Program Name	: Diploma in Computer Hardware & Maintenance, Diploma in Artificial Intelligence and Machine Learning, Diploma in Cloud Computing and Big Data, Diploma in Electronics and Computer Engineering
Program Code	: DE/EJ/IE/IS/CO/CM/CW/IF/ET/EN/EX/HA/AN/BD/TE
Semester	: Second
Course Title	: Elements of Electrical Engineering
Course Code	: 22215

1.   RATIONALE

A technologist is expected to have some basic knowledge of electrical engineering as they have to work in different engineering fields and deal with various types of electrical machines and equipment. Hence, it is necessary to understand magnetic circuits, AC fundamentals, polyphase circuits, different types of electrical machines, their principles and working characteristics. This course deals with the basic fundamentals of electrical engineering and working principles of commonly used AC and DC motors and their characteristics. The basic concepts of electrical engineering in this course will be very useful for understanding of other higher level courses.

2.   COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:
- **Use electrical equipment in industrial applications.**

3.   COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:
   a.   Use principles of magnetic circuits.
   b.   Use single phase AC supply for electrical and electronics equipment.
   c.   Use three phase AC supply for industrial equipment and machines.
   d.   Connect transformers and DC motors for specific requirements.
   e.   Use FHP motors for diversified applications.
   f.   Use relevant protective devices/switchgear for different requirements.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Paper Hrs.	Theory						Practical					
					ESE		PA		Total		ESE		PA		Total	
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.
Legends: L-*Lecture;* **T** – *Tutorial/Teacher Guided Theory Practice;* **P** - *Practical;* **C** – *Credit,* **ESE** - *End Semester Examination;* **PA** - *Progressive Assessment.*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.
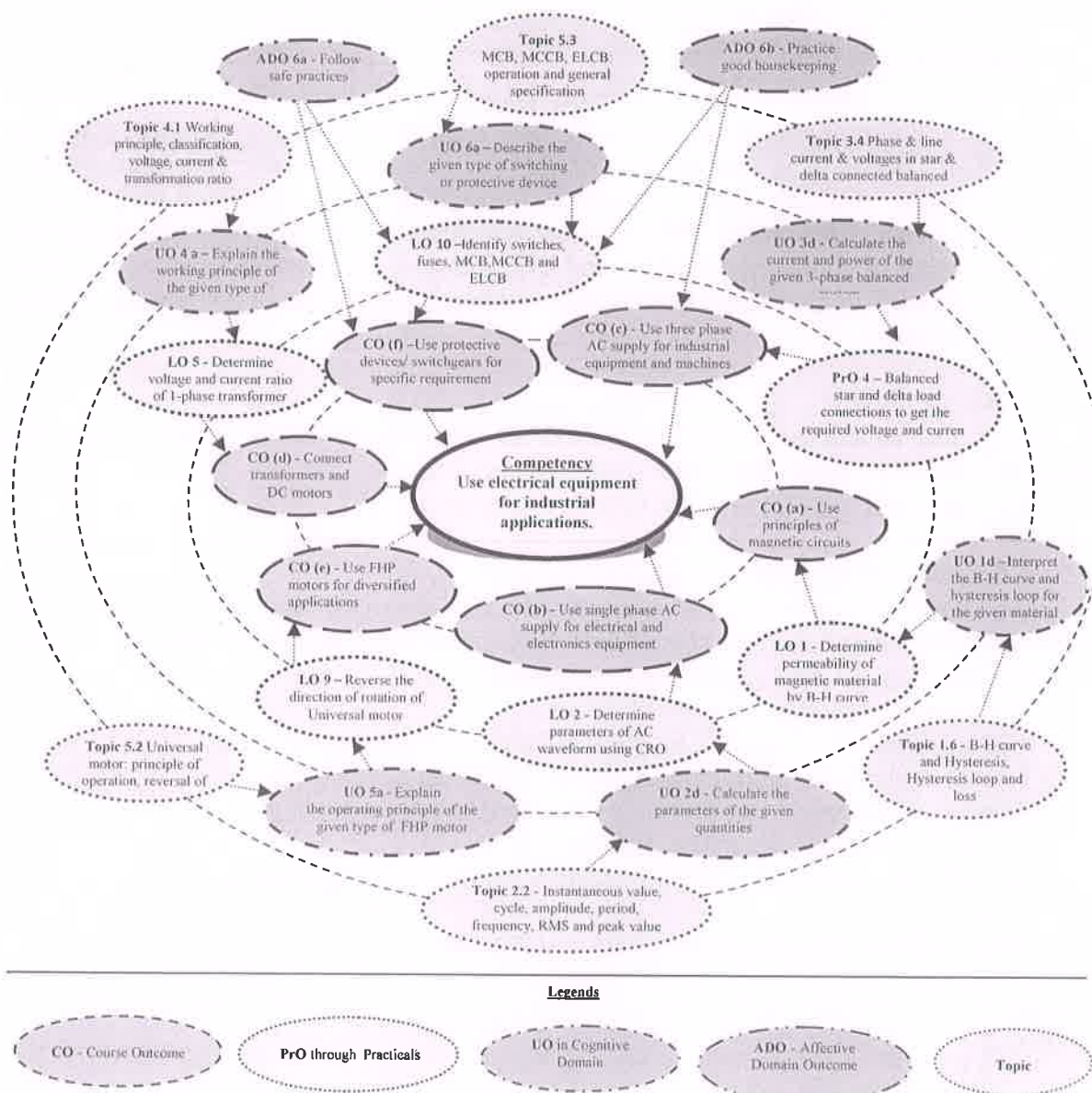

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Determine the permeability of magnetic material by plotting its B-H curve.	I	02*
2	Determine frequency, time period, peak value, rms value, peak factor and form factor of a sinusoidal A.C. waveform on C.R.O. Part I	II	02*
3	Determine frequency, time period, peak value, rms value, peak factor and form factor of a sinusoidal A.C. waveform on C.R.O. Part II	II	02
4	Find the phase difference between voltage and current on C.R.O. for resistive, inductive and capacitive circuits. Part I	II	02
5	Find the phase difference between voltage and current on C.R.O. for resistive, inductive and capacitive circuits. Part II	II	02
6	Connect balanced star and delta load connections to get the required voltage and currents. Part I	III	02*
7	Connect balanced star and delta load connections to get the required voltage and currents. Part II	III	02
8	Determine voltage and current ratio of single phase transformer.	IV	02*
9	Operate the DC shunt motor using 3-point starter.	IV	02
10	Operate the DC shunt motor using 4-point starter.	IV	02
11	Reverse the direction of rotation of single phase induction motor.	V	02*
12	Reverse the direction of rotation of Universal motor.	V	02
13	Identify switches, fuses, switch fuse and fuse switch units, MCB, MCCB and ELCB.	VI	02
14	Connect the switches, fuses, switch fuse and fuse switch units, MCB, MCCB and ELCB in a circuit. Part I	VI	02
15	Test circuit using series lamp and multimeter.	VI	02*
16	Use the earth tester.	VI	02
17	Use the insulation tester.	VI	02
18	Use different types of digital clamp-on meters	VI	02
	Total		**36**

Note

i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Selection of suitable component, apparatus/instrument	20
2	Preparation of experimental set up	10
3	Setting and operation	10
4	Safety measures	10
5	Observations and Recording	10

S.No.	Performance Indicators	Weightage in %
6	Interpretation of result and Conclusion	20
7	Answer to sample questions	10
8	Submission of report in time	10
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

   a. Follow safety practices.
   b. Practice good housekeeping.
   c. Demonstrate working as a leader/a team member.
   d. Maintain tools and equipment.
   e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Single Phase Transformer: 1kVA, single-phase, 230/115 V, air cooled, enclosed type.	1,5
2	Single phase auto transformer (Dimmerstat) - Single-Phase, Air cooled, enclosed model, Input: 0 ~ 230, 10A, Output: 0 ~ 270Volts	1,2,3,5
3	CRO – 20 MHz, Dual channel	2,3
4	Three phase Auto Transformer -15 kVA, Input 415 V, 3 phase, 50 Hz, Output 0-415 V, 30 A per Line, Cooling air natural	4
5	Loading Rheostat - 7.5 kW, 230V, 3 phase, 4 wire, Balanced load. (Each branch having equal load), Load : Wire Wound Fixed Resistors	4
6	Lamp Bank - 230 V 0-20 A	5
7	DC shunt motor coupled with DC shunt Generator	6,7
8	Single phase Induction motor – ½ HP,230 V,50 Hz, AC supply	8
9	Universal motor -1/4 Hp	9
10	Digital Multimeter - 3 1/2 digit	Common
11	DC and AC Ammeters: 0-5-10 Amp	
12	DC and AC Voltmeters: 0-150-300 V	
13	Tachometer: Non contact type, 0-10000 rpm	
14	Rectifier: solid state, Input- 415 V, 3-Phase, AC, Output – 230 V DC regulated, 20 Amp	

8.　UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Magnetic Circuits	1a. Describe the salient features of the given type of circuits. 1b. Apply Fleming's left hand rule and Lenz's law to determine direction of induced EMF in the given circuit. 1c. Explain the given type(s) of induced emf. 1d. Interpret the B-H curve and hysteresis loop for the given material.	1.1 Magnetic flux, flux density, magneto motive force, magnetic field strength, permeability, reluctance 1.2 Electric and magnetic circuits 1.3 Series and parallel magnetic circuits 1.4 Faraday's laws of electromagnetic induction, Fleming's right hand rule, Lenz's law 1.5 Dynamically and statically induced emf, self and mutual inductance 1.6 B-H curve and hysteresis, hysteresis loop and hysteresis loss.
Unit– II AC Fundamentals	2a. Describe the salient features of the given type of power supply. 2b. Represent the given AC quantities by phasors, waveforms and mathematical equations. 2c. Explain the response of the given pure resistive, inductive and capacitive AC circuits with sketches 2d. Calculate the parameters of the given circuit. 2e. Calculate impedance, current, power factor and power of the given AC circuit.	2.1 A.C. and D.C. quantity, advantages of A.C. over D.C. 2.2 Single phase A.C. sinusoidal A.C. wave: instantaneous value, cycle, amplitude, time period, frequency, angular frequency, R.M.S. value, Average value for sinusoidal waveform, Form factor, Peak factor 2.3 Vector representation of sinusoidal A.C. quantity, Phase angle, phase difference, concept of lagging and leading – by waveforms, mathematical equations and phasors 2.4 Pure resistance, inductance and capacitance in A.C. circuit 2.5 R-L and R-C series circuits 2.6 Impedance and impedance triangle 2.7 Power factor and its significance 2.8 Power – active, reactive and apparent, power triangle
Unit– III Polyphase AC Circuits	3a. Describe the salient features of the given type of AC power supply. 3b. Explain the concept of symmetrical system and phase sequence of the given AC supply. 3c. Distinguish the characteristics	3.1 3 phase system over 1 phase system 3.2 3-phase emf generation and its wave form 3.3 Phase sequence and balanced and unbalanced load 3.4 Phase and line current, phase and line voltage in star connected and delta connected balanced system

