ಕರ್ನಾಟಕ ಸರ್ಕಾರ

GOVERNMENT OF KARNATAKA

ಕಾಲೇಜು ಮತ್ತು ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ಇಲಾಖೆ

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

C-20
2020-21

Diploma in Electronics & Communications Engineering

With Effect from 2020-21

C-20

Curriculum Development Cell

Department of Collegiate & Technical Education

Vision

[(To be drafted individually at institution level)]

Create an Environment to acquire skills through learning and practicing in the relevant domain to become effective and successful technician to augment the societal needs, upholding ethics and environmental concern.

Mission

(To be drafted individually at institution level)

- **M1:** Identification of relevant courses and their content necessary for the skill Development in Electronics and Communication Engineering.
- **M2:** Providing adequate emphasis for practical learning augmented by the relevant theoretical concepts.
- **M3:** Facilitating continuous evaluation and outcome assessment.
- **M4:** Opportunity to develop applications.
- **M5:** Facilitating an environment for interactive and interdisciplinary learning.
- **M6:** Exposure to industries, professional bodies and social activities.

Programme Educational Objectives (PEOs)

(To be drafted individually at institution level)

(After 2/3 years of graduation, the students will have the ability to)

PEO1	Demonstrate, Update and adapt domain knowledge in the area of electronics and communication engineering and the allied fields to propose solutions for the core industry in the ever changing global enterprise with ethical practices.
PEO2	Assume leadership roles and succeed in their chosen career path, in industry or public service through engineering ability, life skills and multidisciplinary skill set acquired.
PEO3	Pursue higher education institutes of national level.

PROGRAM OUTCOMES (POs)

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis: I**dentify and analyze well-defined engineering problems using codified standard methods.
3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyze individual needs and engage in updating in the context of technological changes.

CONSISTENCY MATRIX OF PEO'S WITH MISSION

	PEO statements	Adapt to Industry	Higher Learning	Team Spirit	Self-Learning	Leadership Qualities	Societal Needs	Environmental Concern
1	Demonstrate, Update and adapt domain knowledge in the area of electronics and communication engineering and the allied fields to propose solutions for the core industry in the ever changing global enterprise with ethical practices.	*	*			*	*	*
2	Assume leadership roles and succeed in their chosen career path, in industry or public service through engineering ability, life skills and multidisciplinary skill set acquired.	*		*	*	*	*	*
3	Pursue higher education institutes of national level.		*		*			

PROGRAM SPECIFIC OUTCOMES (PSOs)

Program shall specify 2-4 Program Specific Outcomes
(To be drafted individually at institution level)

PSO1	Design and simulate basic electronic circuits and make use of the measuring instruments in the design of analog and digital circuits
PSO2	Apply principles of mathematics, signals and communication theory to analyze different types of signals and operations on signals.

1.0 GENERAL PROGRAMME STRUCTURE AND CREDIT DISTRIBUTION

1. **Definition of Credit:**Credit is a kind of weightage given to the contact hours to teach the prescribedsyllabus, which is in a modular form. For courses, one credit is allocated to one contact hour for theory / tutorial per week and one credit is allocated to 02 contact hours for practical.
2. **Choice-Based Credit System (CBCS):** CBCS is a flexible system of learning that permits students to learn at their own pace, choose electives from a wide range of elective courses

andadopt an inter-disciplinary approach in learning and make best use of the expertise of available faculty.

3. **Range of Credits**

1 Hr. Lecture (L) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
1 Hr. Tutorial (T) per week	1 credit
4 Hrs. Theory (T) per week	4 credit
3 Hrs. Practical (P) per week [1 Hr. Tutorial +2 Hrs. Practical]	2 credit

4. **Programme**: Programme means Diploma Programme that is Diploma in Electronics &Communications Engineering, which is of three years duration.

2.0 PROGRAMME STRUCTURE

1. **Course:** A Course is a component (a paper) of a Programme. All the courses need not carrysame weightage. The course should define Course objectives. A course may be designed to involve lectures / tutorials / laboratory work / seminar / project work/ Internships / seminar or a combination of these, to meet effectively the teaching and learning needs and the credits may be assigned suitably.

2. **Course Code:** Each course shall have an alphanumeric code, which includes last two digits of year of introduction such as 20 subject code EC (EC for Electronics & Communication engineering, CH for Chemical Engineering etc.), then first two digits for example 12 (where 1 represents first semester and 2 represents the course number in incremental order) and the last alphabet represent Theory (T), Practical/Internship/Project (P), Drawing (D), Programme / Open Electives (A, B, C, E, F, G …).

3. **Programme Courses:** Each Programme will consist of Communication skills and Social Sciences (HS), Engineering Mathematics, Statistics and Analytics (BS), Engineering Sciences (ES), Professional Core (PC), Professional Electives (PE), Open Electives (OE), Employability Enhancement Courses (EEC) and Internships.

    1. **Communication Skills and Social Sciences:** Communication Skills and Social Science courses are incorporated in the curriculum to meet the desired needs of communication and life skills amongst students.
    2. **Engineering Mathematics, Statistics and Analytics:** Common to all Engineering Programme to develop reasoning and analytical skills amongst students.
    3. **Engineering Sciences:** Engineering Science shall create awareness on different specializations of engineering studies. The goal of these courses are to create engineers of tomorrow, who possess the knowledge of all disciplines and can apply their interdisciplinary

knowledge in every aspect. It could be any branch of engineering - Civil, Computer Science and Engineering, Electrical, Mechanical, etc.

4. **Professional Core:** Core Courses designed in the programme which are major courses of the discipline, required to attain desired outcomes and to ignite critical thinking skills amongst students.
5. **Professional Elective:** Generally a course can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline or nurtures the candidate's proficiency/skill is called Professional Elective Course.
6. **Open Electives:** An elective course chosen generally from other discipline/ subject, with an intention to seek interdisciplinary exposure is called an open elective. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents of which are similar to that of their departmental core/elective courses.
7. **Audit / Non-Core Courses:** An audit / Non-core course is one in which the student attends classes, does the necessary assignments, and takes exams. The Institute encourages students towards extra learning by auditing for additional number of courses. The results of audit courses shall not be considered for prescribed “carry over courses” limit, however students need to pass audit courses for awarding the diploma.
8. **Employability Enhancement Courses**: It contains the following courses:
    a. **Mini Project**: Mini Project is a laboratory oriented course which will provide a platform to students to enhance their practical knowledge and skills by development of small systems/application.
    b. **Seminar:** Seminar should be based on thrust areas in state of art technologies. Students should identify the topic of seminar and finalize in consultation with Guide. Students should understand the topic and compile the report in standard format and present in front of Panel of Examiners respective Programme.
    c. **Major Project:** Every student must do one major project in the Final year of their program. The minimum duration of project is 6 months. Students can do their major project in Industry or R&D Lab or in house or combination of any two.

3.0 COURSE CODE AND DEFINITION:

Course code	Definitions	Teaching Dept. Code	Name of the Teaching Department	Teaching Dept. Code	Name of the Teaching Department
L	Lecture	SC	Science	MI	Mechanical Engineering [Instruments]
T	Tutorial	CP	Commercial Practice / English	CR	Ceramic Engineering
P	Practical	ME	Mechanical Engineering	EN	Civil Environmental Engg.
HS	Humanities & Social Sciences Courses	EE	Electrical & Electronics Engg.	AN	Aeronautical Engg.
BS	Basic Science Courses	CE	Civil Engineering	MN	Mining & Mine Surveying
ES	Engineering Science Courses	EC	Electronics &Commn. Engg.	MM	Modern Office Management
PC	Program Core Courses	CS	Comp Science &Engg.	LI	Library and Information Science
PE	Program Elective Courses	IS	Info Science &Engg.	FT	Apparel Design and Fabrication Technology
OE	Open Elective Courses	AT	Automobile Engg.	CH	Chemical Engineering
AU	Audit Courses	MC	Mechatronics	PO	Polymer Technology
SI	Summer Internship	MT	Metallurgical Engg.	PT	Printing Technology
PR	Project	HP	Mechanical Engineering [HPT]	TX	Textile Technology
SE	Seminar	WS	Mechanical Engineering[Welding & Sheet Metal]	EI	Electronic Instrumentation & Control Engg.
CIE	Continuous Internal Evaluation	CN	Cinematography	LT	Leather & Fashion Technology
SEE	Semester End Examination	SR	Sound Recording &Engg.	WH	Water Technology & Health Science
		PH	Civil (Public Health & Environment) Engg.	MY	Mechanical Engineering [Machine Tools]
		TD	Tool & Die Making	AR	Architecture
		ID	Interior Decoration	EG	English

4.0 INDUCTION PROGRAMME

The Essence and Details of Induction program can also be understood from the "Detailed Guide on Student Induction program', as available on AICTE Portal, although that is for Diploma students of Engineering & Technology. Suggestive schedule for induction program is given below

(Link:https://www.aicteindia.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf)

Induction Program Schedule (Suggestive only)

(Induction program for students to be offered right at the start of the first year)

SL NO	DAY	TIME	ACTIVITY	VENUE
1	1	09.30-12.30	Registration, Formation of Mentor-mentee groups – Introduction of mentors with-in group.	Class rooms of respective programs
		01.30-04.30	Screening of Institute video clips of various functions held and Photos of various events, Institution Excursion	Seminar hall
2	2	09.30-12.30	Prayer- Physical activities such as yoga; Presentation cum Interactive Session with: Important Institution Functionaries like Principal, HoDs etc.	Play ground and seminar hall
		01.30-04.30	Visit to Central facilities such as Reading room,library,Sport centre, computer centre, hostel, NSS/NCC cell, community development cell functioning in polytechnic	Tour
		01.30-04.30	Lecturer sessions about importance of NSS/NCC/Youth red cross activities and their contribution towards national building and personality and character development	Seminar hall
4	4	09.30-12.30	Personality development talk on Human values	Seminar hall
		01.30-04.30	Interaction with Alumni students of polytechnic of different programs and interaction with few alumina and sharing their experiences	Seminar hall
5	5	09.30-12.30	Introduction to Swatch bharathabhiyan-Importance of abhiyan-Clean drive in around college	Campus
		01.30-04.30	Talent hunt-Music/Antakshri/Instrument play/ Dance/Team Activity	College Auditorium
6	6	09.30-12.30	Talent hunt Activity: Essay/Debate/Best out of Waste/Pick and speak ,other	Seminar hall
		01.30-04.30	Screening of Movie related: personality development, character building, motivational ,Environmental concern, Public health, rural sanitation	College Auditorium
7	7	09.30-12.30	Exchange of views between students and faculty about their Institute/program/carrier opportunities	Seminar hall
		01.30-04.30	Games/Sports Activity	Sports ground

8	**8**	09.30-12.30	Talk by training and placement cell: Carrier opportunities for diploma students, placement activities in college; placement process	Training and placement cell
		01.30-04.30	Talents hunt Activity: (Street Play/Mime/Acting/Stand Up Comedy /Dance etc.)	Seminar hall
9	**9**	09.30-12.30	Personality development talks by eminent speakers on - Leadership styles/How to handle failures/stress management	Seminar hall
		01.30-04.30	Importance of student union, student union activities, Student insurance, How to make student insurance by Student welfare officer of college	Seminar hall
10	**10**	09.30-12.30	Awareness on**:** Student scholarship- introduction to SSP portal – e-pass portal-Authenticated documents, how to apply in portal: Talk by Taluk/District social welfare officer	Seminar hall
		01.30-04.30	Local visits to surrounding places/Industry	Tour
11	**11**	09.30-12.30	**Talk on** Respective Program scheme of studies and detail of courses, Diploma examination pattern, Passing and eligibility criteria, attendance requirements by respective program coordinator	Department Class rooms
		01.30-04.30	Visit to respective programs lab/work shops of institution	Tour
12	**12**	09.30-12.30	Awareness camp on human health ,Community health, Personal hygiene-By Local Taluk medical officer/Community medical officer	Seminar hall
		01.30-04.30	Collection of student feedback on induction program- Make a report Valedictory of two weeks Induction program by collecting student feed back	Seminar hall

Induction Program (mandatory)	**Two- week Duration**
Induction program for students to be offered right at the start of the first year.	• Physical activity • Creative arts • Universal human values • Literacy • Proficiency modules • Lectures by Eminent People • Visits to Local Areas • Familiarization to Dept./Branch & Innovations

5.0 MANDATORY VISITS/WORKSHOP/EXPERT LECTURES:

1. It is mandatory to arrange one industrial visit every semester for the students of each branch.
2. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/ industry/ entrepreneurial orientation.
3. It is mandatory to organize at least one expert lecture per semester for each branch by inviting resource persons from domain specific industry.

6.0 EVALUATION SCHEME:

A. For Theory Courses:

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded

B. For Practical Courses:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for Semester End Exam (SEE) is 40%. The student has to obtain minimum of 40% marks individually both CIE and SEE to pass. The practical Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration exams). Based on this grading will be awarded.

C. For Summer Internship / Projects / Seminar etc.

1. Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

Note:

A. The Continuous Internal Evaluation (CIE) is based on the student's performance in Internal Assessment tests, student activity, mini project, quizzes, assignments, seminars, viva-voce in practical, lab record etc as specified in respective course curriculum.

B. **Major Project/Mini Project:** Students can do their major project in Industry or R&D Labor in house. Mini Project is a laboratory oriented course which will provide a platform to students to enhance their practical knowledge and skills by development of small systems/application.

C. **Personality and character development:** It is mandatory for the students from 1st semester to enroll in any one of the personality and character development programmes (NCC/NSS/YRC/Yoga/Technical Club) and undergo training for their Personality and character development.

- National Cadet Corps (NCC).
- National Service Scheme (NSS) will have social service activities in and around the Institution.
- Youth Red Cross (YRC) will have activities in and around the institution.
- Yoga
- Technical Clubs.

D. **Internship:** A minimum of 10 credits (400 Hrs) of Internship/ Entrepreneurial activities / Project work/ Seminar and Inter/ Intra Institutional Training may be counted toward three-year diploma programme.

E. **Mapping of Marks to Grades:** Each course (Theory/Practical) is to be assigned 100 marks, irrespective of the number of credits, and the mapping of marks to grades may be done as per the following table:

Range of Marks	Level	Assigned Grade	Grade Point
91-100	Outstanding	A+	10
81-90	Excellent	A	09
71-80	Very Good	B+	08
61-70	Good	B	07
51-60	Above Average	C+	06
45-50	Average	C	05
40-44	Satisfactory	D	04
<40	Fail	F	00
Fail due to shortage of attendance and therefore, to repeat the course/semester.		F*	00
Fail in Continuous internal Evaluation (CIE).		F**	00

Note: Those Candidates who have not obtained requisite minimum pass marks in CIE are not eligible to take up SEE in that course until they get requisite minimum pass marks in the CIE. They may re- register for the CIE in the subsequent regular semesters by paying prescribed examination fee.

SGPA and CGPA Calculations

Semester Grade Point Average (SGPA)=	∑[(Course Credits earned)X(Grade Points)] for all the courses in that semester
	∑[Total Course credits applied] for all the courses in that semester
Cumulative Grade Point Average (CGPA)=	∑[(Course Credits earned)X(Grade Points) for all courses, excluding those with F*/F** grades until that semester
	∑[Total Course Credits earned] for all Courses excluding those with F*/F** grades until that semester

Note: The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the semester Diploma marks /grade card.

