 Classification of resistances Measurement of resistance by: Voltmeter Ammeter methods, Wheatstone's bridge method Circuit diagram and operation of Kelvin's Bridge, Kelvin's Double Bridge (No Derivation), Series type & shunt type ohm meter			
5 OTHER INSTRUMENTS	**12**	**6**	**CO1,CO4**

5.1 Construction, operation and applications of Power Factor meter: Electrodynamometer type (single phase) Construction, operation and applications of Frequency meter (Vibrating reed type), Phase sequence indicator (rotating type) Construction, operation and applications of Earth Tester and Meggar			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	FUNDAMENTALS AND PRINCIPLES OF MEASUREMENTS	9	15
2	AMMETER & VOLTMETER	12	18
3	WATTMETER AND ENERGYMETER	15	21
4	RESISTANCE MEASUREMENT	6	9
5	OTHER INSTRUMENTS	6	12
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK

Sr. No.	Practicals (Minimum eight)	Marks
1	Measurement of power by 3 ammeter method	
2	Measurement of power by 3 voltmeter method	
3	Measurement of resistance by Kelvin's Double Bridge	
4	Measurement of power in 3 phase 3 wire circuit by 2 wattmeter method	
5	Measurement of power in 3 phase 3 wire circuit by 1 wattmeter method	
6	Measurement of power in 3 phase 3 wire circuit by 3 phase wattmeter.	
7	Measurement of reactive power in 3 phase , 3 wire circuit by 1 wattmeter method	
8	Measurement of energy by energy meter	
9	Extension of range of Ammeter and Voltmeter using CT & PT	
10	Extension of range of wattmeter for measurement of power in 3 phase, 3 wire circuit by using CT & PT	
11	Measurement of power factor using power factor meter.	
12	Connection & measurement of voltage, current, power & energy using digital meters	
13	Connection & use of power analyzer	
	Total	25

9. LEARNING RESOURCES

Text Books

Sr No	AUTHOR	TITLE OF BOOKS	PUBLICATIONS
1	A. K. Sawhney	A course in Electrical & Electronic Measurements & Instrumentation	Dhanpat Rai & sons
2	S.C. Bhargava	Electrical Measuring Instruments & Measurements	B.S. Publication

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1.	Vijay Singh	Fundamentals of Electrical & Electronic Measurements	New Age International(P) Ltd.
2.	N.V. Suryanarayana	Electrical Measurements & Measuring Instruments	Tata Mc Graw Hill

(CC307) ELEMENTS OF MECHANICAL ENGINEERING

1. COURSE OBJECTIVES

This course will help students to acquire a basic knowledge about mechanical engineering with respect to mechanical elements, mechanical power transmission devices, engines, machinery so as to enable him to do basic job of operation and maintenance in Industries

2. TEACHING AND EXAMINATION SCHEME

Semester	**III**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(CC307) ELEMENTS OF MECHANICAL ENGG.		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**25**	**-**	**125**

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

CC307.CO1: Explain power transmission devices, parts of I.C. engines, boilers, pumps and refrigeration equipments

CC307.CO2: Identify various parts and uses of I.C. engines, boilers accessories and refrigeration components