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	of the given type(s) of star (or delta) connections with sketches. 3d. Calculate the current and power of the given three phase balanced system.	3.5 Current, power, power factor in a 3 phase balanced system 3.6 Star and delta connections
Unit-IV Transformer and DC Motors	4a. Explain the working principle of the given type of transformer. 4b. Distinguish the construction of the given type of transformer. 4c. Describe the construction and working of the given type of DC motor. 4d. Select relevant type of DC motor for the given application with justification.	4.1 Transformer: Working principle, emf equation, Voltage ratio, current ratio and transformation ratio, losses 4.2 Auto-transformer – comparison with two winding transformer, applications 4.3 DC motor construction - parts its function and material used 4.4 DC motor -Principle of operation 4.5 Types of D.C. motors, schematic diagram, applications of dc shunt, series and compound motors
Unit –V Fractional Horse Power (FHP) Motors	5a. Explain the working principle of the given type of FHP motor. 5b. Select relevant FHP motor for the given application with justification. 5c. Describe the procedure to connect the given type of FHP motor for the given application with sketches. 5d. Describe the procedure to connect stepper motor for the given application with sketches.	5.1 FHP: Schematic representation, principle of operation and applications of: split phase Induction motor, capacitor start induction run, capacitor start capacitor run and permanent capacitor motors, shaded pole motors 5.2 Universal motor: principle of operation, reversal of rotation and applications 5.3 Stepper motor: types, principle of working and applications
Unit-VI Protective Devices and Switchgear	6a. Describe the features of the given type of protective device. 6b. Select the relevant protective device for the given application with justification 6c. Select suitable switchgear for the given situation with justification. 6d. State the I.E. rule related to be applied for the given type of earthing with justification.	6.1 Fuse: Operation, types 6.2 Switch Fuse Unit and Fuse Switch Unit: Differences 6.3 MCB, MCCB and ELCB: Operation and general specifications 6.4 Earthing: Importance of earthing, factors affecting earthing 6.5 Methods of reducing earth resistance, I.E rules relevant to earthing

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Magnetic Circuits	10	02	04	04	10
II	AC fundamentals	10	02	04	04	10
III	Polyphase AC circuits	08	02	04	04	10
IV	Transformer and DC motors	14	04	04	06	14
V	Fractional Horse Power (FHP) motors	12	04	04	06	14
VI	Protective Devices and Switchgear	10	02	04	06	12
	Total	64	16	24	30	70

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note: *This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10.   SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:
   a.   Market survey regarding commonly used electrical equipment which are not covered in the curriculum.
   b.   Prepare power point presentation or animation for showing working of DC or AC motors.
   c.   Undertake a market survey of different domestic electrical appliances based on the following points:
        i.   Manufacturers
        ii. Specifications/ratings
        iii. Salient features
        iv. Applications.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:
   a.   Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
   b.   **'L' in item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
   c.   About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
   d.   With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
   e.   Guide student(s) in undertaking micro-projects.

12.   SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a.   **Magnetic circuits:** Each batch will collect B-H curves and hysteresis loops for various types magnetic and non magnetic materials from internet. Based on the permeability and shapes of the curves, each student will decide the suitability of each material for different applications.

b.   **Magnetic circuits:** Each batch will prepare a coil without core. Students will note the deflection of galvanometer connected across the coil for: movement of the North Pole of permanent magnet towards and away from the coil (slow and fast movement), movement of the South Pole of permanent magnet towards and away from the coil (slow and fast movement). Students will demonstrate and prepare a report based on their observations.

c.   **AC fundamentals**: Each batch will visit a nearby sub-station or industry and observe the arrangement for power factor correction/improvement. Each batch will prepare a report based on their observation.

d.   **Polyphase circuits:** Each batch will observe the three phase power distribution panel in their own Institute/Commercial complex/mall etc. and draw single line diagram and prepare a report.

e.   **Transformer:** Each batch will visit nearby pole mounted sub-station and prepare a report based on the following points:
   i.   Rating: kVA rating, primary and secondary voltage, connections
   ii. Different parts and their functions
   iii. Earthing arrangement
   iv. Protective devices

f.   **Fractional horse power motor**: Each batch will select a FHP motor for a particular application (assume suitable rating). They will visit local electrical market (if the market is not nearby you may use the Internet) and prepare a report based on the following points:
   i.   Manufactures
   ii. Technical specifications
   iii. Features offered by different manufacturers
   iv. Price range
   Then select the motor which you would like to purchase. Give justification for your selection in short.

g.   Each batch will visit Institute workshop and prepare a report which includes the following points:
   i.   Different types of prime movers used, their specifications and manufacturers
   ii. Method of starting and speed control

      iii. Different protective and safety devices used

      iv.   Maintenance

h. Each batch will select any one electrical device/equipment which is not included in the curriculum and prepare a short power point presentation for the class based on the following points: construction, working, salient features, cost, merits, demerits, applications, manufacturers etc.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Electrical Technology Vol – I	Theraja, B. L.	S. Chand and Co., New Delhi, ISBN: 9788121924405
2	Electrical Technology Vol – II	Theraja, B. L.	S. Chand and Co., New Delhi, ISBN: 9788121924375
3	Basic Electrical Engineering	Mittle and Mittal	McGraw Hill, New Delhi, ISBN: 978-0-07-0088572-5
4	Fundamentals of Electrical Engineering	Saxena, S. B. Lal	Cambridge University Press, New Delhi, ISBN : 9781107464353
5	Basic Electrical and Electronics Engineering	Jegathesan, V.	Wiley India, New Delhi, ISBN : 97881236529513

14.   SOFTWARE/LEARNING WEBSITES

a. Scilab

b. SIMULINK (MATLAB)

c. PSIM

d. P-SPICE (student version)

e. Electronics Workbench

f. www.nptel.iitm.ac.in

g. www.onlinelibrary.wiley.com

h. xiendianqi.en.made-in-china.com/

i. ewh.ieee.org/soc/es/

j. www.electrical-technologies.com/

k. www.howstuffworks.com.

Program Name	: Diploma in Computer Hardware & Maintenance, Diploma in Artificial Intelligence and Machine Learning, Diploma in Cloud Computing and Big Data, Diploma in Electronics and Computer Engineering
Program Code	: CO/CM/IF/CW/HA/AN/BD/TE
Semester	: Second
Course Title	: Applied Mathematics
Course Code	: 22224

1.   RATIONALE

The core technological studies can be understood with the help of potential of mathematics. This course is being introduced into diploma course to provide mathematical background. The course will give them the insight to understand and analyze engineering problems scientifically using calculus, integration, differential equations and numerical methods. This subject enhances the multidimensional, logical thinking and reasoning capabilities. It also improves the systemic approach in computer programming language.

2.   COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Solve computer related broad-based engineering problems using principles of applied mathematics.**

3.   COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- a. Calculate the equation of tangent, maxima, minima, radius of curvature by differentiation.
- b. Solve the given problems of integration using suitable methods.
- c. Apply the concept of integration to find area and volume.
- d. Solve the differential equation of first order and first degree using suitable methods.
- e. Apply the concepts of numerical methods in computer programming languages.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Paper Hrs.	Theory						Practical					
L	T	P			ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	2	--	6	3	70	28	30*	00	100	40	--	--	--	--	--	--

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.
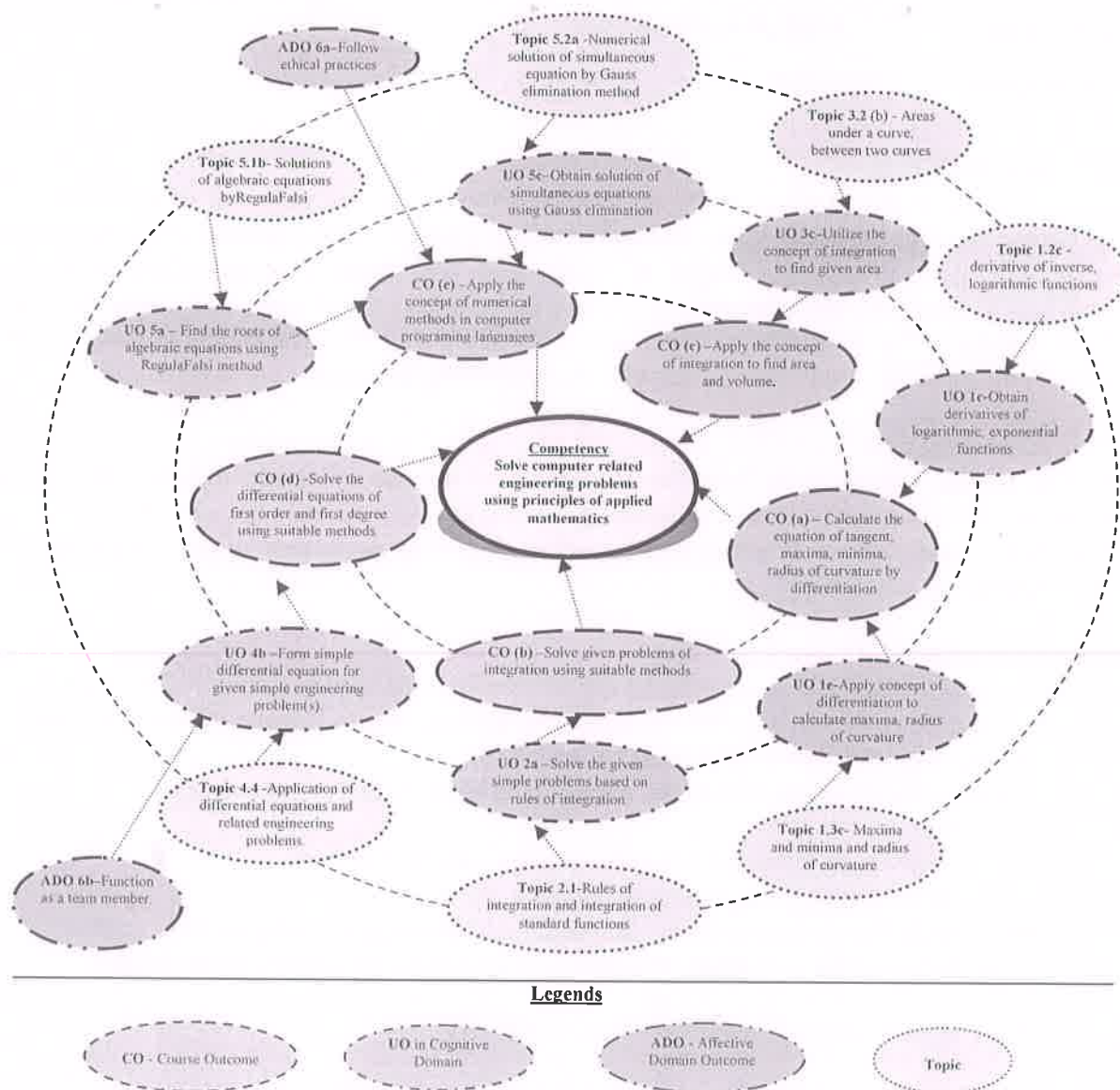
*Legends: **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Assessment.*

5.   COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

Figure 1 - Course Map

6.   SUGGESTED PRACTICALS/ EXERCISES

The tutorials in this section are sub-components of the COs to be developed and assessed in the student to lead to the attainment of the competency.