A. SGPA and CGPA Calculations: An illustrative example for one academic year

Semester	Course Code	Credits Applied (CA)	Result Grade	Grade Points (GP)	Credits Earned (CE)	Credit points (CP=CE x GP)	SGPA, CGPA
I	Course 1	4	B	7	4	4x7=28	SGPA=CP/CA =110/22 = 5.00
I	Course 2	4	F	0	0	0x0=00	
I	Course 3	4	Absent (F)	0	0	0x0=00	
I	Course 4	4	A	9	4	4x9=36	
I	Course 5	2	A+	10	2	2x10=20	
I	Course 6	2	D	4	2	2x4=08	
I	Course 7	2	A	9	2	2x9=18	
	Total	22			14	110	***SGPA = 5.00***

Note: In 1st semester grade/marks card only SGPA is reported. From 2nd semester onwards both SGPA & CGPA will be reported in the grade/marks card.

Semester	Course Code	Credits Applied (CA)	Result Grade	Grade Points (GP)	Credits Earned (CE)	Credit points(CP=CE x GP)	SGPA, CGPA
II	Course 1	4	B	7	4	4x7=28	SGPA=CP/CA
II	Course 2	4	A	9	4	4x9=36	=100/19
II	Course 3	3	D	4	3	3x4=12	
II	Course 4	3	Absent (F)	0	0	0x0=00	= 5.26
II	Course 5	2	A+	10	2	2x10=20	CGPA = CP/CE =(110+136)/(14+22) = 246/36 =6.83
II	Course 6	1	D	4	1	1x4=04	
II	Course 7	2	F	0	0	0x0=00	
		19			14	100	
I Semester Back log courses							
I	Course 2	4	C	5	4	4x5=20	
I	Course 3	4	D	4	4	4x4=16	
	Total	27			22	136	

- Total credits of the semester excluding the credits of the courses under F/F*/F** grade are considered for the calculation of CGPA of the two consecutive semesters under consideration.

B. CGPA Calculation of the entire programme: An Illustrative Example.

Semester	I	II	III	IV	V	VI	Total
Credits of the Semester	22	19	24	24	24	24	137
∑CP	110	136	184	155	191	188	964

$$CGPA = \frac{[110+136+184+155+191+18]}{22+19+22+24+24+24} = \frac{964}{137} = 7.04$$

P=Percentage Conversion= (CGPA-0.75) X 10

Class Declaration:

After the conversion of final CGPA into percentage of marks (P), a graduating student is declared to have passed in:

(i) First Class with Distinction (FCD) if P ≥ 70%

(ii) First Class (FC) if P ≥ 60% but <70% and

(iii) Second Class (SC) if P < 60%.

SCHEME OF STUDIES
DIPLOMA IN ELECTRONICS & COMMUNICATIONS ENGINEERING
(C-20)

I Semester Scheme of Studies - Diploma in Electronics & CommunicationsEngineering [C-20]

S. N	Course Category / Teaching Department	Course Code	Course Title	Hours per week			Total contact hrs /week	Credits	CIE Marks		SEE Marks		Total Marks	Min Marks for Passing (including CIE	Assigned Grade	Grade Point	SGPA and CGPA
				L	T	P			Max	Min	Max	Min					
THEORY COURSES																	Only SGPA for 1st Semester
1	ES/EC	20EC11T	Digital Electronics	4	0	0	4	4	50	20	50	20	100	40			
PRACTICAL COURSES																	
2	BS/SC	20SC02P	Statistics and Analytics	2	0	4	6	4	60	24	40	16	100	40			
3	ES/ME	20ME02P	Computer Aided Engineering Graphics	2	0	4	6	4	60	24	40	16	100	40			
4	ES/EE/EC	20EC01P	Fundamentals of Electrical & Electronics Engineering.	2	0	4	6	4	60	24	40	16	100	40			
AUDIT COURSES																	
5	AU/SC	20AU01T	Environmental Sustainability	2	0	0	2	2	50	20	-	-	50	20			
6	AU Physical Activity		Sports/NCC/NSS/Youth Red Cross/Yoga/ Technical club.	Student shall enrol in any one of these activities in 1st semester and shall participate actively. The student shall obtain 'Participation Certificate' in the activity to get eligible for the award of Diploma.													
Total				**14**	**0**	**12**	**24**	**18**	**270**	**108**	**180**	**72**	**450**	**180**			

T:- Theory P:- Practical D:- Drawing E:- ElectiveBS- Basic Science:: ES-Engineering Science:: HS-Humanities & Social Science:: AU-Audit Course:: EG: English ::SC: Science

Note:

1. Assigned Grade, Grade Point, SGPA and CGPA to be recorded in the Grade/Marks card.
2. AU- Physical Activity- Student participation in the selected physical activity shall be monitored and the participation record shall be maintained by the respective Programme Coordinator (Head of Section).
3. Theory course Semester End Examination (SEE) is conducted for 100 marks (3 Hours duration)
4. Practical course CIE and SEE is conducted for 100 marks (3 Hours duration)

Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20EC11T	**Semester**	I
Course Title	**DIGITAL ELECTRONICS**	**Course Group**	Core
No. of Credits	4	**Type of Course**	**Lecture** (Theory and Demonstration /practice)
Course Category	EC	**Total Contact Hours**	4Hrs Per Week 52Hrs Per Semester
Prerequisites	Arithmetic, basic of electronics	**Teaching Scheme**	(L:T:P)= 4:0:0
CIE Marks	50	**SEE Marks**	50

i) RATIONALE

Innumerable logical and complex problems prevail in the real world which need quick and accurate solutions at low cost. The examples include: Counting number of people entering cinema hall; digital clock; playing video; phone call; transmission of document from one place to other; searching your unique ID in Aadhaar database; withdrawing money from ATM; booking railway ticket; and to check if a 25-digit number is a prime-number or not.

Inherent mapping of real-world problems to digital domain, ability of electronic circuits to process digital signals/binary signals and the support of Boolean algebra/relevant mathematical theories for simplification of circuits and reduction of time-complexity have made digital electronics the most suitable option for solving real-world problems. In fact, digital electronics can provide solutions at electronic-speed and low-cost owing to the enhancements in circuit design, fabrication technology and mass production. And the fact that the hardware of computer is digital electronic circuits elucidates the relevance of digital electronics and it learning. In this context, it is very essential to learn the basics of digital electronics to be a competent electronics professional.

ii) COURSE SKILL SET

The goal of the course is to help the student to attain the following industry-need competencies through various teaching-learning processes.

i) To understand the simple real-world logical problems and Learning to solve them through established methods.

ii) Perform analysis, design and troubleshoot well-known simple digital circuits in practical environment.
iii) To acquire the basic knowledge digital electronic integrated circuits and specifications.

iii) INSTRUCTIONAL STRATEGY

1. Teachers are suggested to take measures to create interest and enhance learning confidence in students.
2. Teachers should give examples from daily routine/realistic/real-world as well as relate to engineering/technology applications on various concepts and principles in each topic so that students are made to understand and grasp the concepts and principles. Wherever applicable SI units are followed.
3. Demonstration can make the subject interesting and develop scientific temper in the students. Student activities should be planned on all the topics.
4. Theory - Demonstrate/practice-Activity approach may be followed throughout the course so that learning may be outcome and employability based.
5. All demonstrations/Hand-on practices are under simulated environment (may be followed by real environment as far as possible).

iv) COURSE OUTCOMES (COs)

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

CO1	Identify and apply arithmetic and conversion operations on different number systems
CO2	Formulate, simplify and implement simple logic functions
CO3	Build/design and analyze various combinational circuits
CO4	Identify and select digital integrated circuits (ICs) for simple applications

v) COURSE TOPICS

Unit No	Unit Name	Hours
1	Number Systems and Codes	8
2	Basic Logic Circuits	14

3	Arithmetic Circuits	9
4	Multiplexers and Demultiplexer	8
5	Encoders and Decoders	7
6	Logic Families	6
	Total	**52 hrs**

vi) COURSE CONTENTS

The following topics/sub topics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

Course Content Delivery	Learning Method	Duration L:P (Hr)
UNIT –I: NUMBER SYSTEMS AND CODES (8Hr)		
1.1Comparison between analog and digital signals with real-world examples. Number systems: Binary, Octal, Decimal and Hexadecimal. Relevance and examples.	Teaching, examples and exercises	1:0
1.2 Conversion between number systems with examples	Teaching, examples and exercises	2:0
1.3 Arithmetic operations-Addition, Subtraction, Multiplication and Division on binary numbers with examples.	Teaching, examples and exercises	1:0
1.4 Addition and subtraction of Hexadecimal numbers. 1's & 2's complement of binary numbers with examples.	Teaching, examples and exercises	1:0
1.5 Application of Complement numbers: Representation of signed binary numbers and Example for realizing subtraction using addition.	Teaching, examples and exercises	1:0
1.6 Codes: Relevance, types (BCD, Gray, Excess-3, ASCII and EBCDIC) with examples and applications.	Teaching, examples and exercises	1:0

1.7 BCD Addition, Conversion between BCD and Decimal, Binary and Gray Numbers, Decimal and Excess-3 with examples.	Teaching, examples and exercises	1:0
UNIT –2: BASIC LOGIC CIRCUITS (14Hr)		
2.1 Boolean algebra: Constants, variables, functions, Logic-gates (NOT, OR, AND, NOR, NAND, EX-OR and EX-NOR): Symbol, function,expression and truth-table.	Teaching, examples and exercises. Hands-on demonstration/practice for all logic gates	1:1
2.2. Boolean identities and laws with proof and examples.	Teaching, examples and exercises	1:0
2.3 De Morgan's and Duality Theorem with proof and examples.	Teaching, examples and exercises Hands-on demonstration/practice for De Morgan's theorem	1:1
2.4 Universal gates: Concept, examples, relevance and realization of all logic gates using NAND gate.	Teaching, examples and exercises	1:0
2.5 Realization of all logic gates using NOR gate.	Teaching, examples and exercises	1:0
2.6 Simplification of Boolean expressions using Boolean algebra and build the logic circuit.	Teaching, examples and exercises	1:0
2.7 SOP and POS forms, Conversion into standard SOP and POS forms.	Teaching, examples and exercises	1:0
2.8 Translate SOP and POS expressions into truth-table, Convert truth-table to SOP and POS expressions (maximum 4 variables).	Teaching, examples and exercises	1:0
2.9 SOP to POS & POS to SOP conversion	Teaching, examples and exercises	1:0

2.10 Karnaugh Map: Need, K-map for 2 variable, 3 variable and 4 variable Boolean expression.	Teaching, examples and exercises	1:0
2.11 Simplification of Boolean expression using K- map and realization of logic circuit for 2 and 3 variable.	Teaching, examples and exercises	1:0
2.12 Simplification of Boolean expression using K- map and realization of logic circuit for 4 variable	Teaching, examples and exercises	1:0
UNIT –3: ARITHMETIC CIRCUITS (9Hr)		
3.1 Features of combinational circuits and examples. Half adder (HA): Concept, truth-table, logical expression, gate-level implementation and application.	Teaching, examples and exercises	1:0
3.2 Full adder (FA): Concept, truth-table, logical expression, gate-level implementation and application. List of FA ICs.	Teaching, examples and exercises. Hands-on demonstration/practice FA using gates	1:1
3.3 Half Subtractor (HS): Concept, truth-table, logical expression, gate-level implementation and application.	Teaching, examples and exercises	1:0
3.4 Full Subtractor (FS): Concept, truth-table, logical expression, gate-level implementation and application.	Teaching, examples and exercises	1:0
3.5 Serial & Parallel adders: Concept, comparison & applications.	Teaching, examples and exercises.	1:0
3.6 Three-bit parallel adder circuit: Given the circuit, analyze it's working.	Teaching, examples and exercises.	1:0
3.7 Two-bit magnitude comparator: Concept, truth-table, logical expression, gate-level implementation and application. Identify ICs	Teaching, examples and exercises. Hands-on demonstration/practice of 2-bit Magnitude Comparator using IC or gate-levelcircuit.	1:1

UNIT –4: MULTIPLEXERS AND DEMULTIPLXERS (8 Hr)		
4.1Multiplexers (Mux): Concept, relevance and applications, 2:1 Mux: Symbol, truth-table, logical expression, gate-level implementation and application. Identify ICs	Teaching, examples and exercises	1:0
4.2High-order Mux: Concept, examples (4:1, 8:1, and 16:1), Relation between number of inputs and control lines.	Teaching, examples and exercises. Hands-on demonstration/practice: 4:1 using 2:1 Mux or 8:1 using 4:1 Mux, using ICs.	1:1
4.3 Realization of high-order (4:1) Mux using low-order (2:1) Mux. List Mux ICs.	Teaching, examples and exercises	1:0
4.4Realization of logic gates and simple logic equations using multiplexers. (Max. 3variables)	Teaching, examples and exercises	1:0
4.5Demultiplexer (Demux): Concept, relevance and applications. 1:2 Demux: Symbol, truth-table, logical expression, gate-level implementation and application.	Teaching, examples and exercises	1:0
4.6High-order Demux: Concept and examples (1:4, 1:8, 1:16), relation between number of outputs and control lines. Analysis of Demux: Given 1:4 Demux, write logical expressions and truth table.	Teaching, examples and exercises Hands-on practice for 1:8 using 1:4 Demux, using ICs	1:1
UNIT –5: ENCODERS AND DECODERS (7 Hr)		
5.1 Encoders and Decoders: Relevance and applications.	Teaching, examples and exercises	1:0
5.2 Decimal-to-BCD encoder: Logic diagram, working, truth-table and applications. List ICs	Teaching, examples and exercises. Hands-on demonstration/practic e of an Decimal to BCD encoder	1:1

5.3 Priority Encoder: Relevance, Logic diagram, working and Truth Table. Identify IC	Teaching, examples and exercises	1:0
5.4 BCD-to-Decimal decoder: Logic diagram, working and truth-table	Teaching, examples and exercises	1:0
5.5 Seven-segment display: Principle and types. Identify ICs for 7-segment display and Decoder.	Teaching, examples and exercises.	1:0
5.6 BCD-to-seven segment decoder: Logic diagram, working and truth table	Teaching, examples and exercises. Hands-on demonstration/ practice on BCD to Seven Segment decoder	0:1
UNIT –6: LOGIC FAMILIES (6Hr)		
6.1 ICs: Concept, advantages and disadvantages. IC classification: Based on scale of integration. Concept, need and types of logic families	Teaching, examples and exercises	1:0
6.2 Logic family specifications: Propagation delay, fan-out, fan-in, power dissipation, noise margin, speed and speed-power product. 6.3 IC data sheet: Identify the specifications in typical standard TTL IC	Teaching, examples and exercises. Demonstration of IC datasheet interpretation	1:0 0:1
6.4 Features of Standard TTL, CMOS & ECL. Identify TTL/CMOS/ECL NAND gate ICs and compare their specifications.	Teaching, examples and exercises.	1:0
6.5 Interfacing between TTL and CMOS: Need, concept and precautions. Handling of ICs and ESD.	Teaching, examples and exercises. Demonstration of ICs' handling / placement /removal on IC base/ sockets with anti-ESD gloves	1:1

➢ SUGGESTED SPECIFICATION TABLE WITH CO'S, HOURS & MARKS.