CC307.CO3: Distinguish between various types of I.C. engines, boilers and pumps

CC307.CO4: Discuss the application of various types of lubricants, maintenance tools, couplings and bearings.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Tools, Engg. Experimentation& Testing	Engg. Practices for Society ,Sustainability & Environment	Project Management	Life -long Learning
CC307.CO1	2	1	-	3	-	3	2
CC307.CO2	2	1	-	1	-	3	2
CC307.CO3	2	3	2	-	-	3	2
CC307.CO4	3	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CC307.CO1	1	2
CC307.CO2	2	2
CC307.CO3	2	2
CC307.CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1 MECHANICAL POWER TRANSMISSION	**15**	**8**	**CO1, CO4**
1.1 Belt drives – classification & applications Chain drives – Power transmitting chains (Block chain, Bush roller chain) and their applications. Gear drives –Spur, Helical & Bevel gear drives and their applications Gear trains (simple & compound only) and their speed ratio.			
1.2 Couplings – rigid coupling (marine type only), flexible coupling (bush pin type only) Bearings – Definition & function of bearings, rolling and sliding contact bearings (their functions and applications.)			
2 I.C. ENGINES	**18**	**12**	**CO1, CO2, CO3**
2.1 Introduction, classification & basic engine components.			
2.2 Construction and working of 4 stroke and 2 stroke engines (petrol & diesel). Difference between petrol and diesel engines. Difference between 2 stroke and 4 stroke engines. Technical terms of I.C. engines – Stroke volume, Compression ratio, Brake power.			
3 THERMAL ENGINEERING EQUIPMENTS & PUMPS	**21**	**14**	**CO1, CO2, CO3**
3.1 Introduction. Basic components of a thermal power station and their function (Condenser, Turbine, Boiler).			
3.2 Boiler – Introduction, function, classification (water tube, fire tube), Construction and working of Babcock & Wilcox boiler and Cochran boiler. Comparison between fire tube and water tube boiler. Boiler mountings and accessories like-, water level indicator, and super heater. Awareness to Indian Boiler Regulations i.e. IBR (Brief Introduction)			
3.3 Introduction, working principle, classification. Centrifugal and reciprocating pump -construction & working. Comparison between Centrifugal pump & Reciprocating pump. Technical specifications - power, discharge, head.			
4. REFRIGERATION & AIR CONDITIONING	**12**	**7**	**CO1, CO2**
4.1 Introduction, unit of refrigeration (Ton), COP, Working and operation of simple vapour compression system (p-h & t-s diagrams to be excluded).			
4.2 Air Conditioning- definition, working of Window and split Air conditioner			
5. MAINTENANCE ENGINEERING	**9**	**7**	CO1, CO4
5.1 Definition, types -preventive, breakdown and predictive maintenance. Necessity of lubrication. Common types of lubricants. Methods of lubrication – wick/drip type, grease gun, grease cup.			
5.2 Maintenance tools and their functions (no construction & working) – spanners (open end & ring type), screw jack, gauges, screw driver, torque wrench, allen key, chain pulley block.			
Total	**75**	**48**	

6. COURSE DELIVERY:
The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	MECHANICAL POWER TRANSMISSION	08	15
2	I.C. ENGINES	12	18
3	THERMAL ENGINEERING EQUIPMENTS & PUMPS	14	21
4	REFRIGERATION & AIR CONDITIONING	07	12
5	MAINTENANCE ENGINEERING	07	09
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK

No	Practical	Marks
1.	Study of different types of gears.	
2.	Removal and mounting of belt. Checking tension in the belt.	
3.	Demonstration of mounting and removal of ball/roller bearing., Knowing its bearing number	
4.	Study of petrol/diesel engine construction.	
5.	Study of petrol/diesel engine working.	
6.	Study of water tube and fire tube boiler (Babcock & Wilcox and Cochran).	
7.	Study of any one refrigeration Air conditioning equipment , method of installation for AC	
8.	Study of centrifugal and reciprocating pumps and common faults in pumps with their troubleshooting	
9.	Literature survey and seminar (A brief power point presentation of around 15 min on any topic relevant to mechanical engineering). It may be done individually or in groups depending on class strength.	
	Total	25

9. LEARNING RESOURCES
Text Books

S. No.	Author	Title of Books	Publishers
1	R.S. Khurmi	Theory of Machines	
2	R.S. Khurmi	Thermal Engineering	S. Chand
3	R.K. Rajput	Textbook of Hydraulic Machines	Laxmi
4	R.K. Rajput	Refrigeration & Air Conditioning	Laxmi
5	S.N. Bhattacharya	Installation, Servicing & Maintenance	S. Chand

(CC303) CIRCUITS & NETWORKS

1. COURSE OBJECTIVES:

The course is designed to introduce students to the facts, concepts & principles of electrical & electronics engineering circuits. The course aims to develop among student understanding to analyze and test different DC &AC circuits.