S. No.	Tutorials	Unit No.	Approx. Hrs. Required
1	Solve problems based on finding value of the function at		2

S. No.	Tutorials	Unit No.	Approx. Hrs. Required
	different points.		
2	Solve problems to find derivatives of implicit function and parametric function	I	2
3	Solve problems to find derivative of logarithmic and exponential functions.	I	2
4	Solve problems based on finding equation of tangent and normal.	I	2
5	Solveproblems based on finding maxima, minima of function and radius of curvature at a given point.	I	2
6	Solve the problems based on standard formulae of integration.	II	2
7	Solve problems based on methods of integration, substitution, partial fractions.	II	2
8	Solve problems based on integration by parts.	II	2
9	Solve practice problems based on properties of definite integration.	III	2
10	Solve practice problems based on finding area under curve, area between two curves and volume of revolutions.	III	2
11	Solve the problems based on formation, order and degree of differential equations.	IV	2
12	Develop a model using variable separable method to related engineering problem.	IV	2
13	Develop a model using the concept of linear differential equation to related engineering problem.	IV	2
14	Solve problems based on finding the roots of algebraic equations using RegulaFalsi Method.	V	2
15	Solve problems based on finding the roots of transcendental equations using Newton Raphson's Method.	V	2
16	Solve problems based on solution of system of equations using Gauss elimination method and Gauss Seidal Method	V	2
	Total		32

Note: The above tutorial sessions are for guideline only. The remaining tutorial hours are for revision and practice.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED:
- Not applicable -

8. UNDERPINNING THEORY COMPONENTS
The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Differential Calculus	1a. Solve the given simple problems based on functions. 1b. Solve the given simple problems based on rules of differentiation.	1.1 Functions and Limits: a) Concept of function and simple examples b) Concept of limit without examples.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	1c. Obtain derivatives of given logarithmic, exponential functions. 1d. Apply the concept of differentiation to find equation of tangent and normal for given problem. 1e. Apply the concept of differentiation to calculate maxima and minima and radius of curvature for the given problem.	1.2 Derivatives : a) Rules of derivatives such as sum, product, quotient of functions. b) Derivatives of inverse, logarithmic and exponential functions. 1.3 Applications of derivative: a) Second order derivative without examples. b) Equation of tangent and normal c) Maxima and minima d) Radius of curvature
Unit– II Integral Calculus	2a. Solve the given simple problem(s) based on rules of integration. 2b. Obtain the given simple integral(s) using substitution method. 2c. Integrate given simple functions using the integration by parts. 2d. Evaluate the given simple integral by partial fractions.	2.1 Simple Integration: Rules of integration and integration of standard functions. 2.2 Methods of Integration: a) Integration by substitution. b) Integration by parts c) Integration by partial fractions.
Unit– III Applications of Definite Integration	3a. Solve given simple problems based on properties of definite integration. 3b. Apply the concept of definite integration to find the area under the given curve (s). 3c. Utilize the concept of definite integration to find area between given two curves. 3d. Invoke the concept of definite integration to find the volume of revolution of given surface.	3.1 Definite Integration: a) Simple examples b) Properties of definite integral (without proof) and simple examples. 3.2 Applications of integration : a) Area under the curve. b) Area between two curves. c) Volume of revolution.
Unit-IV First Order First Degree Differential Equations	4a. Find the order and degree of given differential equation(s). 4b. Form simple differential equations for given simple engineering problems 4c. Solve given differential equations using the method of variable separable. 4d. Solve the given simple problem(s) based on linear differential equations.	4.1 Concept of differential equation 4.2 Order, degree and formation of differential equation. 4.3 Solution of differential equation a. Variable separable form. b. Linear differential equation. 4.4 Application of differential equations and related engineering problems.
Unit –V Numerica	5a. Find the roots of given algebraic equations using Bisection method	5.1 Solutions of algebraic equations: a. Bisection Method.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
I methods	and Regula falsi method. 5b. Determine the roots of given nonlinear equation(s) using Newton's-Raphson method. 5c. Obtain the solutions of given simultaneous equations using Gauss elimination method. 5d. Solve given system of linear equations using Jacobi's method and Gauss Seidal method.	b. Regula falsi Method. c. Newton Raphson Method. 5.2 Numerical solutions of simultaneous equations: a. Gauss elimination method b. Jacobi's Method. c. Gauss Seidal Method.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Differential calculus	20	04	08	12	24
II	Integral calculus	14	02	06	08	16
III	Applications of Definite Integration	10	02	02	04	08
IV	First Order First Degree Differential Equations	08	02	02	04	08
V	Numerical Methods	12	02	05	07	14
	Total	**64**	**12**	**23**	**35**	**70**

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)
Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10.   SUGGESTED STUDENT ACTIVITIES
Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:
   a. Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
   b. Use graphical software: EXCEL, DPLOT, and GRAPH for related topics.
   c. Use Mathcad as Mathematical Tools and solve the problems of Calculus.
   d. Identify problems based on applications of differential equations and solve these problems.
   e. Prepare models to explain different concepts of applied mathematics.
   f. Prepare a seminar on any relevant topic based on applications of integration.
   g. Prepare a seminar on any relevant topic based on some numerical methods.

11.   SUGGESTEDSPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
b. *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
e. Guide student(s) in undertaking micro-projects.
f. Apply the mathematical concepts learnt in this course to branch specific problems.
g. Use different instructional strategies in classroom teaching.
h. Use video programs available on the internet to teach abstract topics.

12.   SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare models using the concept of tangent and normal to bending of roads in case of sliding of a vehicle.
b. Prepare models using the concept of radius of curvature to bending of railway track.
c. Prepare charts displaying the area of irregular shapes using the concept of integration.
d. Prepare charts displaying volume of irregular shapes using concept of integration.
e. Prepare models using the concept of differential equations for mixing problem.
f. Prepare models using the concept of differential equations for radio carbon decay.
g. Prepare models using the concept of differential equations for population growth.
h. Prepare models using the concept of differential equations for thermal cooling.
i. Write algorithm to find the approximate roots of algebraic equations.
j. Write algorithm to find the approximate roots of transcendental equations.
k. Write algorithm to solve system of linear equations.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Higher Engineering	Grewal, B.S.	Khanna publications, New Delhi 2013

S. No.	Title of Book	Author	Publication
	Mathematics		ISBN:8174091955
2	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2016 ISBN:978-81-265-5423-2,
3	Advanced Engineering Mathematics	Das, H.K.	S. Chand Publications, New Delhi, 2008, ISBN-9788121903455
4	Engineering Mathematics, Volume 1 (4th edition)	Sastry, S.S.	PHI Learning, New Delhi, 2009 ISBN: 978-81-203-3616-2,
5	Getting Started with MATLAB-7	Pratap, Rudra	Oxford University Press, New Delhi,2009 ISBN: 0199731241
6	Engineering Mathematics (third edition).	Croft, Anthony.	Pearson Education, New Delhi,2010 ISBN: 978-81-317-2605-1

14.   SOFTWARE/LEARNING WEBSITES
   a. www.scilab.org/ - SCI Lab
   b. www.mathworks.com/products/matlab/ - MATLAB
   c. Spreadsheet applications
   d. www.dplot.com/ - DPlot
   e. www.allmathcad.com/   -   MathCAD
   f. www.wolfram.com/mathematica/   -   Mathematica
   g. http://fossee.in/
   h. https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig
   i. www.easycalculation.com
   j. www.math-magic.com.

Program Name	: Diploma in Computer Hardware & Maintenance, Diploma in Artificial Intelligence and Machine Learning, Diploma in Cloud Computing and Big Data
Program Code	: CO/CM/IF/CW/HA/AN/BD
Semester	: Second
Course Title	: Basic Electronics
Course Code	: 22225

1.   RATIONALE

In today's world most of the consumer appliances are based on electronic circuits and devices. The foundation for working of computer or any of its peripherals are based on electronics. This course has been designed to develop skills to understand and test simple electronic components and circuits.After studying this course students will develop an insight to identify, build and troubleshoot simple electronic circuits.

2.   COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:
- **Use simple electronic circuits of computer system.**

3.   COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:
   a.   Identify electronic components in electronic circuits.
   b.   Use diodes in different applications.
   c.   Interpret the working of junction transistor in the electronic circuits.
   d.   Interpret the working of unipolar devices in the electronic circuits.
   e.   Use sensors and transducers.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Paper Hrs.	Theory						Practical					
L	T	P			ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.
***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment*