Sl No.	COURSE OUTCOME	UNITS LINKED	TEACHING HOURS	DISTRIBUTION (THEORY MARKS)			
				R LEVEL	U LEVEL	A LEVEL	TOTAL
1	Identify and apply arithmetic and conversion operations on different number systems	1	08	5	10	15	**30**
2	Formulate, simplify and implement simple logic functions	2	14	15	20	15	**50**
3	Build/design and analyze various combinational circuits	3,4,5	24	25	35	40	**100**
4	Identify and select digital ICs for simple applications	6	06	10	5	5	**20**
Cognitive-level marks share (Total) →			**52**	**55**	**70**	**75**	**200**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy).

➢ MAPPING OF COS, POS, COGNITIVE LEVELS, LECTURES AND PRACTICES.

CO No.	Course Outcome	POs Mapped	Units Linked	Cognitive Level R/U/A	Lecture Sessions in Hrs	Demonstration/ Hands-on practice in Hrs	TOTAL
CO1	Identify and apply arithmetic and conversion operations on different number systems	1,2,5	1	R/U/A	08	0	08
CO2	Formulate, simplify and implement simple logic functions	1,2,3,4	2	R/U/A	12	2	14
CO3	Build/design and analyze various combinational circuits	1,2,3,4	3,4,5	R/U/A	18	6	24
CO4	Identify and select digital ICs for simple applications	1,5	6	R/U/A	04	2	06
				Total	42	10	**52**

vii) UNIT SKILL-SETS

Unit	Unit Name	Skill Set
1	Number Systems and codes	Comprehend the number systems, operate (conversion, addition and subtraction) on different number systems, identify and select the codes for different applications
2	Boolean Algebra	Translate the problem to truth-table, simplify thelogical expressions using Boolean identities/ laws/K-maps, and implement the logical functions.
3	Arithmetic Circuits	Given simple arithmetic problems, solve using digital circuits and vice-versa (analysis). Identify arithmetic circuits ICs for simple applications.
4	Multiplexers and Demultiplexer	Solve simple multiplexing and demultiplexing problems, vice-versa (analysis). Identify multiplexing ICs for simple multiplexing applications.
5	Encoders and Decoders.	Solve simple coding/decoding problems, and identify coding ICs for simple coding applications.
6	Logic Families	Identify and select the ICs from different IC families based-on application specifications.

viii) MAPPING BETWEEN COs AND POs

Course	COs	Programme Outcomes (POs)						
		1	2	3	4	5	6	7
Digital Electronics	CO1	3	2	0	0	1	0	0
	CO2	3	2	1	1	0	0	0
	CO3	3	2	1	2	0	0	0
	CO4	3	0	0	0	1	0	0

Legends:
Level 3- Highly Mapped**, 2-**Moderately Mapped**, 1-**Low Mapped**, 0-** Not Mapped

ix) SUGGESTED LEARNING RESOURCES:

Reference Books

i) Digital fundamentals Thomas L. Floyd, PEARSON EDUCATION publication, Eleventh edition Global Edition, ISBN 10: 1-292-07598-8, ISBN 13:978-1-292-07598-3.
ii) Digital Electronics principles and integrated circuits. Anil K. Maini. Wiley publications, first edition. ISBN:978-81-265-1466-3.
iii) Digital principles and applications. Donald P Leach, Albert Paul Malvino, GoutamSaha, McGraw Hill Publisher, 7th edition, ISBN:978-0-07-014170-4.
iv) Digital Systems-principles and applications. Ronald J. Tocci, Neal S.Widmer, Gregory L. Moss, Prentice Hall Publications, 8th edition, ISBN:0-13-085634-7.
v) Digital Computer Fundamentals,-Thomas C Bartee, McGraw-Hill Publisher,4th edition. ISBN 0-07-003892-9.

Web-based/onlineResources

1. https://www.electronics-tutorials.ws/
2. https://learn.sparkfun.com/
3. https://www.allaboutcircuits.com/textbook/digital/
4. http://electronicstheory.com/COURSES/ELECTRONICS/e101-1.htm
5. https://www.gadgetronicx.com/electronic-circuits-library/
6. https://www.electronics-lab.com/
7. https://learn.adafruit.com/
8. https://www.instructables.com/circuits/
9. https://www.digitalelectronicsdeeds.com/
10. https://www.electrical4u.com/digital-electronics/
11. https://www.tutorialspoint.com/digital_circuits/index.htm

x) Major Equipment/Instruments

1. Digital trainer kits.
2. Electronics simulation software's.
3. Computers.
4. IC tester, logic probes.

xi) SUGGESTED LIST OF STUDENTS ACTIVITYS for CIE

Note: The following activities or similar activities (as suggested by teacher/ identified by student in co-ordination with teacher) for assessing CIE (IA) for 20 marks (any one)

1. Simulate the working of a logic circuit using a suitable software tool.
2. Performing hands-on practice on design and simulation of digital circuits.
3. Motivate students to take case study on different ASICs (Application specific ICs) digital circuits to inculcate self and continuous learning.
4. Open end activities like
   Simulate a realistic digital circuit containing combination of logic gates.
   Collect the specification sheets of various logic ICs & prepare a Report.
   Record the best practices used in the disposal of E-waste and
   Precautions in the operation of digital systems.
5. Draw the pin diagram of IC's used for (a) Basic Gates (b) Combinational circuits.
6. Realize higher order Multiplexers/Demultiplexerusing lower order Multiplexers/Demultiplexer and experiment them under simulated environment.
7. Collect the real-world applications where combinational digital circuits are involved.

Execution Mode

- Maximum of 4 students in each batch.
- Write qualitative report not exceeding 8 pages; one report per batch.
- Each of the activity can be carried off class, and shall be presented to the teacher using suitable presentation mode
- Assessment shall be made based on quality of activity presentation/demonstration and report (Equal weightage for Information collection/Application, execution, report, and presentation and role in team) or the rubrics table may be followed for assessment purpose.

xii) COURSE ASSESSMENT AND EVALUATION CHART

Sl. No	Assessment	Mode	Schedule	Duration (Minutes)	Max. marks	Conversion of Max Marks
1.	CIE-IA1	Written-test	3 dWeek	80	30	**A**=(IA1+IA3+IA6)/3 Max. of A is 30 **B**=(IA2+IA4+IA5)/3 Max. of B is 20 A+B=50
2	CIE-IA2	MCQs/Quiz	5 Week	60	20	
3.	CIE-IA3	Written-test	7 Week	80	30	
4	CIE-IA4	Open-Book Written-	9 Week	60	20	

		test				
5	CIE-IA5	Activity/Assignment	11 Week	60	20	
6	CIE-IA6	Written-Test	13 Week	80	30	
				Total CIE	**50**	**50**
7.	**SEE**	Written	BTE Schedule	**3 hrs**	**100**	50
				Total(CIE+SEE)		100

Note:

i) Semester-end exam (SEE) is conducted for 100marks.
ii) Continuous internal evaluation (CIE) is for 50marks.
iii) IA1, IA3 and IA6 tests shall be conducted for 30 marks each; average of these IAs will b A.
iv) IA2 (Quiz/MCQs), IA4 (Open-book test) and IA5 (assignment/student activity) are conducted for 20 marks each; average of these IAs will be B. Appropriate rubrics may be used for evaluation. Open- book written test shall be to assess the analytical, reasoning, evaluation and creative skills/abilities of students.
v) Total CIE is average of A and B; any fraction shall be rounded-off to the next higher digit.
vi) Lecture: Practice sessions shall begin only after two weeks of Induction Program in First semester. The schedule of assessment week shall be counted only after 2 weeks of Induction Program.

RUBRICS FOR ACTIVITY

RUBRICS FOR ACTIVITY (10marks) (Example only) **Concerned faculty shall device appropriate rubrics as per the activity**						
Dimension	**Beginning**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	4	**8**	**12**	**16**	**20**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	8
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	6

Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	8
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	8
					Average / Total Marks: (8+6+8+8)/4	**7.5 = 8 marks**

xiii) Model Question Paper I A Test (CIE)

Programme:				**Semester: I**	
Course	**:**			**Max Marks :30**	
Course Code	**:**			**Duration : 1 Hr. 20minutes**	
Name of the course coordinator:				**Test :I/II/III**	
Note: Answer one full question from each section. One full question carries 10 marks.					
Qn. No	**Question**	**CL**	**CO**	**PO**	**Marks**
	Section -1				
1.a)					
b)					
c)					
2.a)					
b)					
c)					
	Section -2				
3.a)					
b)					
c)					
4.a)					
b)					
c)					

Section -3					
5.a)					
b)					
c)					
6.a)					
b)					
c)					

Model Question Paper

Model Question Paper
Semester End Examination

Programme:	**Semester: I**
Course :	**Max Marks: 100**
Course Code:	**Duration: 3 Hrs**

Instruction to the Candidate: Answer one full question from each section. One full question carries 20 marks.

Qn.No	Question	CL	CO	Marks
Section-1				
1.a)				
b)				
2.a)				
b)				
Section-2				
3.a)				
b)				
4.a)				
b)				
Section- 3				

5.a)				
b)				
6.a)				
b)				
Section-4				
7.a)				
b)				
8.a)				
b)				
Section-5				
9.a)				
b)				
10.a)				
b)				

Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20SC02P	**Semester**	I/II
Course Title	**STATISTICS AND ANALYTICS**	**Course Group**	Core
No. of Credits	4	**Type of Course**	Lecture and practice
Course Category	Practice	**Total Contact Hours**	6 Hrs. Per Week
			78 Hrs. Per Semester
Prerequisites	10TH LEVEL MATHEMATICS	**Teaching Scheme**	(L: T:P)-1:0:2
CIE Marks	60	**SEE Marks**	40

RATIONALE

Statistics and analytics help the learner to use the proper methods to collect the data, employ the correct analyses, effectively present the results and conduct research, to be able to read and evaluate journal articles, to further develop critical thinking and analytic skills, to act as an informed consumer and to know when you need to hire outside statistical help. The python language is one of the most accessible programming languages available because it has simplified syntax and not complicated, which gives more emphasis on natural language.

COURSE OUT COMES

At the end of the course, student will be able to

CO1	Understand the tools of data collection, classification and cleaning of data.
CO2	Able to summarize the given statistical data
CO3	Understand the measure of location and dispersion of data.
CO4	Learn the basics of Python programming.

DETAILS OF COURSE CONTENT

The following topics/subtopics is to be taught and assessed in order to develop Unit Skill Sets for achieving CO to attain identified skill sets.

UNIT NO	Unit skill set (In cognitive domain)	Topics/Subtopics	Hours L-T-P
UNIT-1 **STATISTICAL DATA COLLECTION AND TYPES**	1. Able to collect statistical data. 2. Able to distinguish the data types. 3. Understands the usage of data collection tools 4. Able to specify problem statement for data collection 5. Able to collect data pointing the root cause of the problem statement.	a Definition of data and classification (qualitative quantitative discrete and continuous data). b Data collection tools iv) Questionnaires. v) Survey. vi) Interviews. vii) Focus group discussion. 1.3 Data cleaning.	4-0-8
UNIT-2 **SUMMARIZATION OF DATA**	6. Sketches bar, pie and histograms on Microsoft Excel spread sheet. 7. Sketches frequency curve and frequency polygon for the data set on Microsoft Excel spread sheet. 8. Sketches bar, pie and histograms on Microsoft Excel spread	a Descriptive statistics viii) Datatabulation(frequency table ix) Relative frequency table. b Grouped data x) Bar graph xi) Pie chart xii) Line graph xiii) Frequency polygon xiv) Frequency curve xv) Relative frequency polygon xvi) Histograms xvii) Box plot xviii) Leaf-stem plot To be done in Microsoft excel.	8-0-16

	sheet. 9. Sketches frequency curve and frequency polygon for the data set on Microsoft Excel spread sheet.		
UNIT-3 **MEASURE OF LOCATION AND DISPERSION**	➢ Able to determine the descriptive statistical variables using Microsoft Excel. ➢ Able to determine the absolute measures of dispersion of the given data set. ➢ Explain the symmetry and asymmetry of the distributed data.	a Determination of central tendencies Range, Mean, Mode and Median for the data in Microsoft excel. b Determination of absolute measures of dispersion for data like range quartile deviation, mean deviation, standard deviation and variance in Microsoft Excel. c Skewness and kurtosis graphs in Microsoft excel and interpretations of results.	6-0-12
UNIT-4 **INTRODUCTION TO PYTHON PROGRAMMING**	➢ Able Install and run the Python interpreter. Create and execute Python programs. ➢ Understand the concepts of file I/O. ➢ Able to read data from a text file using Python. ➢ Learn variable declarations in Python. ➢ Learn control structures.	4.1 Introduction to PYTHON. 4.2 Syntax of PYTHON. 4.3 Comments of PYTHON. 4.4 Data types of PYTHON. 4.5 Variables of PYTHON. 4.6 If-else in PYTHON. 4.6 Loops in PYTHON. 4.7 Arrays and functions in PYTHON.	8-0-16

	➢ Learn loop constructs.		

SL NO	Practical outcomes/Practical exercises	Unit no	PO	CO	L:T:P
1	Prepare a questionnaire (closed end) containing 25 questions for a specified problem statement: for example experience of an individual in a restaurant.	1	1,2,4,5,7	1	0:0:2
2	Prepare a Google form for a specified problem statement to collect the dataset. (for example questionnaire to conduct online quiz)	1	1,2,4,5,7	1	0:0:2
3	Send out a survey on your problem statement to number of 50 (By Google forms) and collect the data.	1	1,2,4,5,7	1	0:0:2
4	Remove duplicate or irrelevant observations. Remove unwanted observations from the dataset provided, including duplicate observations or irrelevant observations.	1	1,2,4,5,7	1	0:0:2
5	In Microsoft Excel spread sheet draw the frequency distribution table for the given data (data set should contain minimum 50 data).	2	1,2,4,5,7	2	0:0:2
6	In Microsoft Excel spread sheet draw the relative frequency distribution table for the given data (data set should contain minimum 50 data).	2	1,2,4,5,7	2	0:0:2
7	Using Microsoft Excel spread sheet plot bar graph for the data collected from 100 people(for example, conduct a survey on the favorite fruit of a person in your locality(restricting to 5 to 6 fruits). Explain the bar graph with minimum 30 words.	2	1,2,4,5,7	2	0:0:2
8	Using Microsoft Excel spread sheet plot pie chart for the data collected from 50 people(for example, conduct a survey on the smokers with respect to their ages in your locality. Explain the pie chart with minimum 30 words.	2	1,2,4,5,7	2	0:0:2
9	Using Microsoft Excel spread sheet draw a line graph for the given dataset.	2	1,2,4,5,7	2	0:0:2
10	Using Microsoft Excel spread sheet draw frequency polygon and frequency curve for the data collected from 50 people. (For example, marks obtained by the students in your class in 5 subjects in previous examination). Explain your observations from the graph in minimum 30 words.	2	1,2,4,5,7	2	0:0:2
11	Using Microsoft Excel spread sheet construct a box plot for the given dataset. (For example dataset can be the number of passengers in a flat form at different time in a day).	2	1,2,4,5,7	2	0:0:2
12	Using Microsoft Excel spread sheet construct a leaf plot for the given dataset. Explain the graph with minimum 30 words.	2	1,2,4,5,7	2	0:0:2