2. TEACHING AND EXAMINATION SCHEME

Semester	**III**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
Circuits &Networks (CC303)		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**25**	**-**	**125**

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
CC303.CO1: Understand network concepts, theorems & resonance
CC303.CO2: Interpret the response of different RLC circuits to AC supply.
CC303.CO3: Apply various theorems to simplify resistive circuits.
CC303.CO4: Design basic electrical filters.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn& Testing	Engg. Practices for Society,Sustainability & Environment	Project Management	Life -long Learning
CC303.CO1	3	3	2	2	1	2	2
CC303.CO2	3	3	3	3	0	2	3
CC303.CO3	3	3	3	3	1	3	3
CC303.CO4	3	3	3	3	1	2	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CC303.CO1	2	2
CC303.CO2	3	3
CC303.CO3	3	3
CC303.CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1 BASIC TERMINOLOGY	**6**	**4**	**1**
1.1 Definitions of circuit, network, voltage, current , ,power, mesh, loop,,node &branch, port .			
1.2 Definition of network elements Active & passive, Unilateral & bilateral, Linear & non linear,lumped & Distributed.			
1.3 Energy Source Voltage & Current Sources Concept of Ideal & practical energy source			
1.4 Series & Parallel equivalent expressions of resistors, capacitors & inductors.(No derivations),Simple numerical on it.			
2 NETWORK THEOREMS (RESISTIVE ONLY WITH DC SOURCE)	30	22	**3**
2.1 Voltage & Current Divider theorem—Statement of theorem, simple numerical on it. 2.2 Kirchhoff's voltage & current Laws-Stataement of laws & simple numerical on it. 2.3 Concept of Mesh & Node analysis-Explanation of method & simple numerical(maximum 3 loops ,3 nodes) 2.4 Superposition Theorem- Explanation of statement of theorem & simple numerical 2.5 Thevenin's Theorem- Explanation of statement of theorem & simple numerical 2.6 Maximum Power Transfer Theorem -- Explanation of statement of theorem & simple numerical, 2.7 Star Delta transformation - Explanation of conversion from star to delta & vice versa, simple numerical on it			
3 AC CIRCUITS	20	10	**2,1**
3.1 Response of basic R,L,C ,RL , RC,RLC elements to AC signal. 3.2 Phasor diagrams of series RC & series RL circuits,Concept of impedance. 3.3 Simple problems to find impedance,VR,VC,VL ,Phase angle in above circuits 3.4 Concept of series resonance Circuit .Graphical representation of resonance curve ,bandwidth ,half power frequencies. Problems based on Fr,Imax,F1,F2,Z.(Note:Resonance problems are of **L4)** 3.5 Concept of Q factor, Problems to calculate Q factor. 3.6 RC Integrater & Differentiater for sine & square wave input.			
4 NETWORKS	10	6	**3**
4.1 Introduction & Applications: Two port networks: Symmetrical T & Pi networks			
4.2 Characteristics of two port network: Characteristic impedance, short circuit & open circuit impedance			
4.3 Derivations& Simple numerical on Zo, Zoc, Zsc (only for T type)			

5 FILTERS	9	6	**4**
5.1 Introduction of Filter circuits			
5.2 LPF, HPF,BPF, BRF (graphical interpretation), Constant k (LPF, HPF-T type only)			
5.3 Design formulae & numerical			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	BasicTerminology	4	6
2	Network Theorems(Resistive circuis with DC Source)	22	30
3	AC Circuits	10	20
4	Networks	6	10
5	Filters	6	9
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK

No	**Practical**	**Marks**
1	Verification of Ohms law and its application to series parallel Circuits	
2	Verification of KVL and KCL	
3	Verification of superposition theorem	
4	Verification of Thevenins theorem	
5	Verification of maximum power transfer theorem	
6	Study of RLC series resonance circuits	
7	RC Integrator and RC Differentiator	
8	Study of filters LPF &HPF ,T & PI Type	
No	**Class room Assignments**	**Marks**
1	At-least two assignments	
2		
...		
No	**Tutorial Exercise**	**Marks**
1	NIL	
2		
...	Total	