5.   COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.
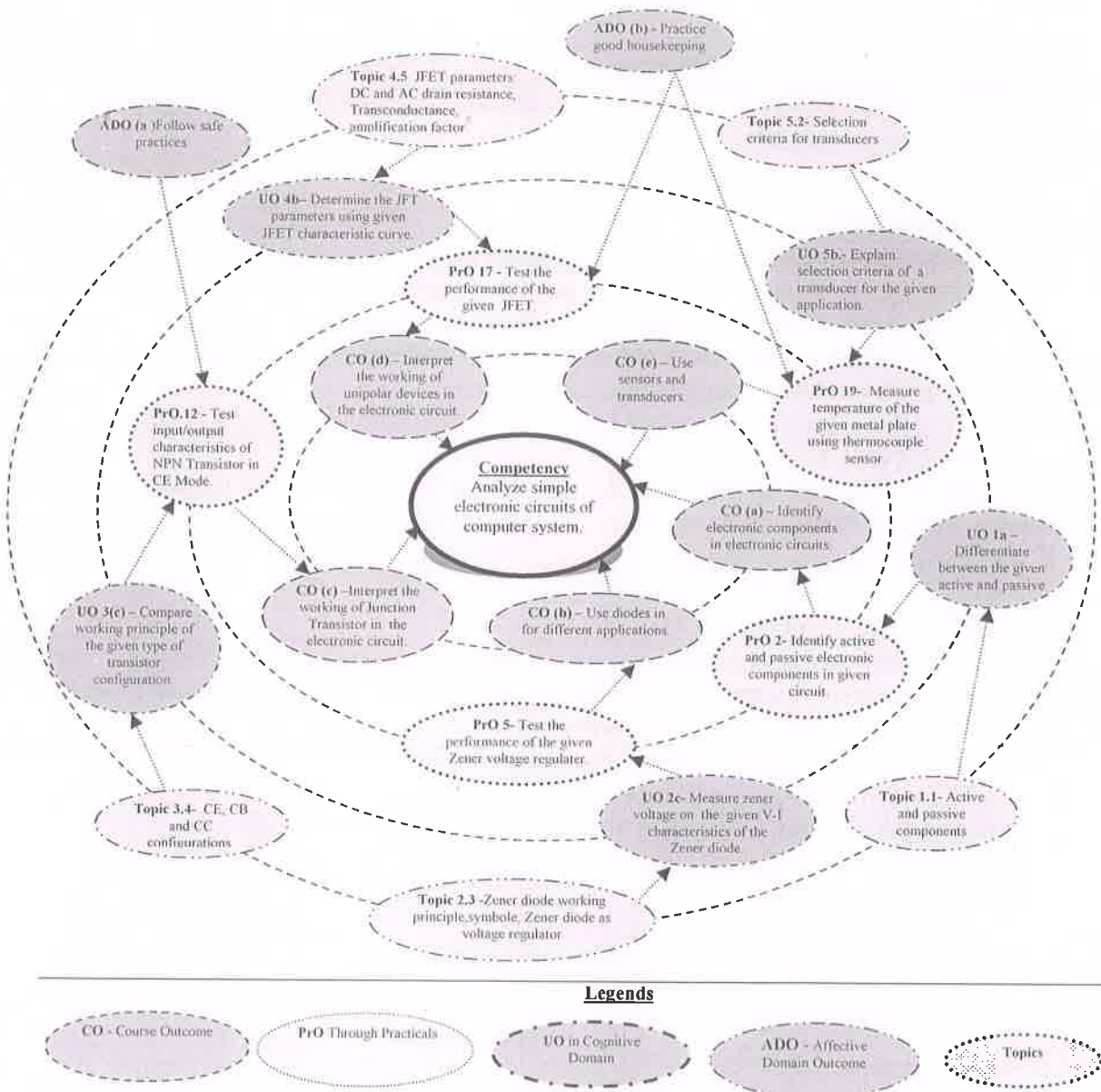

Figure 1 - Course Map

6.   SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Measure amplitude, time period and frequency of sine wave and square wave using CRO.		
2	Identify active and passive electronic components in the given		

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	circuit.		
3	Test the performance of the given PN junction diode.	II	02*
4	Test the performance of the given Zener diode.	II	02
5	Test the performance of the given Zener voltage regulater.	II	02
6	Convert AC signal into DC signal using Half wave rectifier.	II	02
7	Convert AC signal into DC signal using full wave rectifier	II	02
8	Use filters to get regulated DC.	II	02
9	Convert AC signal into DC signal through Bridge rectifier.	II	02
10	Test the performance of the given Bridge rectifier using filter.	II	02
11	Test input/output characteristics of NPN Transistor in CE Mode.	II	02
12	Test input/output characteristics of NPN Transistor in CB Mode.	III	02*
13	Test input/output characteristics of NPN Transistor in CC Mode.	III	02
14	Determine gain and bandwidth of Single stage RC coupled amplifier.	III	02
15	Determine gain and bandwidth of 2 stage RC coupled amplifier.	III	02
16	Test the performance of the given JFET & Determine the characteristics parameter of the given JFET.	III & IV	02*
17	Measure temperature of the given metal plate using thermocouple sensor.	IV	02
18	Test the performance of the given circuit consist of photoelectric sensor.	V	02*
	Total		**36**

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.

b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

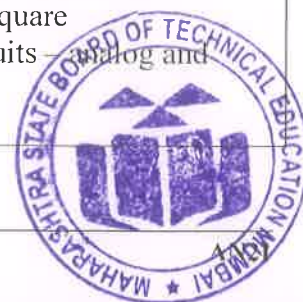## 7.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Single/Dual regulated Power supply(0 to 15Volts).	3-18
2	Digital multimeter ,3and ½ digit, seprate range for resistancs and capacitance,component tester, AC and DC measurement.	3 – 20
3	Dual trace CRO/DSO, 50MHz., with function generator and component tester.	1,4-18
4	Function generator, 20MHz.	1,4-18
5	Trainer kits / breadboard for Rectifiers, regulator, Transistors, JFET and RC coupled single / two stage amplifiers.	4-18
6	Heater, Thermocouple and photoelectric sensor	19,20

8.   UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Electronic Components and Signals	1a. Differentiate between the given active and passive electronic components. 1b. Calculate value of the given resistor and capacitor using colour code. 1c. Compare the characteristics of the given voltage and current source. 1d. Interpret with sketches the given signal.	1.1 Active and passive components 1.2 Resistor,capacitor,inductor symbols,working principles, applications,colour codes, specifications. 1.3 Voltage and Current Source 1.4 Signal waveform, Time and frequency domain representation, Amplitude, Frequency, Phase, Wavelength 1.5 Types of Signals: sinusoidal, triangular and square 1.6 Integrated Circuits – analog and digital.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– II Diodes and Their Applications	2a. Explain with sketches working of the given diode using V-I characteristics. 2b. Measure zener voltage on the given V-I characteristics of the zener diode. 2c. Describe with sketches the working principle of given type of filter. 2d. Compare the salient features of the given type of rectifiers.	2.1 Symbol, construction and working principle of P-N junction diode 2.2 Rectifiers:Half wave, Full wave and Bridge Rectifier,working principle , circuit diagram, performance parameters PIV, ripple factor,efficiency, Need for filters: circuit diagram and working of 'L', 'C' and 'π" filter. 2.3 Zener diode working principle, symbole, as voltage regulator 2.4 Symbol, construction and working principle of light emitting diode(LED) 2.5 Working principle and block diagram of regulated power supply.
Unit– III Bipolar Junction Transistor	3a. Describe with sketches the construction and working of the given type of device. 3b. Explain with sketches the working principle of the given transistor configuration 3c. Determine the current gain of the given transistor configuration. 3d. Explain with sketches the specified transistor parameter. 3e. Explain with sketches the concept of the specified transistor biasing.	3.1 Unipolar and Bipolar devices 3.2 Symbol, construction and working principle of NPN transistor. 3.3 Transistor as switch and amplifier. 3.4 CE, CB and CC configurations. 3.5 Regions – Cut-off, saturation and Active region. 3.6 Transistor parameters- alpha, beta, input and output resistance and relation between alpha and beta 3.7 Transistor biasing- DC load line, Q-point and Fix bias and voltage divider biasing. 3.8 RC coupled amplifier.
Unit-IV Field Effect Transistors	4a. Explain with sketches the construction and working principle of the given type of FET. 4b. Determine the FET parameters from the given FET charasteristic curve. 4c. Describe the specified JFET paramenter. 4d. Describe the specified MOSFET paramenter.	4.1 FET-Types: JFET and MOSFET 4.2 Classification of JFET 4.3 Symbol, construction and working principle of N-channel and P-channel JFET, Drain and transfer characteristics of JFET 4.4 JFET parameters: DC and AC drain resistance, Transconductance, amplification factor 4.5 Symbol, construction and working principle of MOSFET.
Unit –V Sensors and Transducers	5a. Differentiate between the given type of sensor and transducer	5.1 Working of sensors and transducers 5.2 Selection criteria for transducers 5.3 Active and passive transducers

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	5b. Explain selection criteria of a transducer for the given application. 5c. Describe with sketches the working of photodiode and photo transistor as control device for the given application. 5d. Describe the steps to measure the temperature of a given metal using the given transducer.	5.4 Inductive, capacitive, resistive pressure and Piezoelectric transducer 5.5 Photodiode and phototransistor transducers 5.6 Thermocouple and Proximity sensors.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Electronic Components and Signals	08	02	04	06	12
II	Diodes and Their Applications	10	04	04	08	16
III	Bipolar Junction Transistor	14	04	06	08	18
IV	Field Effect Transistor	08	02	03	06	11
V	Sensors and Transducers	08	03	04	06	13
	Total	48	15	21	34	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)
Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs.. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10.   SUGGESTED STUDENT ACTIVITIES
Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:
   a. Prepare journals based on practical performed in laboratory.
   b. Study of datasheet of electronic components.
   c. Prepare charts of symbols of Electronic components.
   d. Search information about Ratings and specifications of Regulator, diode transistors, CRO, function generator.
   e. Collect information of analog and digital ICs and prepare charts of the same.
   f. Collect information of passive transducers and prepare charts of the same.
   g. Prepare posters to illustrate the use of photoelectric sensors in remote controls.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course :

a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.

b. *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.

c. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).

d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.

e. Guide student(s) in undertaking micro-projects.

f. Guide students in preparing charts and display boards.

g. Guide students in searching information regarding datasheets and electronic components.

h. Show Video/Animation clippings for functioning of instruments.

i. Observe continuously and monitor the performance of students in lab.

12.   SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. **Diode:** Build a circuit on general purpose PCB to clip a positive half cycle at 1.5 v of a waveform with input signal 5Vpp., and prepare the report.

b. **Diode:** Build a circuit on general purpose PCB to clamp a waveform at 3.0V using diode and passive components.

c. **FET:** Prepare chart on comparison of specifications of FETs using data sheets of at least three FET.

d. **FET:** Prepare a chart on FETs contains its symbol, advantages and applications. .

e. **Rectifier:** Build a half wave rectifier for 6V, 500mA output current on general purpose PCB.

f. **Rectifier:** Build a full wave bridge rectifier with capacitor filter for 6V, 500mA output current on general purpose PCB .

g. **BJT:** Build a circuit to switch on and off the LED by using BJT as switching component.

h. **Photodiode:** Build a circuit on breadboard to turn the relay on and off by using photo diode and prepare a report.

   i. **Voltage Regulator:** Build a circuit of DC regulated power supply on general purpose PCB for 9V and 500mA output.

   j. **Transistor as a switch:** Build / test transistor switch circuit on breadboard/General purpose PCB for various input signal.

   k. **Use of sensors for driving relays / output devices:** Students will build/test circuit on breadboard/General purpose PCB. Verify output of designed circuit by appling different inputs.

   l. **Prepare display boards consisting of electronic components**: prepare display boards/ models/ charts/ Posters to visualize the appearance of electronic active and passive components.