13	Using Microsoft Excel spread sheet find the Mean, Mode and Median for the data (univariate data) given and also represent them in a Histogram.	3	1,2,4,5,7	2	0:0:2
14	Generate a 50 random data sample (even and odd number dataset) using Microsoft Excel spread sheet and determine the range and Quartiles.	3	1,2,4,5,7	2	0:0:2
15	Collect the current yield of a crop from 50 different persons (problem statement can be changed according to priorities of the tutor) in your locality and determine mean deviation and Quartile deviation in Microsoft excel spread sheet and brief your inference with less than 30 words.	3	1,2,4,5,7	3	0:0:2
16	Collect the data of any 2 livestock population from 50 different houses in your locality (problem statement can be changed according to priorities of the tutor) and determine standard deviation for both the two separately in Microsoft excel spread sheet and brief your inference with less than 30 words.	3	1,2,4,5,7	3	0:0:2
17	Collect the data of two wheeler (with a rider and a pillion) crossing a busy junction in your locality in the peak hours (problem statement can be changed according to priorities of the tutor) and determine the variance of the data in Microsoft excel spread sheet and brief your inference with less than 30 words.	3	1,2,4,5,7	3	0:0:2
18	Using Microsoft Excel spread sheet draw a Skewness graph and kurtosis graph for randomly generated dataset.	3	1,2,4,5,7	3	0:0:2
20	Write a python program to add 2 integers and 2 strings and print the result.	4	1,2,4,5,7	4	0:0:2
21	Write a python program to find the sum of first 10 natural numbers.	4	1,2,4,5,7	4	0:0:2
22	Write a python program to find whether the number is odd or even.	4	1,2,4,5,7	4	0:0:2
23	Write a python program to find the variance and standard deviation for the given data..	4	1,2,4,5,7	4	0:0:2
24	Write a python program to display student marks from the record.	4	1,2,4,5,7	4	0:0:2
25	Write a python program to create a labeled bar graph using matpoltlib. pyplot.	4	1,2,4,5,7	4	0:0:2
26	Write a python program to create a labeled pie chart using matpoltlib. pyplot.	4	1,2,4,5,7	4	0:0:2
Total Hours					**0:0:52=52**

MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	Experiment Linked	Cognitive Level **R/U/A**	Tutorial & Practical Sessions in Hrs.	**TOTAL**
CO1	Understand the tools of data collection, classification and cleaning of data.	1,2,4,5,7	1-4	A	12	12
CO2	Able to summarize the given statistical data	1,2,4,5,7	5-12	A	33	33
CO3	Understand the measure of location and dispersion of data.	1,2,4,5,7	13-18	A	12	12
CO4	Learn the basics of Python programming.	1,2,4,5,7	19-26	A	21	21
					78	**78**

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Statistics & Analytics	CO1	3	3	0	3	3	0	3
	CO2	3	3	0	3	3	0	3
	CO3	3	3	0	3	3	0	3
	CO4	3	3	0	3	3	0	3
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped								

SUGGESTED LEARNING RESOURCES:

1. Statistical Analysis with Excel For Dummies (For Dummies Series) Paperback Import, 9 April 2013 by Joseph Schmuller (Author)
2. https://www.brianheinold.net/python/A_Practical_Introduction_to_Python_ProgrammingHeinold.pdf
3. http://www.bikeprof.com/uploads/9/0/6/5/9065192/excel_stats_handout_npl.pdf
4. https://adminfinance.umw.edu/tess/files/2013/06/Excel-Manual1.pdf
5. https://www.brianheinold.net/python/A_Practical_Introduction_to_Python_ProgrammingHeinold.pdf
6. Introduction to Python programming for beginners by Vivian Baily Kindle edition.
7. PYTHON PROGRAMMING: Python programming: the ultimate guide from a beginner to expert by Clive Campbell.
8. Open source for python: https://hub.gke2.mybinder.org/user/jupyterlab-jupyterlab-demo-zfkdwy4y/lab

SUGGESTED LIST OF STUDENT ACTIVITY

Note: The following activities or similar activities for assessing CIE (IA) for 10 marks (Any one)

1	Describe the data collection activity itself (interviews, surveys, library research, etc.) AND why this specific form of data collection was chosen. Be sure to explain why you think this kind of data will help you in your design process. Also be sure to provide details about the activity: how many interviews, how long they took, where they took place, how many questions asked in a survey, how many respondents, etc. Present the results of your data collection. You do not have to have completely analyzed all your data, but do make sure you present the results of your research. If you did a survey, please attach a copy of the survey as an appendix; if you did interviews, please attach a copy of the interview questions. Discuss any preliminary analysis of your data. What have you learned thus far from the data should be discussed from an analytical perspective (rather than a data dump). For example, if you surveyed people about their use of the local bus system, and 90% of your respondents said they take the bus when it is raining, and 60% of your respondents said they usually wait more than 10 minutes for a bus, think about what this teaches you rather than just the information itself. In this instance, you can see that people are generally waiting for several minutes in the rain for a bus, so a covered bus stop might be a good idea. Keep in mind that your findings from data should lead directly to the conclusions you make about your design recommendations. This is the time to begin thinking very specifically about your research in those terms. This is also an opportunity to think about your definition of "better" and how it applies to your design goals and your choice of research activities (for example, if you are choosing to make something better by making it cheaper, maybe you are interviewing people to see how much loss of functionality or decrease in features for a technology they are willing to tolerate).
2	https://ils.unc.edu/courses/2013_spring/inls541_001/Assignments.html#Assignment_9

	DOWNLOAD a dataset from the above link and use data visualization tools to analyze it.
3	Acquire the dataset from https://www.kaggle.com/datasets (For example acquire the data of IPL ball by ball scores and find the standard deviation and variance of score of a batsmen)and clean the data for the root cause of the problem statement and summarize the date and explain the inference.

COURSE ASSESSMENT AND EVALUATION CHART

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	CIE (Continuous Internal Evaluation)	Models	Students	Two IA Tests (Written)	20	Blue Book	1,2,3.
				Three Skill tests	20	Model	1,2,3
				Student Activity	20	Model/Report	
				TOTAL	60		
	SEE (Semester End Examination)	End Exam		End of the course	100	Models	1,2,3
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3, Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3 Effectiveness of Demonstrations& Assessment Methods

Sl.No	Assessment	Duration	Max marks	Conversion
1	CIE Assessment 1 (Written Test -1-theory) - At the end of **3rd week**	60 minutes	20	Average of two written tests 20
2	CIE Assessment 2 (Written Test -2-theory) - At the end of **13th week**	60 minutes	20	
3	CIE Assessment 3 (Skill test) - At the end of **5th week**	3 Hrs	20	Average of three skill tests 20
4	CIE Assessment 4 (Skill test) - At the end of **7th week**	3 Hrs	20	
5	CIE Assessment 5 (Skill test) - At the end of **9th week**	3Hrs	20	
6	CIE Assessment 6 (Student activity) - At the end of **11th week**	-	20	20
7	Total Continuous Internal Evaluation (CIE) Assessment			60
8	Semester End Examination (SEE) Assessment (Practical Test)	3Hrs	100	40
		Total Marks		**100**

Note:

1. CIE written test is conducted for 20 marks (Two sections). Each section shall have two full questions of same CL, CO. Student shall answer one full question (10 marks) from each section.
2. CIE Skill test is conducted for 100 marks (3 Hours duration) as per scheme of evaluation and the obtained marks are scaled down to 20 marks.
3. SEE is conducted for 100 Marks (3 Hours duration) as per scheme of evaluation.

MODEL QUESTION PAPER

CIE, SKILL TEST AND SEMESTER END EXAMINATION

Course & Programme: Common to all Engineering Programmes.	**Semester:** II
Subject: Statistics and Analytics Practice	**Max Marks:** 100
Course Code : 20SC21P	**Duration :** 3Hrs

Instruction to the Candidate: Answer both questions

Qn.No	Question	CL	CO	PO	Marks
1	For the given ungrouped data set plot the bar graph by grouping the data in Microsoft excel spread sheet and interpret the obtained results. (Dataset. bar graphs and interpretation have to be entered in the answer script). OR Generate a random data set in Microsoft excel spread sheet containing 50 data and find the mean mode and median in Microsoft excel spread sheet and interpret the obtained results. (Dataset, bar graphs and interpretation have to be entered in the answer script).	A	2,3	1,2,4,5,7	50
2	Write the python program to enter two integers and two strings and to print the sum two integers and two strings.	A	4	1,2,4,5,7	50

Questions are not framed from Unit 1 in the final SEE. Short questions can only be asked from that unit.

SCHEME OF EVALUATION FOR BOTH CIE AND SEE

Sl. No	Particulars	Marks
1	Short questions from Unit 1	10
2	Observation	30

3	Conduction	20
4	Output and Interpretation of result	20
5	Viva-voce	20
Total		100

EQUIPMENT LIST

FOR STATISTICS AND DATA ANALYTICS LAB

2 laboratories. Each containing 30 computers (Desktop) with the following system requirements.

SYSTEM REQUIREMENTS			
SL NO	REQUIREMENTS	MINIMUM	RECOMMENDED
1	RAM	4GB FOR FREE RAM	8GB OF TOTAL SYSTEM RAM
2	DISK SPACE	2.5 GB AND 1 GB FOR CACHES	SSD DRIVE WITH AT LEAST 5 GB OF FREE SPACE
3	MONITOR RESOLUTION	1024x768	1920×1080
4	OS(OPERATING SYSTEM)	OFFICIALLY RELEASED 64-BIT VERSIONS OF THE FOLLOWING: MICROSOFT WINDOWS 8 OR LATER	LATEST 64-BIT VERSION OF WINDOWS

Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20ME02P	**Semester**	I/II
Course Title	**Computer Aided Engineering Graphics**	**Course Group**	CS,EC,EE & Other allied branches
No. of Credits	4	**Type of Course**	Lecture & Practice
Course Category	PC	**Total Contact Hours**	6Hrs Per Week
			78Hrs Per Semester
Prerequisites	Enthusiasm to learn the subject/Visualizing/Creativity	**Teaching Scheme**	(L: T:P) = 1:0:2
CIE Marks	60	**SEE Marks**	40

1. COURSE RATIONALE:

Engineering Drawing is an effective language of engineers. It is the foundation block which strengthens the engineering & technological structure. Moreover, it is the transmitting link between ideas and realization.

2. LIST OF COMPETENCIES:

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies:

1. Prepare engineering drawings both manually and using CAD with given geometrical dimensions using prevailing drawing standards and drafting instruments.
2. Visualize the shape of simple object from orthographic views and vice versa

3. COURSE OUT COMES:

CO1	Adopt the standards, dimensioning and construct appropriate drawing scales, in technical drawing development.
CO2	Visualize objects in all planes and learn displaying techniques for graphical communication in design process.
CO3	Sketch orthographic projections into isometric projections and vice versa.
CO4	Use computer software and Apply computer aided drafting tools to create 2D /3 D engineering drawings

4. INSTRUCTIONAL STRATEGY:

1. Teacher should show model of real of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet.
2. Focus should be on proper selection of drawing instruments and their proper use.
3. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings.
4. Separate labs for practice on Engineering graphics Software should be established.

5 COURSE DETAILS:

The following topics/sub topics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

Unit	Major Learning Topics and Sub-Topics	Outcomes (in cognitive domain)	Hours L-T-P
UNIT-1 **Basic elements of Drawing**	1.1 List the different drawing instruments and application 1.2 Convention of lines and its application (Thick, Thin, Axis etc.) 1.3 Practice use of drawing instruments 1.4 Representative fraction Scales - Full Scale, Reduced Scale and Enlarged Scale 1.6 Dimensioning a) Aligned system and Unidirectional system in the Sketches b) Chain dimensioning and Parallel dimensioning 1.7 Construct different polygons	1. Drawing equipment's, instruments and materials. 2. Equipment's-types, specifications, method to use them, applications. 3. Instruments-types, specifications, methods to use themandapplications. 4. Pencils-grades, applications, Different typesoflines. 5. Scaling technique used indrawing. 6. Dimensioningmethods. - Alignedmethod. Unilateral with chain, paralleldimensioning. 7. Constructions of geometrical figures	**4-0-8**
UNIT-2 **CAD Interface**	22.1 Introduction to CAD- Hardware requirements. 2.2 Various CAD software available 2.3 Familiarization of CAD window - Commands like New file, Saving the file, opening an existing drawing file, Creating templates 2.4 Setting up new drawing: Units, Limits, Grid, Snap. Standard sizes of sheet. 2.5 Selecting Various plotting parameters such as Paper size, paper units, drawing orientation, plot scale, plot offset, plot area, print preview	1. CAD-Definition-Importance. 2. Familiarization with CAD Environment and utilities. 3. Setting up layout in CAD software's by taking plotting parameters	**4-0-8**
UNIT-3 **Exposure to CAD Commands**	3.1 Draw basic entities like Line, Circle, Arc, Polygon, Ellipse, Rectangle, Multiline, Dimensioning, Inserting text Applying constraints - horizontal, vertical, parallel, concentric, perpendicular, symmetric equal, collinear 3.2 Insert title block for the drawing and take the Print out 3.3Create objects by applying constraints and convert the objects to full scale, reduced scale and enlarged scale 3.4 Apply copy, mirroring, array, fillet and trim on the object created	1. Computer graphics & its terminology. 2. CAD definition, concept & need. 3. Commands used in CAD 4. Functional areas of CAD. - Coordinate systems. 5. Familiarization of Cad commands 6. Draw simple Geometrical figures using CAD	**6-0-12**
UNIT-4 **Orthographic projections**	4.1 Introduction to orthographic projection 4.2 Conversion of pictorial view into Orthographic Views	1. Types of projections-orthographicconcept and applications. 2 Various term associated	**4-0-8**

		with orthographic projections. (a) Theory of projection. (b) Methods of projection. (c) Orthographic projection. (d) Planes of projection. 3. Conversion of simple pictorial views into Orthographic views. Illustrative problems on orthographic projection. Note : (1) Problem should be restricted up to - Front view/Elevation, Top view/Plan and Side views only. Use First Angle Method only.	
UNIT-5 **Isometric projections**	5.1 Introduction to Isometric Projections 5.2 Isometric Scales and Actual Scale 5.3 Isometric View and Isometric Projection 5.4 Conversion of Orthographic Views into Isometric	1. Isometric axis, lines and planes. 2. Isometric scales. 3. Isometric view and isometric drawing. 4. Difference between isometric projection and isometric drawing. 5. Illustrative problems limited to Simple elements	**4-0-8**
UNIT-6 **CAD Drafting**	6.1 Draw different types of 2D/3D modeling entities using viewing commands, to view them (Problems solved in chapter no 3 and 4 i.e Orthographic, isometric projection). 6.2 2D/3D modeling for Branch specific components	1 Difference between 2D & 3D models. 2.2D/3D modeling – concept, Simple objects	**4-0-8**
		TOTAL	**26-0-52**

6. LIST OF PRACTICAL EXERCISES:

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	1	1. Teacher will demonstrate a: Use of a. Drawing instruments. b. Planning and layout as per IS. c: Scaling technique.	**1-0-2**
		2. Draw following. Problem – 1 Drawing horizontal, vertical, 30 degree, 45 degree, 60 & 75 degrees lines using Tee and Set squares/ drafter. (Sketch book)	
		Problem – 2 Indicate different convention of lines on the drawing.(SketchBook)	**1-0-2**
		Problem – 3 Copy the sketch to the required scale and dimensioning adopting right system and positioning of dimensions using Tee and Set squares / drafter. (SketchBook)	**1-0-2**

		Problem 4. Draw regular geometric constructions Pentagon, Hexagon, Square, circle, Triangle and other shapes. (SketchBook)	**1-0-2**
2	2	Use of CAD commands, plotting the drawing	**4-0-8**
3	3	Problem 5: Drawing basic entities: Circle, Arc, Polygon, Ellipse, Rectangle, Multiline	**6-0-12**
4	4	Problem 6: Draw Orthographic views for the given object. (CAD Drawing) (Minimum 5 Problems)	**4-0-8**
5	5	Problem 7: Draw Isometric projections for the given Orthographic views(CAD Drawing) (Minimum 5 Problems)	**4-0-8**
6	6	Problem 8: Produce Orthographic (2D) Drawings in CAD – Chap 3 Problem 14: Produce Isometric and 3D Drawings in CAD – Chap 4 (CAD Drawings and Printout) (Minimum 5 Problems)	**2-0-4**
		Problem 9: create 3D models of Program specific Elements such as Panel box (Minimum 3 Problems related to Program specific)) (CAD Drawings and Printout)	**2-0-4**
		TOTAL	**26-0-52**

1 Theory & practice should be in first angle projections and IS codes should be followed wherever applicable.
2 The dimensions of line, axes, distances, angle, side of polygon, diameter, etc. must be varied for each student in batch so that each student will have same problems, but with different dimensions.
3 The sketchbook has to contain data of all problems, solutions of all problems and student activities performed.
4 Students activities are compulsory to be performed.