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Sudhakar &shyammohan	Circuits & Networks	McGrawHill Education
2	B.L.Theraja	Basic electrical eng.Vol I	S.Chand
3	Royal Signals	Handbook of Line Communication	HMSO
4	B.R.Gupta &V.Singhal	Network filters & Transmission lines	S.K.Kataria & Sons
5	Schaum Series	Electrical Circuits	McGrawHill Education

(CC309) DIGITAL ELECTRONICS

1. COURSE OBJECTIVES:

The students need to learn basic concepts of digital circuits and system which leads to design of complex digital system such as microprocessors.

The students need to know combinational and sequential circuits using digital logic fundamentals. This is the first course by which students get exposure to digital electronics world.

The students will able to

1. To understand various number representations and conversion between different representation in digital electronic circuits.
2. To introduce the students to various logic gates, SOP, POS and their minimization techniques.
3. To analyze logic processes and implementation of logical operations using combinational logic circuits.
4. To understand, analyze and design sequential circuits

2. TEACHING AND EXAMINATION SCHEME

Semester	**III**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
		L	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
Digital Electronics CC309		**03**	**-**	**02**	**05**	**75**	**25**	**25**	**25**	**150**

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

CC309.CO1: Relate the knowledge of Number Systems in Digital Applications.

CC309.CO2: Build different Sequential and Combinational Circuits.

CC309.CO3: Simplify logical problems using digital circuits.

CC309.CO4: Develop basic digital electronics circuits.

.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CC309.CO1	3	2	3	3	0	0	3
CC309.CO2	3	3	3	3	3	3	3
CC309.CO3	3	3	3	3	3	0	3
CC309.CO4	3	3	3	3	2	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CC309.CO1	2	2
CC309.CO2	2	2
CC309.CO3	2	2
CC309.CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	

Unit	**M**	**Thr**	**CO**
1 Number System	**14**	**09**	**CO1**
1.1 **Digital and Analog Signals**. Definition of digital and analog signals,Comparison between Analog and Digital signals			
1.**2 Number System**:- Decimal, Binary, Hexadecimal. Introduction to Decimal,Binary and Hexadecimal Number Systems. Counting in each system. Conversion from one system to other.			
1.3 Codes:- introduction and importance of Codes.BCD code, GRAY code conversion of Gray to Binary, Binary to Gray, BCD to binary and Binary to BCD. Represent Decimal Numbers in BCD and Gray codes. ASCII code and its importance.			
1.4 Binary Addition (upto 4 bits), 1's complement of a Binary number, 2's complement of a Binary number. Binary Subtraction using 2's complement method. Addition of signed decimal numbers.			
2Combinational Circuits	**19**	**12**	**CO1,CO2,CO3**
2.1 Logic Gates:- Symbol, Expression and Truth Tables of Basic gates(AND,OR,NOT) and Combinational gates(NOR,NAND,EXOR,EXNOR).			
2.2 Boolean Algebra:- DeMorgan's Theorems, Laws of Boolean Algebra ,Duality Theorem,			
2.3Simplification of Boolean Expressions using Boolean Algebraic laws and by using K-Maps Techniques(upto 4 Variables in SOP Form),			
2.4 Universal Gates:- Implementation of NOT,OR,AND,EXOR gates using NOR and NAND Gates			
2.5Adders:- Half Adder circuit using logic gates , Full Adder circuit using logic gates, block diagram of 4 bit parallel adder. Subtractors:- Half subtractor circuit using logic gates, Full Subtractor using logic gates			
2.6Combinational circuits:- Block diagram and Implementation using basic gates:- Multiplexers(4 to 1), Demultiplexer(1 to 4), Encoder (4 to 2), Decoder(2 to 4). BCD to 7 segment Decoder driver (Common Cathode).			
3 Flip Flops	**12**	**08**	**CO1,CO2,**
3.1 Definition of FlipFlop. Applications. Symbol, Truth Tables, Operation and timing diagrams of RS F/F using NAND gates. ,			
3.2 Symbol, Truth Tables, Operation and timing diagrams			