13.   SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Electronic Instrumentation	Kalsi, H.S.	McGraw Hill Education, New Delhi,2010, **ISBN:** 978-0070702066
2	Electronics Principles	Malvino, Albert Paul, David	McGraw Hill Eduction, New Delhi, **ISBN:** 978-0070634244
3	A text book of Applied Electronics	Sedha, R.S.	S.Chand and Co. ,New Delhi, 2008,**ISBN** 978-8121927833
4	A course in electrical and electronic measurements and instrumentation	Sawhney, A.K.	Dhanpat Rai & Company, New Delhi, 2014 edition, **ISBN-:** 978-8177001006
5	Principles of Electronics	Mehta, V.K. Mehta, Rohit	S. Chand and Co. Ram Nagar, New Delhi-110 055, 11th Edition,2014 , ISBN 9788121924504

14.   SOFTWARE/LEARNING WEBSITES

   a. https://learn.sparkfun.com/tutorials/transistors

   b. http://www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf

   c. http://faculty.cord.edu/luther/physics225/Handouts/transistors_handout.pdf

   d. http://www.technologystudent.com/elec1/transis1.htm

   e. http://www.learningaboutelectronics.com/Articles/N-channel-JFET

   f. http://www.electrical4u.com/jfet-or-junction-field-effect-transistor

   g. www.nptel.com

   h. http://www.electronics-tutorials

Program Name : **Diploma in Computer Hardware & Maintenance, Diploma in Artificial Intelligence and Machine Learning, Diploma in Cloud Computing and Big Data, Diploma in Electronics and Computer Engineering**

Program Code : **CO/CM/IF/CW/IF/HA/AN/BD/TE**

Semester : **Second**

Course Title : **Programming in 'C'**

Course Code : **22226**

1.   RATIONALE

Diploma engineers (also called technologists) have to write programs to cater with various IT solutions. In order to develop a program to solve a given problem, they have to build logic, develop algorithms and flow charts. This course is designed keeping in view developing these skills. Besides its use to write codes for low level programming such as developing operating systems, drivers, and compilers; 'C' has been widely used as a general-purpose language to develop basic applications. This course deals with fundamental syntactic information about 'C' that will help the students to apply the basic concepts, program structure and principles of 'C' programming paradigm to build given application. The course is basically designed to create a base to develop foundation skills of programming language.

2.   COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

*   **Develop 'C' programs to solve broad-based computer related problems.**

3.   COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

a.   Develop flowchart and algorithm to solve problems logically.
b.   Write simple 'C' programs using arithmetic expressions.
c.   Develop 'C' programs using control structure.
d.   Develop 'C' programs using arrays and structures.
e.   Develop/Use functions in C programs for modular programming approach.
f.   Develop 'C' programs using pointers.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
					Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	2	2	7	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.
***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment*

5.   COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.
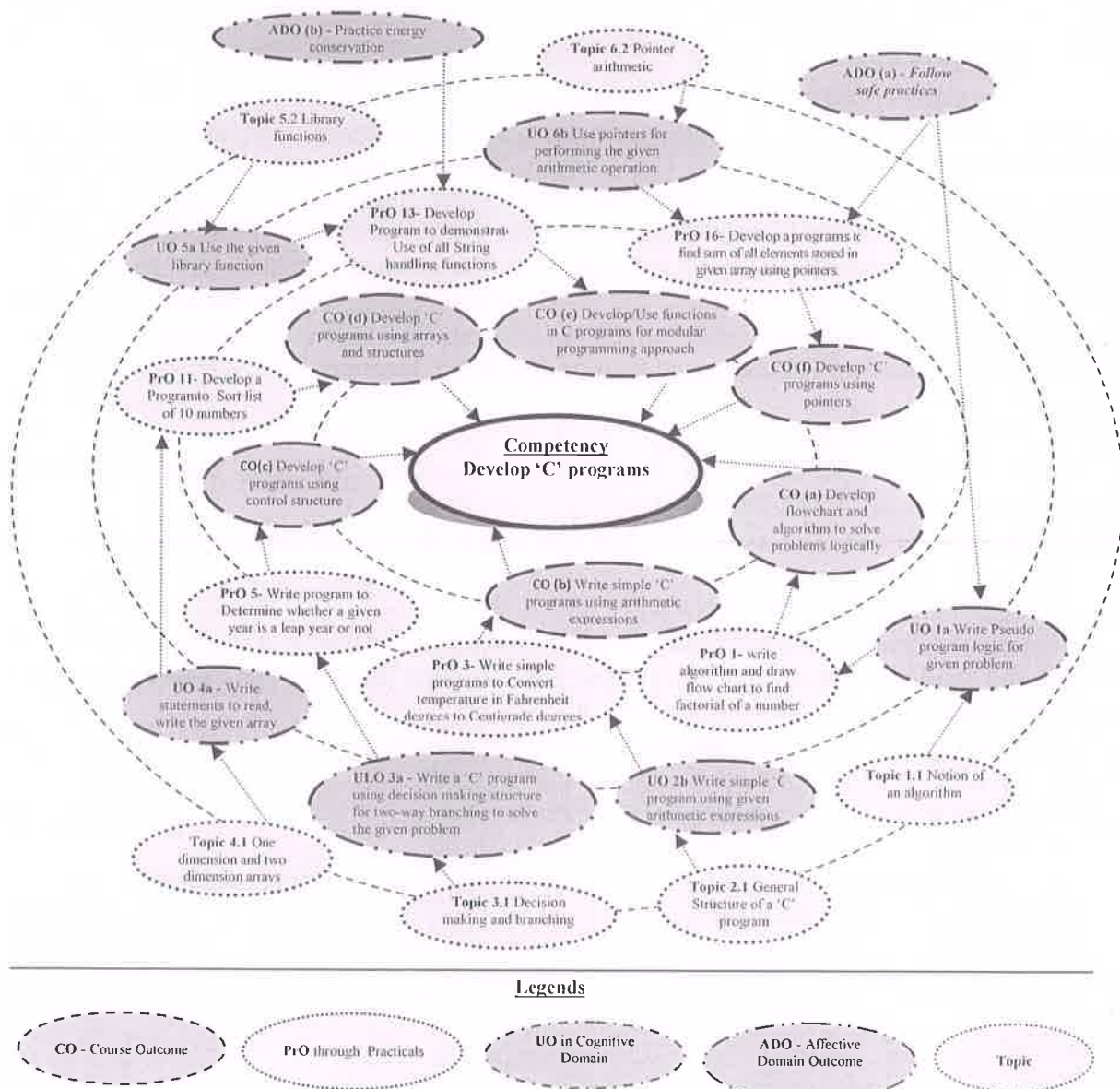

Figure 1 - Course Map

6.   SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	**Write/compile/execute simple 'C' program:** Develop minimum 2 programs using Constants, Variables, arithmetic expression.	II	02
2	**Write/compile/execute simple 'C' program:** Develop minimum 2 programs increment/decrement operators, exhibiting data type conversion	II	02
3	Write simple programs to convert temperature in Fahrenheit degrees to Centigrade degrees.	II	2
4	Write simple programs to calculate the area and perimeter of the rectangle, and the area & circumference of the circle	II	2
5	**Decision Making and branching using if, if-else structure** Write program to: (i) Determine whether a given year is a leap year or not. (ii) Determine whether a string is palindrome.	III	02*
6	Write program to: (i) Find the greatest of the three numbers using conditional operators (ii) Find if a given character is vowel.	III	02
7	**Using switch statement:** Write programs to : (i) Print day of week by taking number from 1 to 7 . (ii) Print a student's grade by accepting percent marks.	III	02
8	**Using switch statement:** Write programs to check whether the triangle is isosceles, equilateral, scalene or right angled triangle	III	02
9	**Looping:** Write a program to : (i) Find sum of digits of a given number. (ii) Generate multiplication table up to 10 for numbers 1 to 5.	III	02
10	Write a program to : (iii) Find Fibonacci series for given number. (iv) Write a program to produce the following output: 　　　　1 　　2　　　3 　4　　5　　6 7　　8　　9　　10	III	02
11	**Array:** Develop a Program to: (i) Sort list of 10 numbers. (ii) Perform addition of 3x3 matrix.	IV	02
12	**Structure:** Develop a Program to: (i) Create a structure called library to hold details of a book viz. accession number, title of the book, author name, price of the book, and flag indicating whether book is issued or not. Fetch some sample data and display the same. (ii) Develop and execute C Program to Add Two Distances given in kilometer-meter Using Structures	IV	02
13	**Library Functions:** Develop Program to demonstrate: (i) Use of all String handling functions. (ii) Use of few Mathematical functions. (iii) Use of few other miscellaneous functions.	V	02
14	**User Defined Functions:** Develop a Program to:	V	02
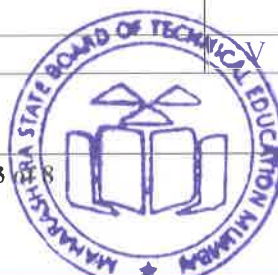
S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	(i) Create a function to find GCD of given number. Call this function in a program. (ii) Find Factorial of given number using recursion.		
15	**Pointers:** Develop a Program to Print values of variables and their addresses.	VI	02
16	Develop a Program to Find sum of all elements stored in given array using pointers.	VI	02
		Total	**32**

Note

i. *A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
a.	Correctness of algorithm	40
b.	Debugging ability	20
c.	Quality of input and output displayed (messaging and formatting)	10
d.	Answer to sample questions	20
e.	Submit report in time	10
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

    a. Follow safety practices.
    b. Practice good housekeeping.
    c. Demonstrate working as a leader/a team member.
    d. Maintain tools and equipment.
    e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

    • 'Valuing Level' in 1st year
    • 'Organising Level' in 2nd year
    • 'Characterising Level' in 3rd year.