7. SUGGESTED LIST OF STUDENT ACTIVITIES:

SL.NO.	ACTIVITY
1	Sketch the combinations of set squares to draw angles in step of 15^0 .30^0 , 45^0 , 60^0 , 75^0 , 90^0 , 105^0 , 120^0 , 135^0 , 150^0 , 165^0 , 180^0 .
2	Take two simple objects. Sketch isometric of them.
3	Take two simple objects. Sketch Pictorial orthographic views of them.
4	Prepare a 2D drawing using AutoCAD and 2D parametric sketcher environment.
5	Prepare 3D solid models using AutoCAD any one mechanical component (Four components).

8. SUGGESTED LEARNING RESOURCES:

1. Bureau of Indian Standards. *Engineering Drawing Practice for Schools and Colleges IS: Sp-46.* BIS. Government of India, Third Reprint, October 1998; ISBN: 81-7061-091-2.
2. Bhatt, N. D. *Engineering Drawing*. Charotar Publishing House, Anand, Gujrat 2010; ISBN: 978-93-80358-17-8.
3. Jain &Gautam, Engineering Graphics & Design, Khanna Publishing House, New Delhi (ISBN: 978- 93-86173-478)
4. Jolhe, D. A. *Engineering Drawing*. Tata McGraw Hill Edu. New Delhi, 2010; ISBN: 978-0-07-064837-1
5. Dhawan, R. K. *Engineering Drawing*. S. Chand and Company, New Delhi; ISBN: 81-219-1431-0.

6. Shah, P. J. *Engineering Drawing*. S. Chand and Company, New Delhi, 2008, ISBN:81-219-2964-4.
7. Kulkarni, D. M.; Rastogi, A. P.; Sarkar, A. K. *Engineering Graphics with AutoCAD* . PHI Learning Private Limited-New Delhi (2010); ISBN: 978-8120337831.
8. Jeyapoovan, T. *Essentials of Engineering Drawing and Graphics using AutoCAD*. Vikas Publishing HousePvt. Ltd, Noida, 2011; ISBN: 978-8125953005.
9. Autodesk. *AutoCAD User Guide*. Autodesk Press, USA, 2015.
10. Sham, Tickoo. *AutoCAD 2016 for Engineers and Designers* .Dreamtech Press; Galgotia Publication, New Delhi, 2015; ISBN 978-9351199113.

9.SOFTWARE/LEARNING WEBSITES :

1. https://www.youtube.com/watch?v=TJ4jGyDWCw
2. https://www.youtube.com/watch?v=dmt6_n7Sgcg
3. https://www.youtube.com/watch?v=_MQScnLXL0M
4. https://www.youtube.com/watch?v=3WXPanCq9LI
5. https://www.youtube.com/watch?v=fvjk7PlxAuo
6. http://www.me.umn.edu/coursesme2011/handouts/engg%20graphics.pdf
7. https://www.machinedesignonline.com

10. Mapping of Course Outcomes with Programme Outcomes (Suggestive only):

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Engineering Graphics	CO1	3	0	0	3	0	0	0
	CO2	3	0	0	3	0	0	0
	CO3	3	0	0	3	0	0	0
	CO4	3	0	0	3	0	0	0

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped

Method is to relate the level of PO with the number of hours devoted to the CO s which maps the given PO.
If ≥50% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 3
If 30 to 50% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 2
If 5 to 30% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 1
If < 5% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is considered not mapped i.e. Level 0

11. COURSE ASSESSMENT AND EVALUATION CHART:

Sl. No	Assessment	Time frame in semester	Duration	Max marks	Conversion
1.	Portfolio Evaluation of Drawings (CAD Practice Exercises)	Entire Duration	-	20	**20**
2	Skill Test-1 (Skill test 1 - Unit-1& 2)	At the end of 4 week	3 Hrs	100	Average of two skill tests 1and 2 (Both skill tests are to be reduced to weightage of 20 independently) 20
3	Skill Test-2 (Skill test 2 is of CAD based-Unit,3,4)	At the end of 8 week	3 Hrs	100	

4	Skill Test-3 (Skill test 3 is of CAD based Unit 5,6)	At the end of 13 week	3 Hrs	100	Skill tests-3 is to be reduced to weightage of 20
5	Total Continuous Internal Evaluation (CIE) Assessment				**60**
6	Semester End Examination (SEE) Assessment conducted for 100 marks, finally reduced to 40 marks weightage		3 Hrs	100	**40**
				TOTAL	**100**

Scheme of Valuation for End Examination

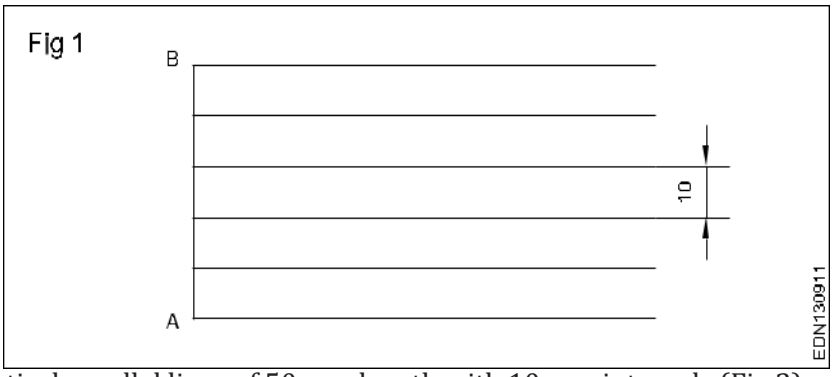
SL NO	QUESTIONS	MARKS
1.	Create Orthographic views for the given Pictorial drawing. Indicate all Dimensions and Annotations.(CAD)	**50**
	OR	
	Create Isometric Projections for the given Orthographic views (CAD)	**50**
2.	Create 3D drawing for the given Sketch (CAD)	**50**
	TOTAL	**100**

12. CAD Laboratory and Other Requirements to Conduct Engineering Graphics Course

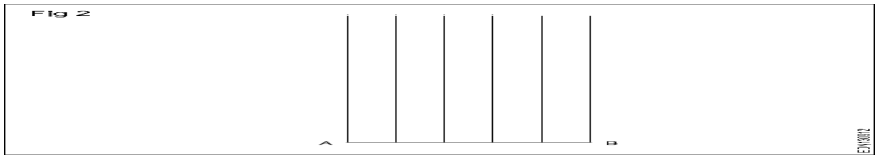
1. Latest Configuration Computers which can be able to run latest any Computer Aided Drafting Software. (At least One Computer per student in practical session.)-30 no
2. Any latest Authorized Computer Aided Drafting Software (30 user licenses)
3. Plotter of size A2/A3
4. LCD Projector.

MODEL QUESTION BANK (Suggestive only)

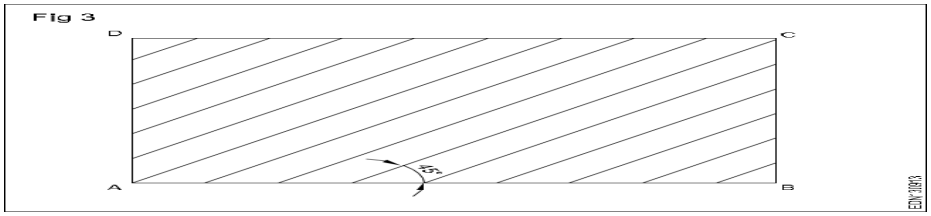
1. Draw six horizontal parallel lines of 50 mm long with 10 mm intervals (Fig 1).



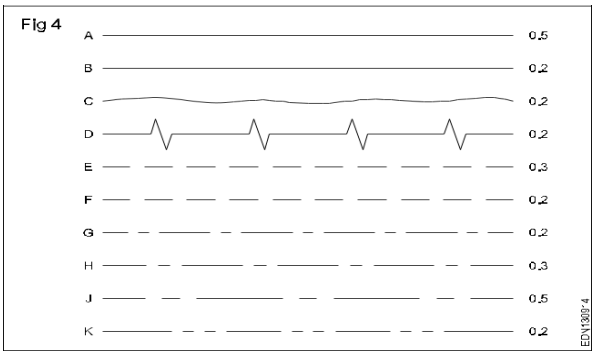
2. Draw six vertical parallel lines of 50 mm length with 10 mm intervals (Fig 2)



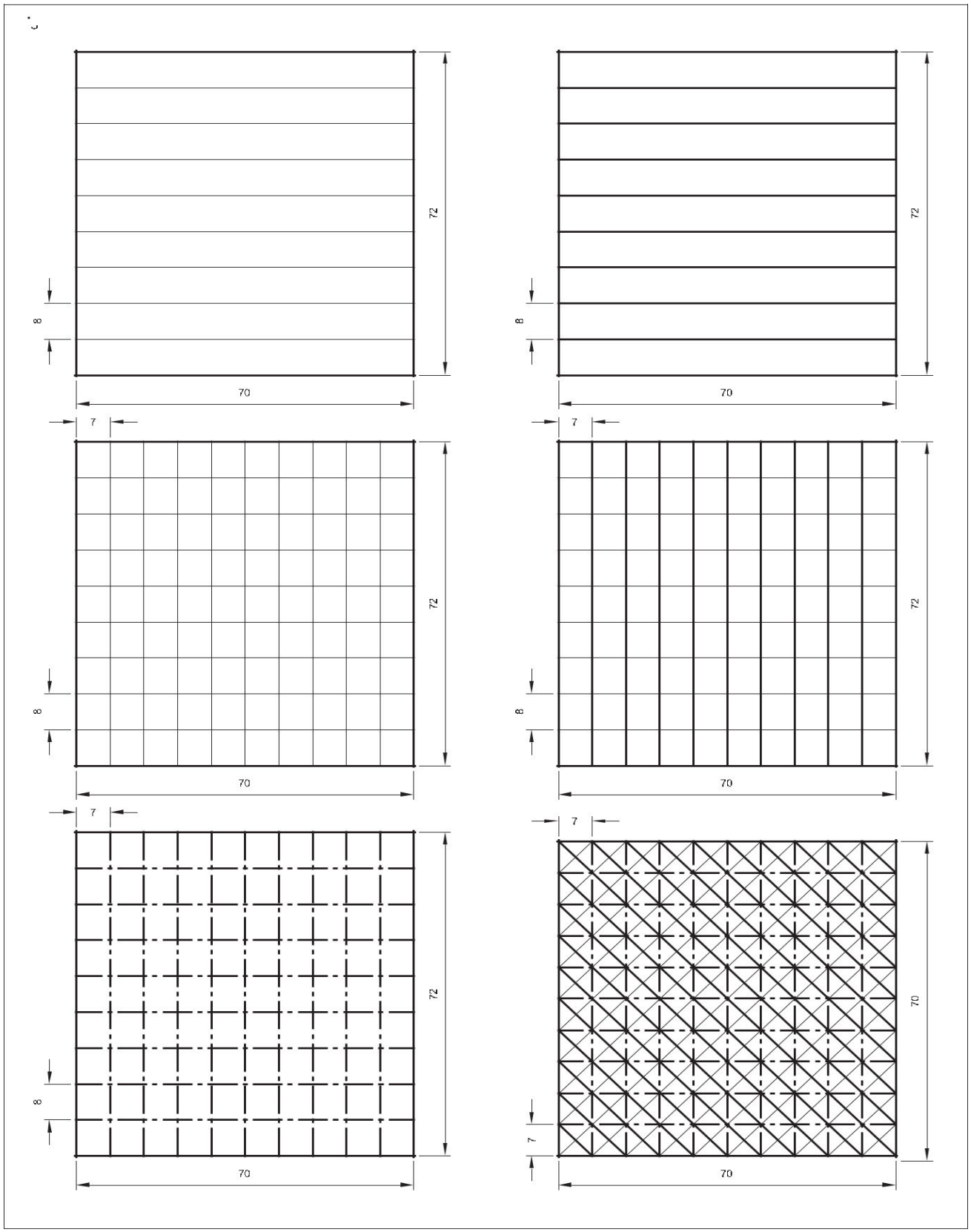
3. Draw 45° inclined lines (Fig 3).



4.Draw the given types of lines using 0.5 range thickness of line according to the specification (Fig 4).



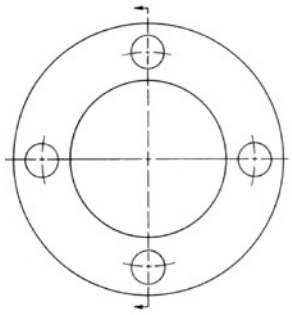
5. Draw the following Exercises in A4 sheet (Fig 5).



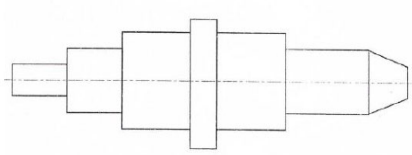
6a) Illustrate the elements of dimensioning with the help of a sketch.

b) Illustrate the dimensioning of given common features: diameter, radius, chord, Arc and angle.

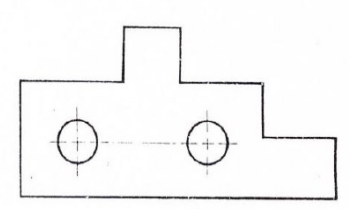
7. Copy the sketch to 1:1 scale and dimension it using Aligned system.



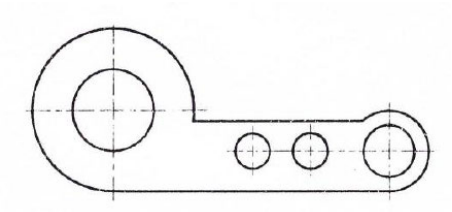
8. Copy the sketch to 1:1 scale and dimension it using unidirectional system with Parallel dimensioning method.