of clocked RS F/F using NAND Gates, Concept of Asynchronous inputs(Preset and Clear)			
3.3 Symbol, Truth Tables, Operation of Clocked D F/F			
3.4 Symbol, Truth Tables, Operation of Clocked JK F/F, Excitation table of JK flip flop			
3.5 Race around condition in JK F/F. Symbol, Truth Tables, Operation of JK master slave F/F.			
3.6 Symbol, Truth Tables, Operation of T F/F,			
4 Registers And Counters	**19**	**12**	**CO1,CO2,CO4**
4.1 Registers: Definition of Shift Registers, Applications of Registers Symbols and Logic block diagram of SISO,SIPO,PISO and PIPO Registers,			
4.2 Serial IN Serial Out Register (size of the register 4 bits) Logic Diagram and Operation of SISO Register usingnegative edge triggered D F/F along with the Truth Table and Timing diagrams			
4.3 Serial IN Parallel Out Register (size of the register 4 bits) Logic Diagram and Operation of SIPO Register using negative edge triggered D F/F along with the Truth Table and Timing diagrams.			
4.4 Parallel IN Serial Out Register (size of the register 4 bits) Logic Diagram and Operation of PISO Register using negative edge triggered D F/F along with the Truth Table and Timing diagrams			
4.5 Parallel In Parallel Out Register (size of the register 4 bits) Logic Diagram and Operation of PISO Register using negative edge triggered D F/F along with the Truth Table and Timing diagrams . Concept of Shift right, Shift left, Ring Counter.			
4.6 Counters: Introduction to counters, Modulus of counters. Count sequence, No of Flip Flops required for Specified counters			
4.7 Asynchronous Counters:- 4 bit UP counter using JK Flip Flops only and 4 bit DOWN counter using JK Flip Flops only.			
4.8 Synchronous Counters:- 4 bit UP counter using JK Flip Flops only and 4 bit DOWN counter using JK Flip Flops only, Decade (Mod 10) using JK Flip Flops only			
4.9 Design of Synchronous counters(upto 4 bit) using only JK Flip Flops			
5 DAC and ADC and Memories	**11**	**7**	**CO1,CO4**
5.1 Definitions, Types of DAC and ADC(noDescription),Applications		1	
5.2 Binary Ladder Network for DAC:- Logic circuit and		4	

operation. Simple numerical problems Successive Approximation ADC .:- Logic circuit and operation. Simple numerical problems.			
5.3Memories: Introduction, Semiconductor memories and its types –ROM,RAM,PROM, EPROM,EEPROM(only definition and applications)		2	
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	**Number System**	09	14
2	**Combinational Circuits**	12	19
3	**Flip Flops**	08	12
4	**Registers And Counters**	12	19
5	**DAC and ADC**	07	11
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK

No	**Practical (Perform any 8)**	**Marks**
1.	Verification of Logic gates and Demorgan's Theorems	
2.	Universal gates (NAND and NOR)	
3.	Verification of Boolean Expression	
4.	Half Adder and Full Adder using logic gates	
5.	Half Subtractor and Full Subtractor using logic gates	
6.	MUX and D-MUX	
7.	RS F/F, D F/F and JK F/F	
8.	Assemble and Test Binary Counter/Decade counter	
9.	Assemble and test DAC using DAC0808	
10.	Assemble and test ADC using ADC0808	
	Total	25
...		
No	Class room Assignments	
	At least 2 assignments	
No	**Tutorial Exercise**	**Marks**
1	NIL	
...	Total	

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.P.Jain,	Modern Digital Electronics	Fourth Edition, Tata McGraw-Hill Education.
2	Malvino & Leach,	Digital Principles and Applications	Seventh Edition, McGraw-Hill Education

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Thomas L. Floyd,	Digital Fundamentals	10th Edition, Pearson Education Inc, 2011
2	A.K. Maini,	Digital Electronics: Principles and Integrated Circuits	Wiley India Publications