7.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S. No.
1	Computer system (Any computer system with basic configuration)	All
2	'C' Compiler	

8.   UNDERPINNING THEORY COMPONENTS

The following topics/subtopics is to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Program Logic Development	1a. Write Pseudo program logic for the given problem. 1b. Identify the given symbols of a flow chart. 1c. Explain guidelines for preparing flowchart with example. 1d. Create flowchart to logically solve the given problem.	1.1 **Fundamentals of algorithms:** Notion of an algorithm. Pseudo-code conventions like assignment statements and basic control structures. 1.2 **Algorithmic problems:** Develop fundamental algorithms to solve simple problems such as: (i) solve simple arithmetic expression (ii) find the greatest of three numbers (iii) determine whether a given number is even or odd (iv) determine whether a given number is prime. 1.3 **Flowchart:** Flowchart, Symbols of flowchart, Guidelines for preparing Flowchart
Unit– II Basics of C programming	2a. Identify the given building block of a C program. 2b. Write simple 'C' program using the given arithmetic expressions 2c. Write a simple 'C' Program demonstrating the given data type conversion 2d. Write I/O Statements for the given data.	2.1 **Introduction to C**: History of 'C' General Structure of a 'C' program: Header files, 'main' function. 2.2 **Data Concepts:** Character set, tokens, keywords, Identifiers, Variables, Constant, data types, C operators, Arithmetic operators, Arithmetic expression, declaring variables, and data type conversion. 2.3 **Basic Input output:** Input and Output statements, using printf() and scanf(), character input/output statements, Input/output formatting, Use of comments
Unit– III Control Structures	3a. Write a 'C' program using decision making structure for two-way branching to solve the given problem. 3b. Write a 'C' program using	3.1 **Decision making and branching:** Relational and logical operators, if statement, if else statement, nested if-else, if-else ladder, The switch statement

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	decision making structure for multi-way branching to solve the given problem. 3c. Write a 'C' program using loop statements to solve the given iterative problem. 3d. Use related statements to alter the program flow in the given loop.	3.2 **Looping:** While loop, Do… While loop For loop, Go to statement, Use of break and continue statements
Unit-IV Array and Structure	4a. Write statements to read, write the given array. 4b. Manipulate the given array of characters and numbers. 4c. Use the structure for solving the given problem. 4d. Write a sample program to demonstrate use of the given enumerated data type.	4.1 Characteristics of an array, One dimension and two dimension arrays 4.2 Array declaration and Initialization 4.3 Array of characters, Operation on array 4.4 Character and String input/output 4.5 Introduction and Features of Structures, Declaration and Initialization of Structures 4.6 Type def, Enumerated Data Type, using structures in C Program
Unit –V Functions	5a. Use the given Library function. 5b. Develop relevant user defined functions for the given problem. 5c. Write 'C' codes to pass the given function parameters using "call by value" and "call by reference" approach. 5d. Write recursive function for the given problem.	5.1 Concept and need of functions 5.2 Library functions: Math functions, String handling functions, other miscellaneous functions. 5.3 Writing User defined functions, scope of variables. 5.4 Parameter passing: call by value, call by reference. 5.5 Recursive functions
Unit-VI Pointers	6a. Use pointers to access memory locations using pointer to solve the given problem. 6b. Use pointers for performing the given arithmetic operation. 6c. Develop a program to access elements of the given array using pointers. 6d. Develop a program to access elements of the given structure using pointers.	6.1 Concepts of pointers: declaring, initializing, accessing. 6.2 Pointer arithmetic. 6.3 Handling arrays using pointers 6.4 Handling functions using pointers 6.5 Handling structures using pointers

Note: *To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'*

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Program Logic Development	04	02	02	04	08
II	Basics of C programming	06	02	04	04	10
III	Control Structures	10	02	02	08	12
IV	Arrays and Structures	12	02	02	10	14
V	Functions	10	02	04	08	14
VI	Pointers	06	02	02	08	12
	Total	48	12	16	42	70

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note: *This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10.   SUGGESTED STUDENT ACTIVITIES
Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:
   a.   Prepare journal of practicals.
   b.   Undertake micro-projects.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)
These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:
   a.   Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
   b.   *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
   c.   About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
   d.   With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
   e.   Guide student(s) in undertaking micro-projects.
   f.   Demonstrate students thoroughly before they start doing the practice.
   g.   Encourage students to refer different websites to have deeper understanding of the subject.
   h.   Observe continuously and monitor the performance of students in Lab.

12.   SUGGESTED MICRO-PROJECTS
Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application

based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:
  a. Prepare sample mark sheet for 10 students.
  b. Generate salary slips of employees in an organization.
  c. Develop book issue system of library.
  d. Any other micro-projects suggested by subject faculty on similar line.
(Use structure and other features of 'C' to develop above listed applications)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Programming in ANSI C	Balgurusamy, E.	McGraw Hill Education, New Delhi 2012, ISBN: 978-1259004612
2	The C Programming Language	Brian, W. Kernighan, Ritchie Dennis	PHI Learning Private Limited, New Delhi 1990, ISBN: 978-8120305960
3	Let us C	Kanetkar, Yashawant	BPB Publications, New Delhi 2016, ISBN:978-8183331630
4	C Programming	Dr. Rajendra Kawale	Devraj Publications, Dist Solapur, Maharashtra

14. SOFTWARE/LEARNING WEBSITES
  a. http://nptel.ac.in/courses/106105085/4
  b. www.w3schools.com
  c. www.programiz.com/c-programming
  d. https://www.codecademy.com/courses/getting-started-v2/0/1
  e. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/
  f. http://spoken-tutorial.org/

Program Name: Diploma in Computer Hardware & Maintenance, Diploma in Artificial Intelligence and Machine Learning, Diploma in Cloud Computing and Big Data, Diploma in Electronics and Computer Engineering, Diploma in Agricultural Engineering, Diploma in Polymer Technology

Program Code: CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/ EP/EU/IS/IC/AE /FG/ME/PG/PT/DC/TX/TC/HA/AN/BD/TE/AL/PO

Semester : Second

Course Title : Business Communication Using Computers

Course Code : 22009

1. RATIONALE

Communication is the key factor for smooth and efficient functioning of any industry or business activity. Effective business communication is the lifeblood of any organization and is required to maintain quality and progress. The efficacy of business communication skills are essential for engineering professionals for instructing, guiding and motivating subordinates to achieve desired goals at work place. It is very crucial for an entrepreneur to run organization successfully by communicating effectively and skillfully with employees, customers and investors. Thus this course has been designed to enhance the skills to '*Communicate effectively and skillfully at workplace.*'

2. COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences

- **Communicate effectively and skillfully at workplace.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above-mentioned competency:

- a. Communicate effectively by avoiding barriers in various formal and informal situations.
- b. Communicate skillfully using non-verbal methods of communication.
- c. Give presentations by using audio- visual aids.
- d. Write reports using correct guidelines.
- e. Compose e-mail and formal business letters.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Paper Hrs.	Theory						Practical					
					ESE		PA		Total		ESE		PA		Total	
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
--	--	2	2	--	--	--	--	--	--	--	35@^	14	15~	06	50	20

($\sim^1$): For only practical courses, the PA (15 marks) has two components under practical marks i.e. the assessment of practical has a weightage of 60% (i.e.09 marks) and micro-project assessment has a weightage of 40% (i.e.06 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.
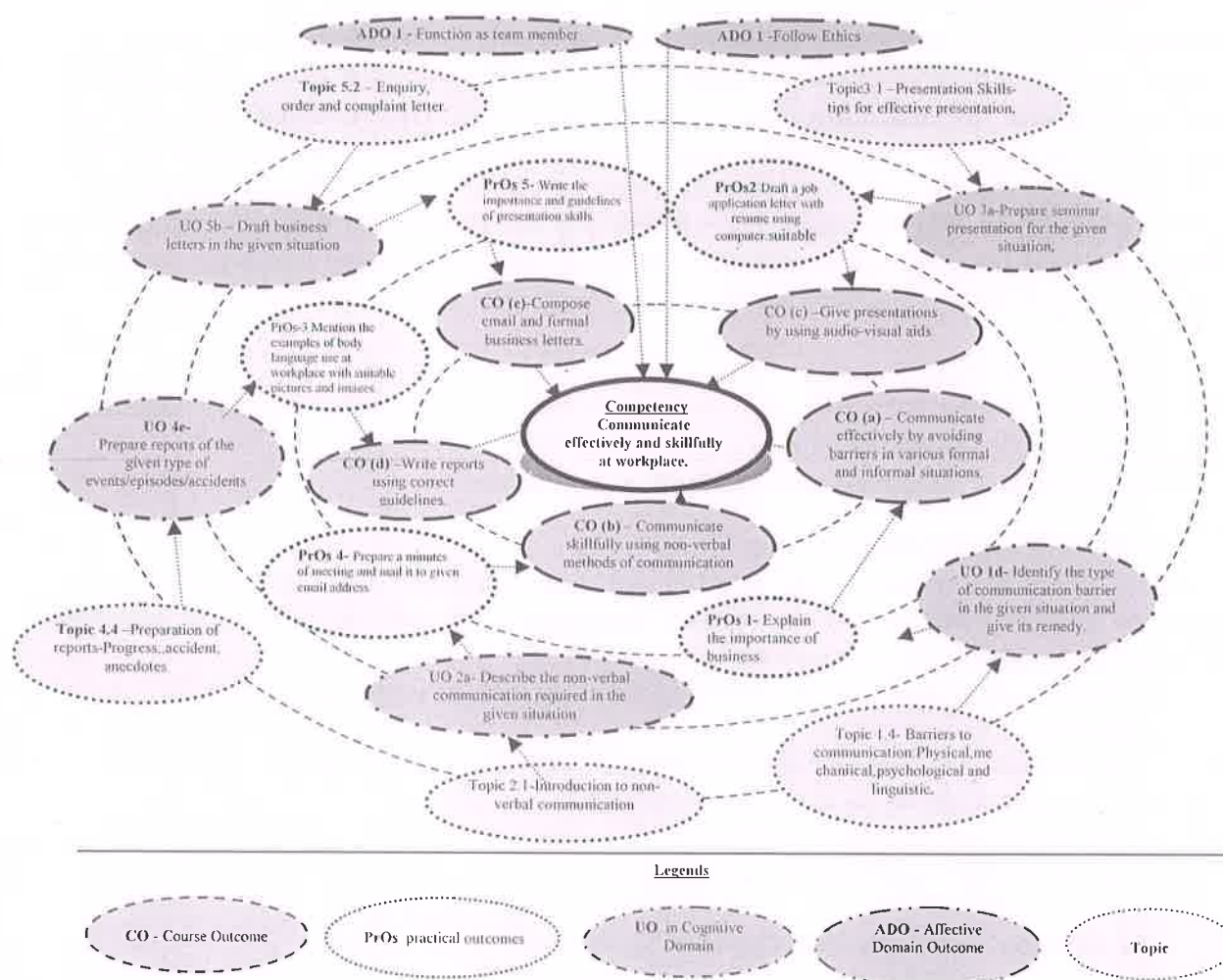

Figure 1 - Course Map

6. SUGGESTED PRACTICALS ACTIVITIES / EXERCISES (Integrate the theory in the laboratory when conducting practical)

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Explain the importance of business communication for an organization using case study	I	2*
2	Draft a job application letter with resume using computer.	V	2*
3	Mention the examples of body language use at workplace with suitable pictures and images.	II	2*
4	Prepare a minutes of meeting and mail it to given email address	VI	2
5	Write the importance and guidelines of presentation skills.	III	2*
6	Draft a detailed Progress Report.	IV	2*
7	Organize a debate on types of communication.	I & III	2
8	Summarize an industry report using techniques of summarizing.	IV	2
9	Draft a complaint letter on given topic.	V	2
10	Design PowerPoint presentation on any technical topic.	III	2*
11	Explain the eight principles of effective communication.	I	2*
12	Explain various non-verbal codes with examples.	II	2
13	Explain the importance of personal appearance stating tips of grooming for a professional.	II	2*
14	Draft a memo on given topic.	V	2
15	Present any Two barriers to communication using case study.	I	2*
16	Present a technical paper using IEEE format.	III	2*
		Total	32