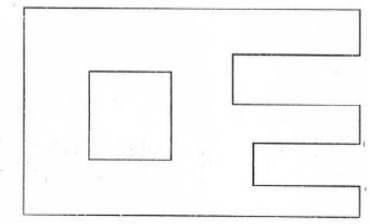
9. Copy the sketch to 1:1 scale and dimension it using Aligned system with Chain dimensioning method.



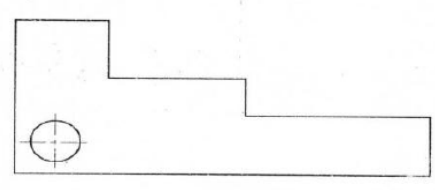
10.Copy the sketch to 1:1 scale and dimension it using Aligned system with Parallel dimensioning method.



11. Copy the sketch to 1:1 scale and dimension it using unidirectional system with Chain dimensioning method

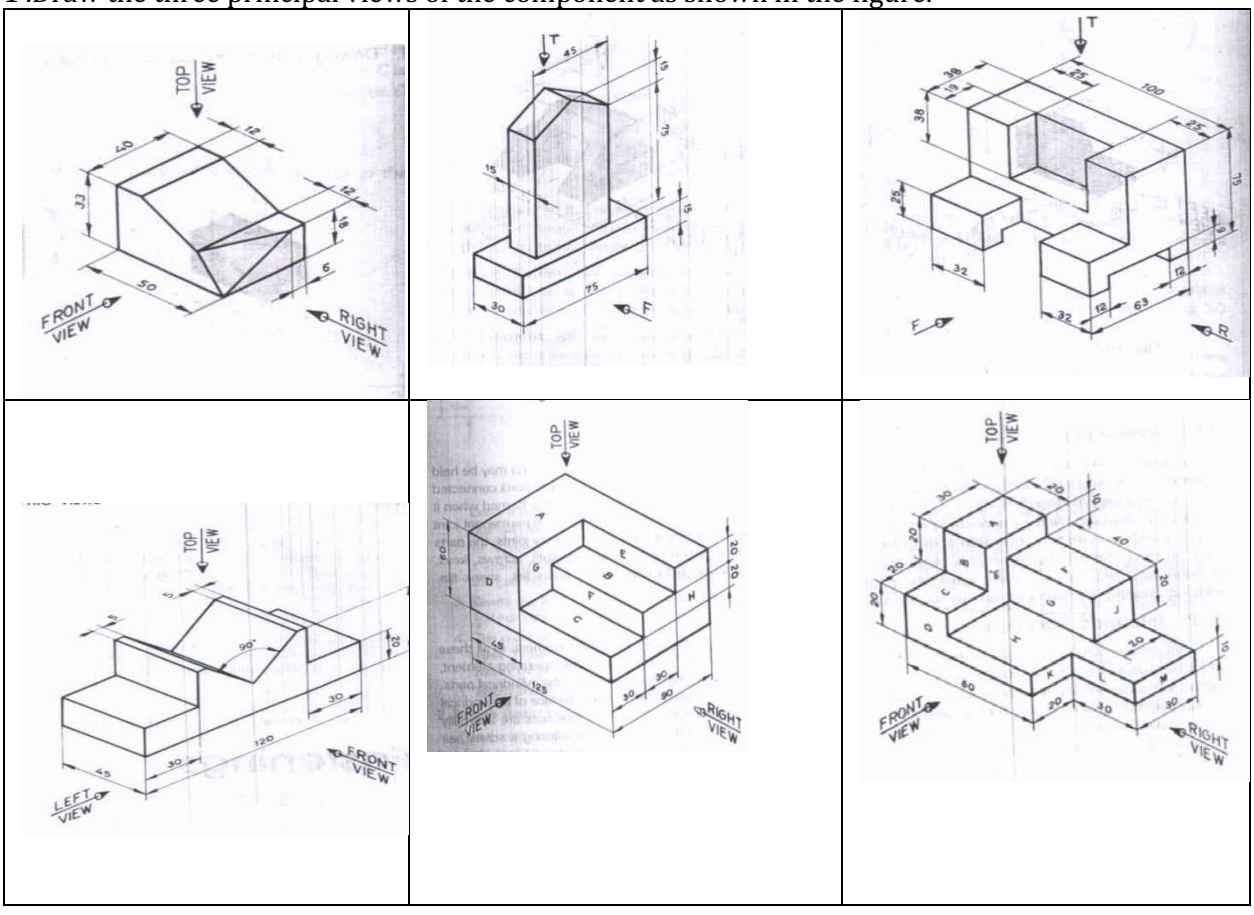


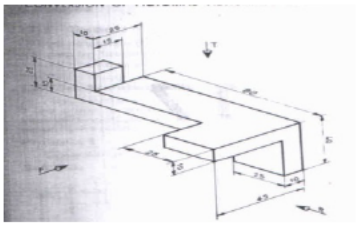
12. Copy the sketch to 1:1 scale and dimension it using unidirectional system with Parallel dimensioning method.

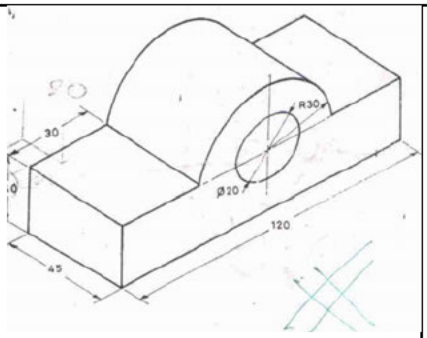


ORTHOGRAPHIC ROJECTIONS

1 .Draw the three principal views of the component as shown in the figure.



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Ø20
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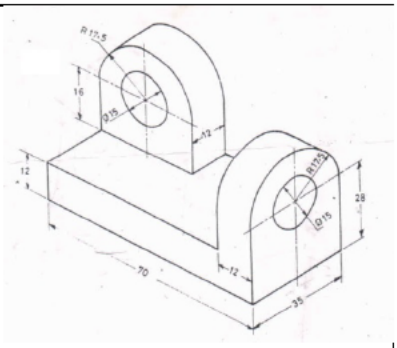
45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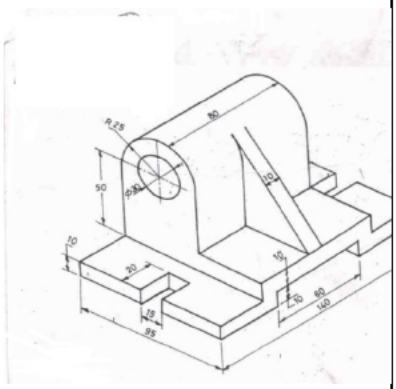
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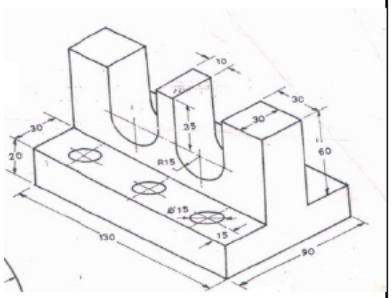
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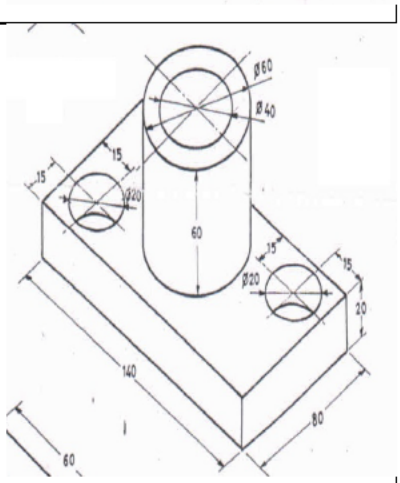
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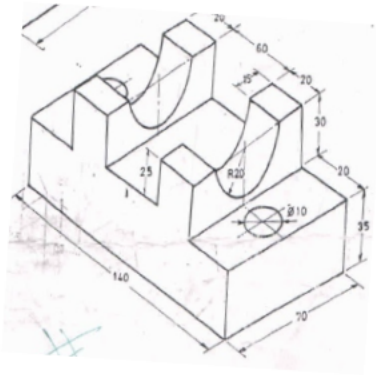
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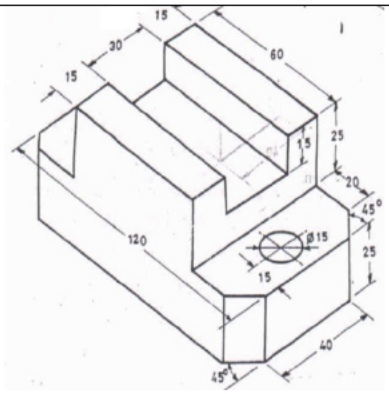
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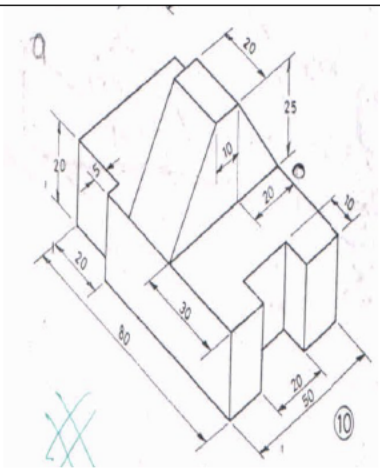
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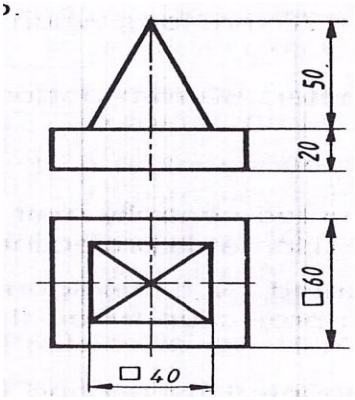
10

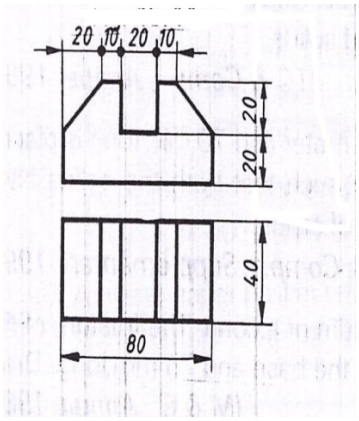
ISOMETRIC PROJECTIONS

1. .Draw the isometric view of the machine component whose orthographic views are given below:

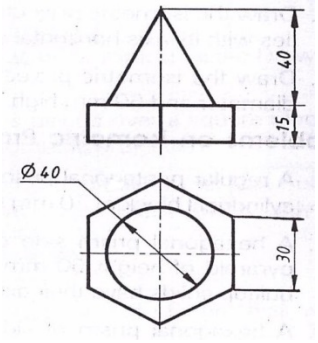
1.



2.



3.



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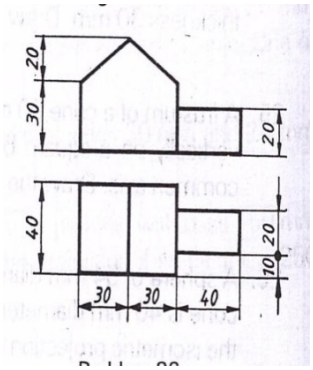

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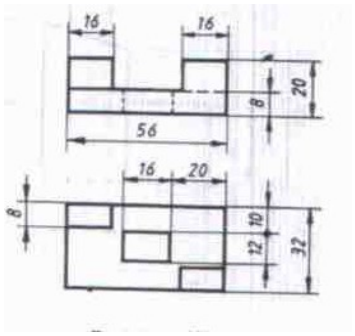

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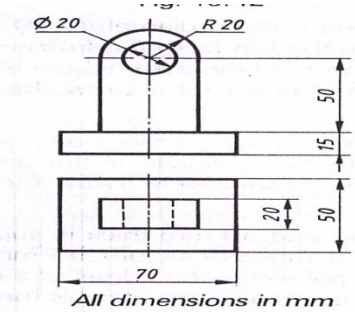

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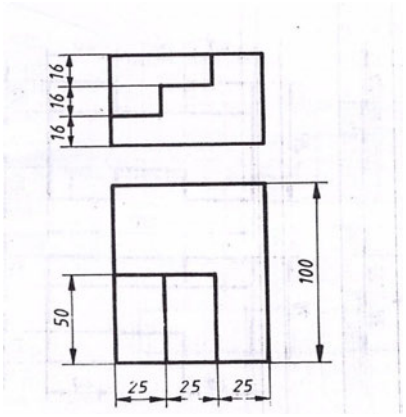

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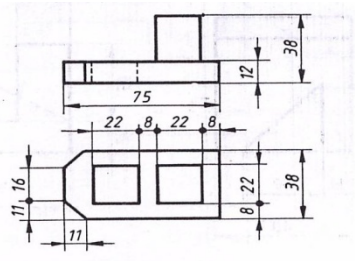

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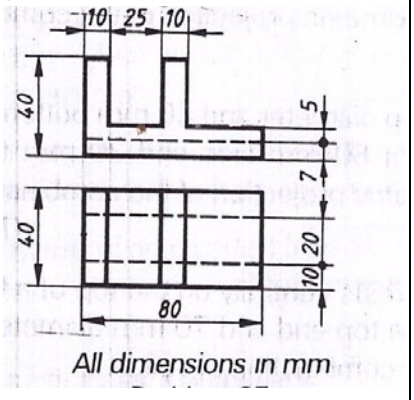
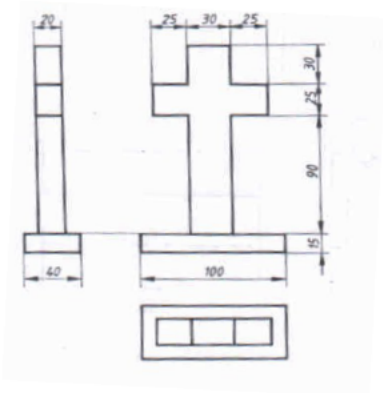
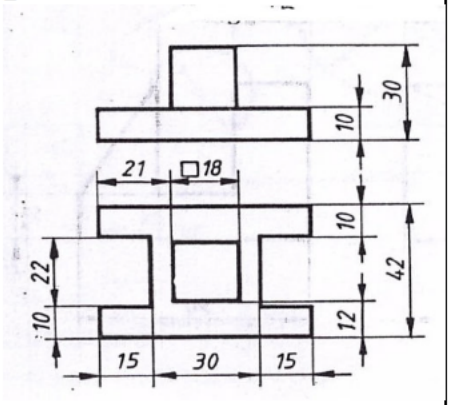
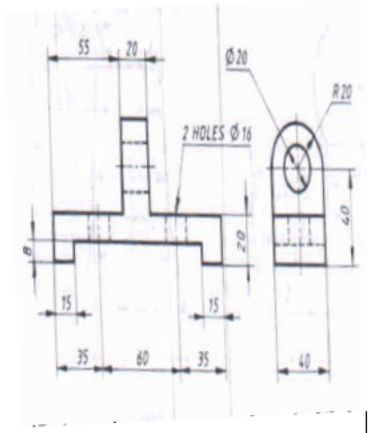
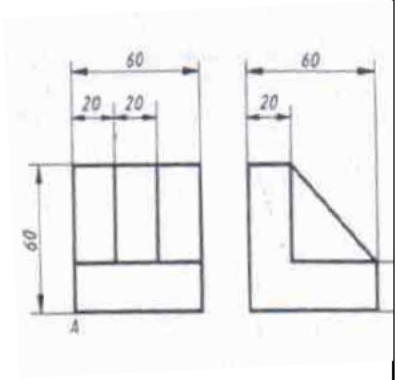
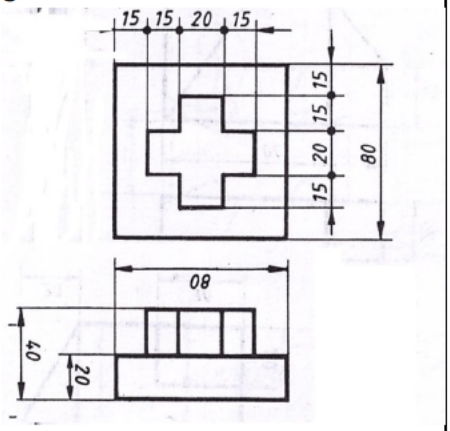
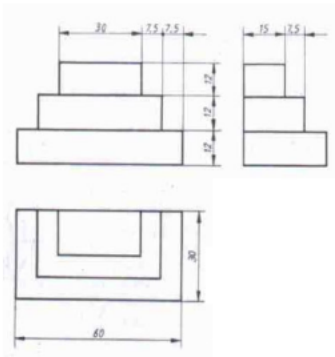
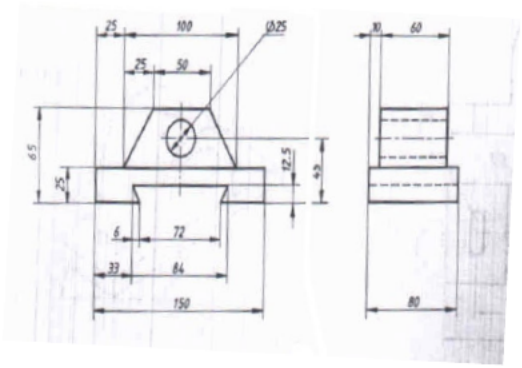


2. Draw the isometric Projection of the machine component whose orthographic views are given below:

1 	2 	3 
4 	5 	6 

3. Draw the isometric Projection of the machine component whose orthographic views are given below

1



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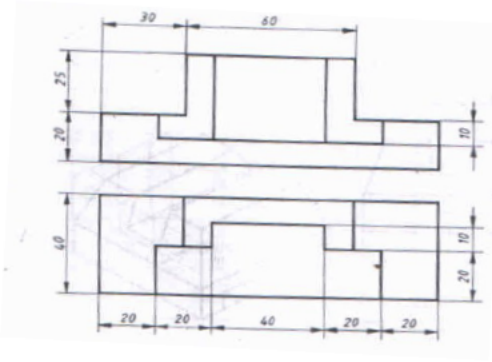

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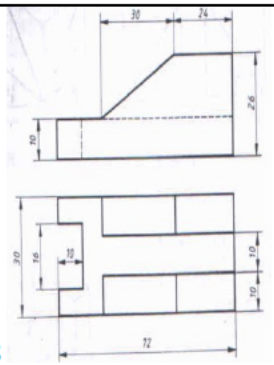

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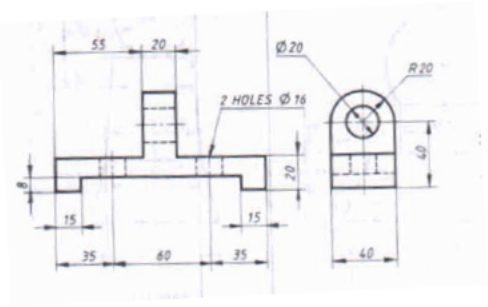

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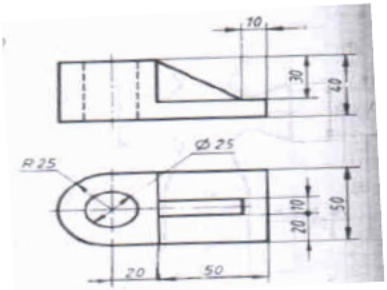

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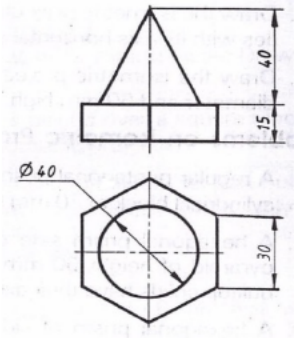

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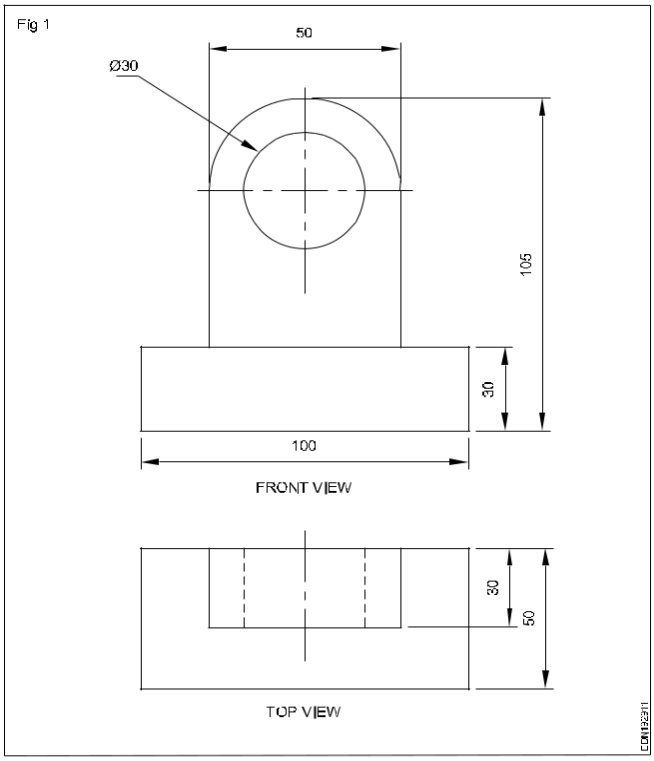

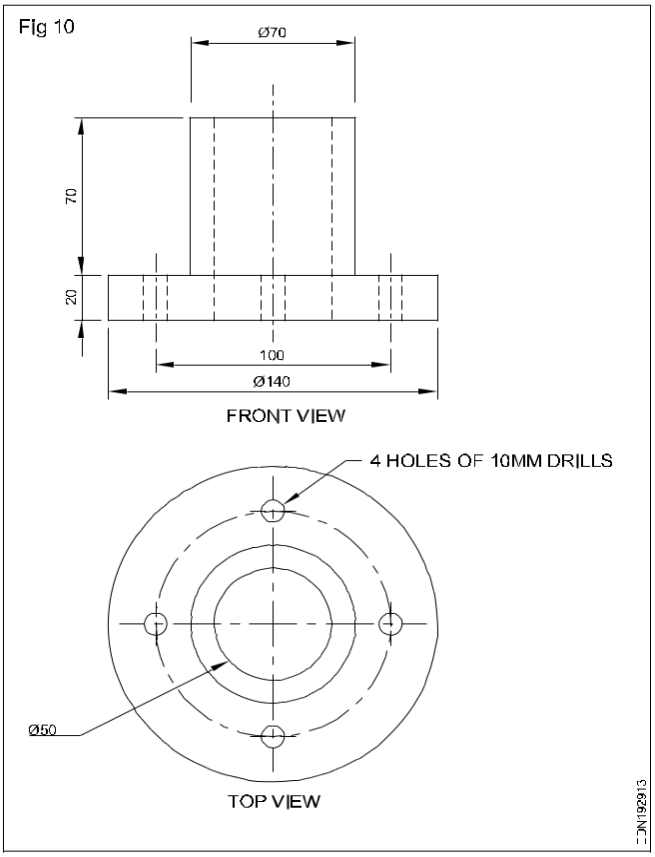

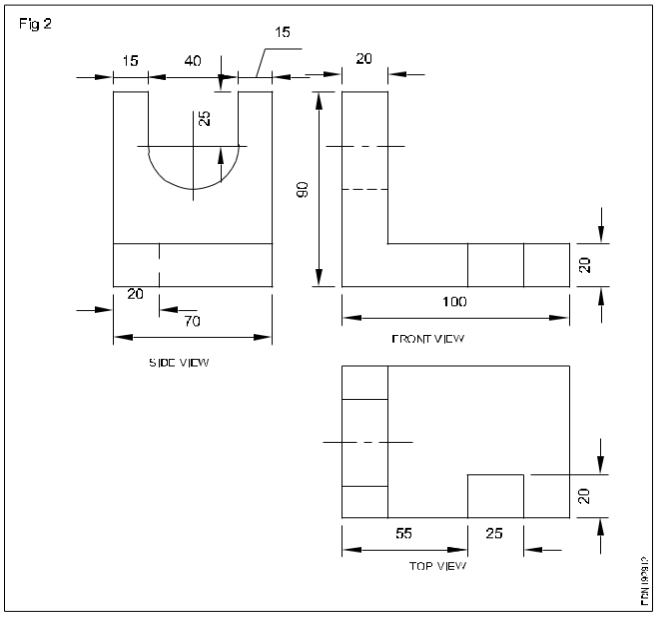

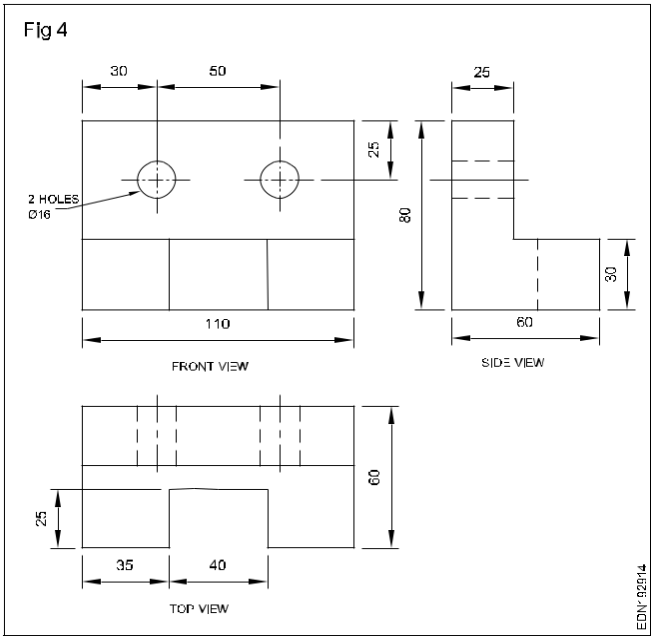

Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20EC01P	**Semester**	I/II
Course Title	**FUNDAMENTALS OF ELECTRICAL & ELECTRONICS ENGINEERING**	**Course Group**	Core
No. of Credits	4	**Type of Course**	Lecture & Practice
Course Category	PC	**Total Contact Hours**	6Hrs Per Week 78Hrs Per Semester
Prerequisites	Basic Science	**Teaching Scheme**	(L:T:P)= 1:0:2
CIE Marks	60	**SEE Marks**	40

1. RATIONALE

Fundamentals of Electrical and Electronics Engineering is essential for all streams of diploma engineering to work in any industry as it covers basic electrical safety,troubleshooting and repairing of simple electrical systems. Basic knowledge of electrical wiring circuits, protective devices, electrical machines and basic electronics devices is required to work in any engineering field.

2. COURSE SKILL SET

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

1. Perform and test domestic wiring
2. Can operate electrical machine
3. Test different electronics devices

3. INSTRUCTIONAL STRATEGY

1. Expose to different learning tools used in respective labs, Operational safety and Procedure to be followed in the laboratory.
2. Instructor should give examples from daily routine as well as, engineering/technology applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles. In all contents, SI units should be followed.
3. Activity- Theory - Demonstrate/practice approach may be followed throughout the course so that learning may be skill and employability based.

4.COURSE OUT COMES

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

CO1	Comply with the safety procedures
CO2	Apply the fundamentals of electricity.
CO3	Install and test electrical wiring system.
CO4	Identify and Operate electrical machines, Batteries and UPS.

CO5	Identify and test the different electronic devices.

5. COURSE TOPICS:

Unit No	Unit Name	Hours
1	Electrical Safety	6
2	Electrical Fundamentals	15
3	Protective Devices and Wiring circuits	15
4	Electric Machines and Batteries and UPS	15
5	Introduction to Electronic Devices and Digital Electronics	27
	Total	**78Hr**

6. COURSE CONTENT

The following topics/sub topics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

Sl No	Unit skill set (In cognitive domain) *On successful completion of the class, the students will be able to*	Topics/Sub topics	Practical	Hours L-T-P
		UNIT-1 Electrical Safety		
1	Comply with the Electrical safety	1. Electrical Symbols 2. Electrical safety • Identify Various types of safety signs and what they mean • Demonstrate and practice use of PPE • Demonstrate how to free a person from electrocution • Administer appropriate first aid to victims, bandaging, heart attack, CPR, etc. • Fire safety, causes and precautionar y activities. • Use of appropriate fire extinguishers on different types of fires. • Demonstrate rescue techniques applied during fire hazard, correct method to move injured people during emergency • Inform relevant authority about any abnormal situation • Earthing: Types	1. Electrical symbols related to electrical engineering. 2. Electrical safety 3. Electrical earthing	02-00-04

		➢ http://nreeder.com/Flash/symbols.htm ➢ http://bouteloup.pierre.free.fr/iufm/as/de/house/safety.html		
UNIT-2 Electrical Fundamentals				
2	1. Identify and select the different measuring devices. 2. Identify different electrical supply systems 3. Identify open circuit, close circuit and short circuit conditions.	1. Describe the sources of electrical energy. 2. Electrical current, voltage, emf, potential difference, resistance with their SI units. 3. Mention the meters used to measure different electrical quantities. Identification Measuring devices • Ammeter • Voltmeter • Wattmeter • Ohmmeter • Digital Multimeter • Megger • Tong tester 4. Explain supply systems like AC, DC. ➢ http://nreeder.com/Flash/units.htm	1. Connect voltmeter and ammeter in a simple circuit. (Practicing of identification and connection of different meters)	1:0:2
3	Calculate basic electrical quantities	• Relationship between V, I and R. (Ohms law) • Behavior of V, I in Series and Parallel DC circuits. • Describe open circuit, close cir cuit and short circuit • http://nreeder.com/Flash/ohmsLaw.htm	1. Measure current, voltage and analyze effective resistance in seriescircuit 2. Demonstrate effects of shorts and opens in a circuit	1:0:2
4	Connect resistances in different combination	1. Equation to find the effective Resistances connected in series 2. Equation to find effective Resistances connected in parallel 3. Resistances connected series and parallel combinations 4. Simple problems.	1. Determine the equivalent Resistance of parallel connected resistances.	1:0:2
5	Calculate and measurement of different parameters of an AC quantity.	**Ac sinewave: S**inusoidal voltage, current, amplitude, time-period, cycle, frequency, phase, phase difference, and their units. ➢ http://nreeder.com/Flash/freqPeriod.htm ➢ http://nreeder.com/Flash/oscill	Generate and demonstrate the measurement of frequency, time period and phase difference of	1:0:2

		oscope.htm	AC quantity using CRO and function generator.	
6	1. Calculate and measure electric power and energy 2. Identify and differentiate Single phase and Three phase supply	1. Electrical work, power and power factor • SI units • Mention the meters used to measure them ➢ http://nreeder.com/Flash/powerLaw.htm	• Measure the voltage, current, powerusing relevant measuring instruments in a Single-phase load.	1:0:2
7.		1. Electrical energy • SI units • Mention the meters used to measure them 2. Single phase and Three phase supply.	1. Measure single phase energy using relevant measuring instruments in a Single-phase load. 2. Measure the voltages in Three phase supply.	
UNIT-3 Protective Devices and Wiring circuits				
8.	1. Identify and select Protective Devices for given current and voltage rating 2. Identify and select the various electrician tools	• Necessity of Protective Devices • Various Protective devices and their functions •fuse wire, •Glass cartridge fuse • HRC fuse • Kit-kat fuse • MCB • MCCB • RCCB • ELCB • Relay • Different types of electrician tools and their function. • Describe various wiring tools. • State procedure of care and maintenance of wiring tools.	1. Wire up and test PVC Conduit wiring to control one lamp from two different places using suitable protective devices.	1:0:2