Note

i. *A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry. The size of batch for the practical should not exceed more than 21 students strictly for the maximum attainment of COs and PrOs.*

ii. *Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:*

7.   MAJOR EQUIPMENTS / INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	LCD Projector	All
2	Smart Board with networking	All
3	Language lab with internet	All
4	Printer	Wherever Applicable

8.   UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	**Speaking Skills**	
Unit – I Introduction to Business Communication	1a. Describe the importance of the business communication in the given situation. 1b. Identify the missing element in the given communication process. 1c. Identify the type of communication in the given situation. 1d. Identify the type of communication barrier in the given situation and its remedy.	1e. Use different types of verbal and non–verbal communication for the given situation.	1.1 Introduction to Communication- Elements, Importance, Functions. 1.2 Types (meaning and importance) –Verbal (Oral-Written), Formal, Informal, Vertical, Horizontal and Diagonal communication. 1.3 Principles of effective communication. 1.4 Barriers to communication - Physical, mechanical, psychological and linguistic. 1.5 Business communication: Meaning, characteristics and importance.
Unit– II Non-Verbal Communication	2a. Describe the non-verbal communication required in the given situation. 2b. Describe personal appearance required in the given communication situation. 2c. Describe the given facial expressions.	2d. Use relevant facial expressions in the given situation. 2e. Answer questions after listening to presentations.	2.1 Introduction to Non-Verbal communication (Meaning and importance) 2.2 Body Language: Aspects of body language: gestures, eye contact, posture, facial expressions, personal appearance (dressing and grooming) vocalics. 2.3 Body language - positive and negative body language.
Unit– III Presentation skills	3a. Prepare seminar presentation for the given situation. 3b. Prepare debate points 'for' and 'against' the given topic. 3c. Prepare the points for computer presentation	3d. Make seminar presentation 3e. Participate in debate speaking 'for' or 'against' the given topic. 3f. Make effective	3.1 Presentation skills- tips for effective presentation. 3.2 Guidelines for developing powerpoint presentation. 3.3 Presenting Technical papers

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	**Speaking Skills**	
	for the given topic.	computer presentations	
Unit– IV Office Drafting	4a. Draft the given notice using the relevant format. 4b. Draft the given memorandum using the relevant format. 4c. Prepare agenda for the given type of meetings. 4d. Prepare minutes of the given type of meetings. 4e. Prepare reports of the given type of events/episodes/ accidents	4f. Read the agenda of the given meeting. 4g. Read the report of the given event. 4h. Initiate telephone calls for given situation. 4i. Answer official phone calls for given situation.	4.1. Office drafting: Formats and Guidelines. 4.2. Formulating notices and memoranda. 4.3. Preparation of agenda and writing minutes of meetings. 4.4. Preparation of reports- progress reports, Accident reports, case study. 4.5. Summarizing techniques.
Unit-V Business Correspon dence	5a. Respond to given job advertisements by writing your CV/ Resume. 5b. Draft business letters in the given situations. 5c. Draft complaint letters for the given situations. 5d. Compose E- mails with relevant for the given situation.		5.1 Business correspondence. 5.2 Enquiry, order and complaint letters. 5.3 E-mails- netiquettes. 5.4 Difference –Curriculum Vitae, Bio-data and Resume. 5.5 Job application and resume writing

Note: To attain the COs and competency, above listed Learning Outcomes (UOs) need to be undertaken to achieve the 'Application Level' of Blooms's 'Cognitive Domain Taxonomy' Theory related topic should be covered during practical hours using multimedia.

9. **SUGGESTED SPECIFICATION TABLE FOR INTERNAL END SEMISTER EXAMINATION**

Unit No.	Unit Title	Distribution of practical Marks			
		R Level	U Level	A Level	Total Marks
I	Introduction to Business Communication	02	02	01	05
II	Non-verbal Communication	02	01	02	05
III	Presentation Skills	02	01	02	05
IV	Office Drafting	02	04	04	10
V	Business Correspondence	02	04	04	10
	Total	**10**	**12**	**13**	**35**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note: *This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of PrOs and UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED GUIDELINES FOR ASSESSMENT TOOL TO CONDUCT INTERNAL END SEMETER EXAM (ESE) .

Weightage (20 Marks) A	Weightage (15 Marks) B	Total
Assessment based on PrOs, practicals conducted during semester Based on computer and written skill. (Minimum four questions each five marks) Sample questions: Eg. I Draft an email to The manager regarding the shortage of raw material at production department. Note-submit the printout of mail. (Computer based) Eg. II Write job application with resume. (written)	Oral examination based on UOs Topics mentioned in syllabus. (Minimum five questions each two marks to be asked) Eg. I Explain the importance of communication in professional life. II. State any four guidelines of presentation skills.	(35 Marks) A+B Duration: 2 hours

SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Collect good articles from newspapers and magazines and read them with correct intonation.
b. Listen to Business news on TV and radio.
c. Watch videos of effective presentations on television and open learning sources for presentation skills and body language.
d. Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.

b. **'L' in item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.

c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).

d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.

a. Arrange various communication activities using functional grammar.

b. Show video/animation films to develop listening skills and enhance vocabulary.

c. Use real life situations for explanation.

d. Prepare and give oral presentations.

e. Guide micro-projects in groups as well as individually.

12.   SUGGESTED TITLES OF MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of CrAs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement** hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. Study the personal appearance and grooming of employees visiting sales store, shopping mall in the vicinity.

b. Comparative study of Bio-data, Resume and Curriculum vitae.

c. A detailed study of guidelines required for presentation skills.

d. Summarize technical content using English newspaper, magazines or online resources.

e. Prepare a booklet on aspects of body language in pictorial form.

f. A detailed study of the importance, of technical paper of technical paper presentation.

g. Case study on the importance of Business communication in an organization.

h. Report on various formal/business activities.

i. Study of oral presentation of famous business leader.

j. Detailed study of business etiquettes observed in organization.

k. Summarize the business article with the help of English newspapers/magazines and other sources.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Effective Communication Skills	M Ashraf Rizvi	Tata McGraw Hill

S. No.	Title of Book	Author	Publication
2	Communication Skills	Sanjay Kumar and Pushp Lata	Oxford University Press
3	Personality Development and Soft Skills	Barun K. Mitra	Oxford University Press

14.   SOFTWARE/LEARNING WEBSITES

a. https://www.britishcouncil.in/english/learn-online
b. http://learnenglish.britishcouncil.org/en/content
c. http://www.talkenglish.com/
d. languagelabsystem.com
e. www.wordsworthelt.com
f. www.notesdesk.com
g. http://www.tutorialspoint.com
h. www.studylecturenotes.com
i. totalcommunicator.com
j. www.speaking-tips.com

Program Name	: Diploma in Computer Hardware & Maintenance, Diploma in Artificial Intelligence and Machine Learning, Diploma in Cloud Computing and Big Data
Program Code	: CO/CM/IF/CW/HA/AN/BD
Semester	: Second
Course Title	: Computer Peripheral and Hardware Maintenance
Course Code	: 22013

1. RATIONALE

Maintenance and troubleshooting of computer system and its peripherals is an important skill to upkeep the computer systems and peripherals. Diploma pass out must be able to use and maintain these system peripherals authentically. They must also possess basic skills of assembling desktop computers, interfacing with peripheral devices, installing new devices and carry out preventive and breakdown maintenance and troubleshooting. This course is designed to develop these vital skills in them through lab based activities to solve problems associated with computer hardware.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:
- **Maintain computer hardware and peripherals.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented COs* associated with the above mentioned competency:
   a. Identify different types of computer systems.
   b. Troubleshoot common motherboard problems.
   c. Select processors required for relevant systems.
   d. Partition/format hard disk drives.
   e. Troubleshoot peripherals and networks.
   f. Test power supplies.

4. TEACHING AND EXAMINATION SCHEME

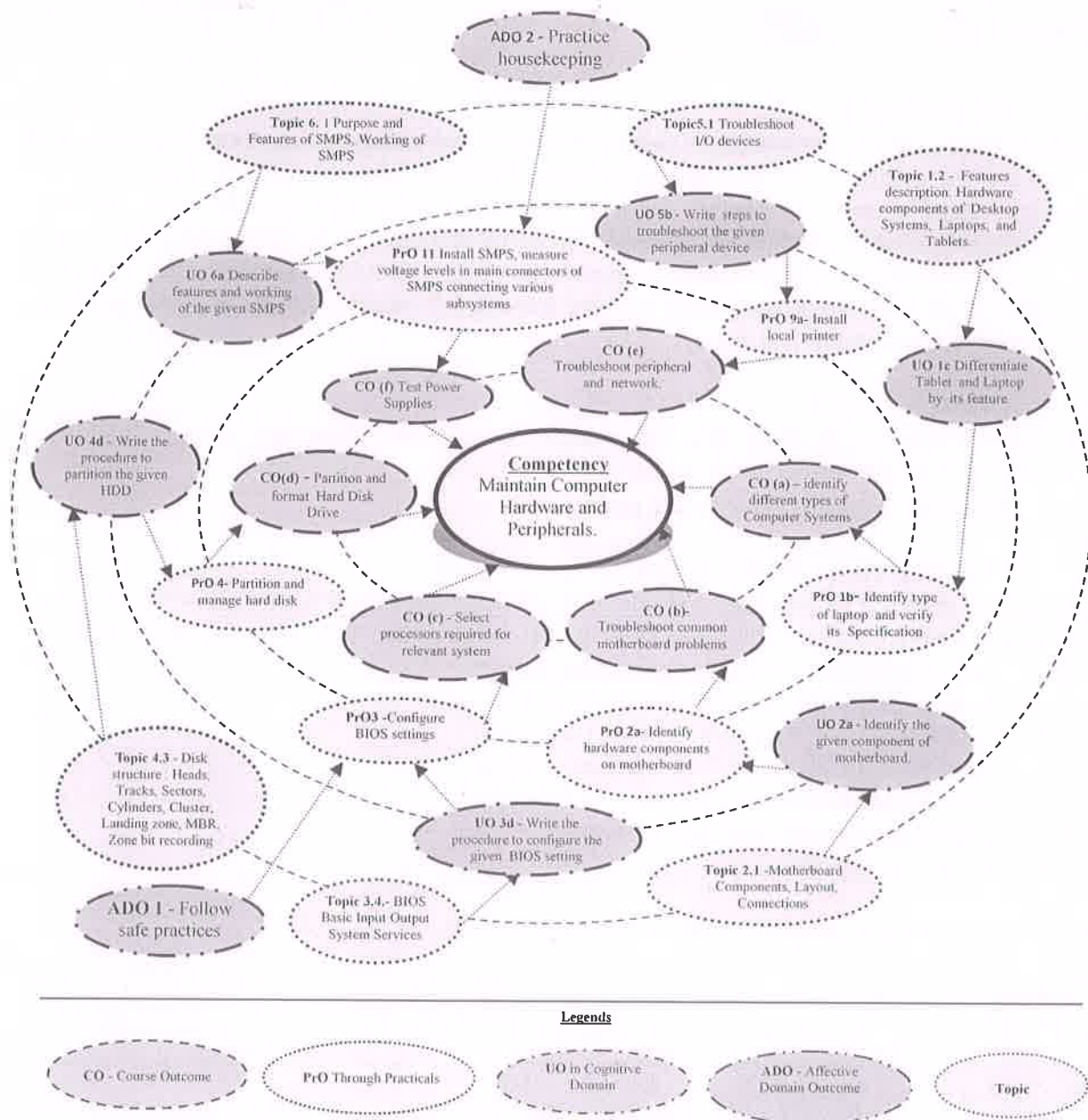| Teaching Scheme			Credit (L+T+P)	Examination Scheme												
					Theory						Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	-	2	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40

*(~): For the **practical only courses**, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e.30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e.20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.*

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5.   COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

Figure 1 - Course Map

6.   SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	a. Identify desktop and server by its type and verify its specifications	I	2*
	b. Identify type of laptop and verify its Specification		
2	a. Identify hardware components on motherboard	II	2*
	b. Troubleshoot common problems of motherboard.		
3	Configure BIOS settings	III	2*
4	Partition and manage hard disk: format hard drives with different file systems. (Part-I)	IV	2*
5	Partition and manage hard disk, format hard drives with different file systems. (Part-II)	IV	2
6	Install Operating System – Windows family (such as Windows 7/ Windows 10,Windows server 12)	IV	2
7	Install Operating System –Unix family (such as Linux/Ubuntu/Centos)	IV	2
8	Troubleshoot Hard disk problems.	IV	2
9	a. Install local printer (Software configuration settings on printer and troubleshooting)	V	2*
	b. Share Printer in Network(Software configuration settings on printer and troubleshooting)		
10	Set keyboard, mouse, monitor, Speaker, Microphone and LCD Projector	V	2
11	Install SMPS, measure voltage levels in main connectors of SMPS connecting various subsystems.	VI	2*
12	Assemble and Disassemble Desktop System (Part-I)	VI	2
13	Assemble and Disassemble Desktop System (Part-I)	VI	2
14	Troubleshoot computer system by diagnosing the problem	VI	2
15	Use diagnostic software for fault finding and viruses	VI	2
16	Undertake Preventive Maintenance of PC using vacuum cleaner and simple tools.	VI	2
	Total		**32**

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. All the above listed practical need to be performed compulsorily, so that the student reaches the 'Applying Level' of Blooms's 'Cognitive Domain Taxonomy' as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Use of Appropriate tool to solve the problem	10
b.	Operate equipment skillfully	30
c.	Follow Safety measures	10
d.	Completed the exercise in stipulated time	30
e.	Answer to sample questions	10
f.	Submit report in time	10
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

    a. Follow safety practices.
    b. Practice good housekeeping.
    c. Demonstrate working as a leader/a team member.
    d. Follow ethical practices.

- The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:
  - 'Valuing Level' in 1st year.
  - 'Organising Level' in 2nd year.
  - 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Computer system with all necessary components like; motherboard, random access memory (RAM), read-only memory (ROM), Graphics cards, sound cards, internal hard disk drives, DVD drive, network interface card	All
2	LCD/DLP Projector	Student Activity
3	Mouse :Mechanical, Optical, Opto-Mechanical	8
4	Laptop	All
5	Bluetooth based wireless mouse and keyboard or any other device	8
6	Dot Matrix Printer, Laser Printer, Inkjet Printer	7
7	Computer Maintenance kit	All
8	Logic probe, logic pulser, current tracer	11
9	Digital voltmeter	9
10	Operating systems	5,6,7,8,,11,12
11	Power Supply	All
12	Diagnostics Software	12
13	Vacuum Cleaner/Blower	13

Note: There are no specifications fixed for the above listed equipments, devices and instruments. Depending on the availability in the institute they can be utilized for the purpose.

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I **Features of** **Computer** **Hardware**	1a. Explain characteristics of the given type of computer systems. 1b. Describe features of the given desktop systems. 1c. Describe features of the given Tablet systems. 1d. Describe features of the given server systems.	1.1 Computers: Desktop Computers, Tablet, Laptop, Mainframe, Supercomputer. 1.2 Features description: Hardware components of Desktop Systems, Laptops, and Tablets. 1.3 Types of Servers, Server Feature descriptions and its applications.
Unit– II **Motherboa** **rd**	2a. Identify the given component of motherboard. 2b. Describe features of the given motherboard. 2c. Differentiate hardware based and software based problems of motherboard. 2d. Describe the procedure to identify the given type of motherboard problems.	2.1 Motherboard : Components, Layout, Connections 2.2 Motherboards : Types and Features 2.3 Enhancing features of motherboard: Adding and or replacing components. 2.4 Troubleshooting problems of a motherboard.
Unit– III **Processor** **and BIOS**	3a. Describe architecture of given type of Multi-core processors. 3b. Explain the purpose of the given type of co-processors. 3c. Explain the level and purpose of cache memory. 3d. Write the procedure to configure the given BIOS setting.	3.1 Processor : Common Features, Types of Processors, Basic Structure of CPU, Different levels of cache, system bus, clock speed, packaging 3.2 Multiple Core Processors: Description, Two core processor architecture and multi-core processor architecture 3.3 Co-processors: Graphics, Math. 3.4 BIOS: Basic Input Output System Services, Bios Interaction, date and time, Boot device priority, boot setting configuration, password security.
Unit– IV **Hard Disk**	4a. Describe features of the given type of hard disk interface. 4b. Describe features of the given type of disk structure. 4c. Explain characteristics of the given disk performance parameter. 4d. Write the procedure to partition the given HDD. 4e. Describe the given type of file system.	4.1 Hard Disk Drive 4.2 Hard Disk Interfaces: EIDE, Serial ATA, SCSI, USB and IEEE 1394 (Firewire), RAID, Solid State Drive (laptop) 4.3 Disk structure : Heads, Tracks, Sectors, Cylinders, Cluster, Landing zone, MBR, Zone bit recording 4.4 Disk performance parameters Characteristics: Seeks and Latency, Data Transfer Rate 4.5 File system: FAT16, FAT32, NTFS, Unix file system, EXT2/EXT3, RAID

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– V I/O and Modem	5a. Describe features of the given I/O device. 5b. Write steps to troubleshoot the given peripheral device 5c. Explain use of the given I/O cable. 5d. Explain features of given type of Interface. 5e. Describe the procedure to troubleshoot the given network problem.	5.1 Troubleshoot I/O devices: Keyboard, Switches, Mouse, Scanners, Webcam, Monitors, Printers, Speaker and Mike, LCD Projector 5.2 I/O Cables: Specification of I/O Cables, Types of I/O cables, Types of I/O Ports, Internal and External modem, Block diagram and specifications. 5.3 Network Interface: Definition of network interface, Types of network interface, troubleshooting of network connectivity, Antivirus
Unit–VI Power Supply	6a. Describe features and working of the given SMPS 6b. Describe features and working of the given UPS. 6c. Differentiate the salient features of the specified type of UPS. 6d. Describe the steps to troubleshoot the given tpe of SMPS.	6.1 Purpose and Features of SMPS, Working of SMPS 6.2 Fault finding in power supply 6.3 Uninterrupted Power Supply: Characteristics of UPS, Types of UPS, online and offline 6.4 Preventive Maintenance of Power Supply

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN
-Not Applicable --
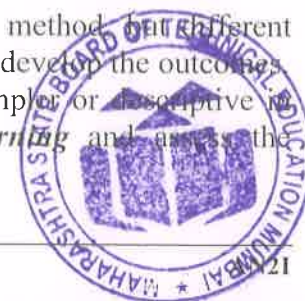
10. SUGGESTED STUDENT ACTIVITIES
Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:
  a. Prepare specification chart of different types/family of processors (Ex. Intel/AMD)
  b. Prepare journal of practical.
  c. Prepare a presentation to display Layout of different motherboards and different System components and present it in groups.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)
These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:
  a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
  b. *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
  c. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the

development of the COs through classroom presentations (see implementation guideline for details).

d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.

e. Guide student(s) in undertaking micro-projects.

f. Demonstrate students thoroughly before they start doing the practice

g. Show video/animation films to explain handling/functioning of different instruments.

h. Continuously observe and monitor the performance of students in Lab/Workshop

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours during the course.*

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

a. **SMPS**: List down the components available in SMPS. Measure different output voltages from SMPS.

b. **Computer motherboard:** Prepare brief report by identifying different electronics components in a given motherboard. Classify them in passive and active components.

c. **Microprocessor:** Prepare a small report of different microprocessors being used in industry (Any four) by doing market survey.

d. **Computer Specifications:** Prepare a small report on major specification of different types of computer systems available in your lab.

e. **Peripheral Specifications:** Prepare a small report based on technological differences and installation procedure of printers and scanners.

f. **Network Layout:** Prepare a small report by doing survey of computer labs. List various networking devices/components with its application.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	The computer hardware installation, interfacing, troubleshooting and maintenance	James, K.L.	PHI Learning, New Delhi, 2014 ISBN: 978-81-203-4798-4
2.	Comdex: Hardware and Networking Course Kit	Gupta, Vikas	Dreamtech Press, New Delhi ISBN: 978-93-5119-265-7
3.	The Complete PC Upgrade And maintenance Guide	Minasi, Mark	BPB Publication, New Delhi ISBN:978-81-265-0627-9
4.	Computer Architecture and Maintenance Vol.1	Kadam, Sachin	Shroff Publication, Mumbai ISBN:978-93-50230244

14.   SOFTWARE/LEARNING WEBSITES
   a.   http://www.howstuffworks.com/
   b.   http://www.gcflearnfree.org/computerbasics/keeping-your-computer-clean/1/
   c.   https://www.youtube.com/watch?v=4iaxOUYalJU
   d.   http://www.instructables.com/id/Computer-Assembly/