9	1. Identify and select Wiring systems for a given applications 2. Identify and select the cables used for different current and voltage ratings. 3. Draw the wiring diagram	1. Describe different types of wiring systems. • Surface conduit • concealed conduit • PVC casing capping 2. Wiring systems and their applications. 3. Describe the types of wires, cables used for different current and voltage ratings.	1. Wire up and test PVC Conduit wiring to control of 2 sockets and 2 lamps.	2:0:4
10	Estimate and plan electrical wiring	Explain Plan and estimate the cost of electrical wiring for one 3m × 3m room consisting of 2 lamps, 1ceiling fan, 2 three pin sockets.	Prepare the estimation and plan	1:0:2
UNIT-4 Electrical Machines and Batteries and UPS				
11	1. Identify the types of transformer. 2. verify the transformation ratio.	**Transformer** • working principle • Transformation ratio • Types and applications with their ratings	Connect the Single- phase transformer as Step-Up, Step-Down transformer and verify the transformation ratio.	1:0:2
12	1. Start and run the induction motor. 2. Troubleshoot DOL/Star-delta starter and induction motor	1. **Induction motor** • Single phase and three phase Induction motor. • Necessity of starters. • Describe DOL AND STAR-DELTA starters. 2. What are different causes and remedies for a failure of starter and induction motor.	1. Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/ Star-delta starter. 2. Troubleshoot the DOL/ Star-delta starter and induction motor	2:0:4

13	Select and test the battery for a given application	**Battery** • Types of batteries (Lead acid battery, lithium, sealed maintenance free (SMF) battery, Modular battery). • Selection criteria of batteries for different applications. • Ampere-Hour Capacity. • Efficiency	Testing Condition of charging and discharging of a Lead-acid battery	1:0:2
14	Select the size of the UPS for a given application	**UPS** • List the types and applications • Selection criteria of UPS • Sizing of UPS	Sizing of UPS	1:0:2
UNIT-5 Introduction to Electronic Devices and Digital Electronics				
15	Identify and differentiate Conductors, insulators and semiconductors.	1.Compare Conductors, insulators and semiconductors with examples. 2. Identification of types and values of resistors-color codes. ➢ http://nreeder.com/Flash/resistor.htm	Determine the value of resistance by color code and compare it with multimeter readings.	1:0:2
16	Identify and test PN junction Diode	**PN junction diode** • Symbol • Characteristics • Diode as switch. • Types of diodes and ratings • Applications	Identify the terminals of a Diode and test the diode for its condition.	1:0:2
17	Build and test bridge rectifier circuit	**Rectifier** • Need for AC to DC conversion • Bridge rectifier with and without C filter, • Rectifier IC.	Construct and test bridge rectifiers using semi-conductor diode and rectifier IC. Compare the waveforms using CRO.	1:0:2
18	1. Identify and test Transistor 2. Build and test transistor as an electronic switch	**Transistor (BJT)** • Symbol • Structure • Working principle	1. Identification of transistor terminals and test. 2. Construct and test the transistor as an electronic switch	1:0:2
19.	1. Identify and test different digital IC 1.	• Comparison of analog and digital signal • Digital systems, examples. • Binary numbers, Boolean identities and laws. • Digital system building blocks: Basic logic gates, symbols and truth tables. IC-Definition and advantages.	• Test a Digital IC. • Identification and selection of suitable ICs for basic gates. 1. Verify NOT, AND, OR, NOR, EXOR and NAND gate operations (two inputs).	2:0:4

20	Identify and test various Sensors and actuators.	**1.Sensors** • Concept • Types: Temperature, Pressure, Water, Light, Sound, Smoke, proximity Sensors, Flow, humidity, voltage, vibration, IR (Principle/working, ratings/ specifications, cost, and applications) **2.Actuators** • Concept • Types and applications. • Relay as an actuator.	2. Connect and test an IR proximity sensor to a Digital circuit. • Connect and test a relay circuit using an Opto-coupler. (Photo Diode & Transistor) **Refer note**	2:0:4
21	Know the application of Microcontroller and PLC	• Microcontroller as a programmable device, and list of real-world applications. • PLC and Their applications. (Activity based learning)	• Identify different application microcontroller. • Identify commercially available PLC and their specifications	1:0:2
			TOTAL	**26-0-52=78 Hours**

7. PRATICAL SKILL EXERCISES

Sl. No.	Practical Out Comes/Practical exercises	Unit No.	PO	CO	L: T:P Hrs.
1	• Identify Various types of safety signs and what they meanDemonstrate and practice use of PPE • Demonstrate how to free a person from electrocution appropriate first aid to victims, bandaging, heart attack, CPR, etc. • Fire safety, causes and precautionary activities. • Use of appropriate fire extinguishers on different types of fires. • Demonstrate rescue techniques applied during fire hazard. • Inform relevant authority about any abnormal situation during fire hazard.	1	1,4	1	0:0:2
2	• Demonstrate different types of earthing/using videos. • Prepare a Report on types of Earthing	1	1,4	1	0:0:2
3	Connect voltmeter and ammeter in a simple circuit. (Practicing of identification and connection of different meters)	2	1,4	2	0:0:2
4	1.Determine the equivalent Resistance of series connected resistances. 2.Demonstrate effects of shorts and opens in a circuit	2	1,4	2	0:0:2

5	Determine the equivalent Resistance of parallel connected resistances.	2	1,4	2	0:0:2
6	Generate and demonstrate the measurement of frequency, time period and phase difference of AC quantity using CRO and function generator.	2	1,4	2	0:0:2
7	Measure the voltage, current, power using relevant measuring instruments in a Single-phase load.	2	1,4	2	0:0:2
8.	1.Measure single phase energy using relevant measuring instruments in a Single-phase load. 2. Measure the voltages in Three phase supply.				
9.	Wire up and test PVC Conduit wiring to control one lamp from two different places using suitable protective devices.	3	1,4	3	0:0:2
10	2. Wire up and test PVC Conduit wiring to control of 2 sockets and 2 lamps.	3	1,4	3	0:0:2
11	Wire up and test PVC Conduit wiring to control one lamp from two different places.	3	1,4	3	0:0:2
12	Plan and estimate the cost of electrical wiring for one 3mx3m room consisting of 2 CFL 1ceiling fan, 2 three pin sockets.	3	1,4	3	0:0:2
13	Connect the Single- phase transformer as Step-Up, Step-Down transformer and verify the transformation ratio.	4	1,4	4	0:0:2
14	Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/star-delta starter.	4	1,4	4	0:0:2
15	Troubleshoot the DOL/Star-delta starter and induction motor	4	1,4	4	0:0:2
16	Testing Condition of charging and discharging of a Lead-acid battery.	4	1,4	4	0:0:2
17	Estimate the UPS rating for a computer lab with 50 computers/domestic.	4	1,4	4	0:0:2
18	Determine the value of resistance by color code and compare it with multimeter readings	5	1,4	5	0:0:2
19	Identify the terminals of a Diode and test the diode for its condition.	5	1,4	5	0:0:2
20	Construct and test bridge rectifiers using semiconductor diode and rectifier IC. Compare the waveforms using CRO.	5	1,4	5	0:0:2
21	Identification of transistor terminals and test. Construct and test the transistor as an electronic switch.	5	1,4	5	0:0:2
22	Test an IC. Verify the truth-table AND, OR, NOT logic gates.				
23	Verify the truth-table NAND, NOR, EX-OR, EX-NOR logic gates.	5	1,4	5	0:0:2
24	Connect and test anIR proximity sensor to a Digital circuit. **NOTE:**Any sensor listed in the theory may be used for condition appropriately.				

25	Connect and test a relay circuit using an Optocoupler. (Photo Diode & Transistor)	5	1,4	5	0:0:2
26	1.Identify MCS-51 variants 2.Identify commercially available PLC and their specifications.	5	1,4	5	0:0:2
Total					**0:0:52 =52Hrs**

8.MAPPING OF CO WITH PO

CO	**Course Outcome**	PO Mapped	Experiment	Cognitive Level **R/U/A**	Lecture & Practical Sessions in Hrs	**TOTAL**
CO1	Comply with the safety procedures	PO1, PO4	1-2	A	6	
CO2	Apply the fundamentals of electricity.	PO1, PO4	3-7	A	15	
CO3	Install and test electrical wiring system and protective devices.	PO1, PO4	8-12	A	15	
CO4	Identify and Operate electrical machines, Batteries and UPS.	PO1, PO4	13-17	A	15	
CO5	Identify and test the different electronic devices.	PO1, PO4	18-26	A	27	

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Fundamentals of Electrical and Electronics Engineering	CO1	3	0	0	3	0	0	0
	CO2	3	0	0	3	0	0	0
	CO3	3	0	0	3	0	0	0
	CO4	3	0	0	3	0	0	0
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped								

9. SUGGESTED LEARNING RESOURCES:

Reference Books:

1. ABC of Electrical Engineering by B. L. Theraja and A. K. Theraja, S Chand Publishers, New Delhi, 2014 Edition.
2. Basic Electrical and Electronics Engineering by S. K. Bhattacharya, Pearson Education India, 2012 Edition.
3. Electronic Devices and Circuits by I. J. Nagrath, PHI Learning Pvt. Ltd., 2007 Edition.
4. Basic Electrical Engineering byV. Mittle and ArvindMittle, McGrawHill Companies, 2005 Edition.
5. The 8051 Microcontroller & Embedded systemsusinkbnnnjbbh bbvvvvg assembly and C (2ndEdition)–M.A.Mazidi , J.C. Mazidi&R.D.McKinlay ISBN: 81-317-1026-2
6. Programmable Logic controllers, W BOLTON

e-Resources

1. https://www.youtube.com/watch?v=mc979OhitAg&list=PLWv9VM947MKi_7yJ0_FCfzTBXpQU-Qd3K
2.https://www.youtube.com/watch?v=CWulQ1ZSE3c
3. en.wikipedia.org/wiki/Transformer
2. www.animations.physics.unsw.edu.au//jw/AC.html
3. www.alpharubicon.com/altenergy/understandingAC.htm
4. www.electronics-tutorials
5. learn.sparkfun.com/tutorials/transistors
6. www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf
7. www.technologystudent.com/elec1/transis1.htm
8. www.learningaboutelectronics.com
9. www.electrical4u.com
10.https://www.youtube.com/watch?v=zLW_7TPf310
11. https://www.youtube.com/watch?v=8PTNjw-hQIM

10.SUGGESTED LIST OF STUDENTS ACTIVITYS for CIE

Note: the following activities or similar activities for assessing CIE (IA) (Any one)

Each student should conduct different activity and no repeating should occur

1	Using suitable meters/ instruments give the practical working circuits to measure
2	Resistance, Current, Voltage, Power and Energy in DC and AC (Single phase) Circuits.
3	List out the different types of wiring systems used in your laboratories or house with their representation.
4	Mini-Projects: Like preparing extension box, switch box and wiring models,
5	List out the different protective devices used in your laboratories or house with their ratings.
6	Applications of Electro Magnetic Induction, statically induced and dynamically induced emf, self and mutual induced emfs.
7	Prepare a report on types of starters and enclosures used for various industrial applications of AC motors.
8	Types of Cells and Battery maintenance
9	Visit nearby Battery charging shop or show room and prepare a report of the visit.
10	Prepare a report on various types of diodes used for various industrial applications.
11	Prepare a report on various types of sensors and actuators used for various industrial applications.
12	Mini-Projects: Connect and test a sensor (domain application) to a Digital circuit

11. COURSE ASSESSMENT AND EVALUATION CHART

Sl.No	Assessment	Duration	Max marks	Conversion	
1.	CIE Assessment 1 (Written Test -1-theory) - At the end of **3rd week**	60 minutes	20	Average of two written tests 20	
2.	CIE Assessment 2 (Written Test -2-theory) - At the end of **13th week**	60 minutes	20		
3.	CIE Assessment 3 (Skill test) - At the end of **5th week**	3 Hours	100	20	Average of three skill tests 20
4	CIE Assessment 4 (Skill test) - At the end of **7th week**	3 Hours	100		
5	CIE Assessment 5 (Skill test) - At the end of **9th week**	3 Hours	100		
6	CIE Assessment 6 (Student activity) - At the end of **11th week**	-	20	20	
7.	Total Continuous Internal Evaluation (CIE) Assessment			60	
8.	Semester End Examination (SEE) Assessment (Practical Test)	3 Hours	100	40	
Total Marks				**100**	

Note:

1. CIE written test is conducted for 20 marks (Two sections). Each section shall have two full questions of same CL, CO. Student shall answer one full question (10 marks) from each section.
2. CIE Skill test is conducted for 100 marks (3 Hours duration) as per scheme of evaluation and the obtained marks are scaled down to 20 marks

12. SCHEME OF VALUATION FOR SKILL TEST (CIE) & SEE

(CONTINOUS INTERNAL & SEMESTER END EXAMINATION)

Sl. No.	Particulars	Marks
1.	Identification of meters/ equipment/wires/tools etc.	10
2.	Writing Circuit/writing diagram and Procedure*	25
3.	Conduction	35
4.	Results	10
5	Viva-voce	20
Total		**100**

12. RUBRICS FOR ACTIVITY

RUBRICS FOR ACTIVITY (Example only) Faculty need to develop appropriate rubrics for respective activity						
Dimension	**Beginning**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	
					Average / Total Marks:	

Lab Equipment Requirement

The following are the specification of the apparatus required for FEEE lab and number of apparatus required for the batch of 20 students.

Sl. No.	Name of Equipment and Specification	Quantity Required
1	Dual Channel 30 V, 2 A continuously variable DC Regulated Power Supply with Current and Overload Protection	05 Nos.
2	+/- 15 V, 2 A, fixed DC Regulated Power Supply	05 Nos.
3	Portable Moving Coil DC Voltmeters a) 0 - 1 V b) 0 - 10 V c) 0 - 30 V	Each 05 Nos.

4	Portable Moving Iron AC Voltmeters a) 0 - 300 V b) 0 - 600 V	Each 05 Nos.
5	Portable Moving Coil DC Ammeters a) 0 - 100 mA b) 0 - 1 A c) 0 - 2 A	Each 05 Nos.
6	Portable Moving Iron AC Ammeters a) 0 - 2 A b) 0 - 5 A c) 0 - 10 A	Each 05 Nos.
7	Watt-meters a) 150/ 300V, 2 A, UPF b) 300/ 600 V, 5/ 10 A, LPF	Each 02 Nos.
8	Rheostats – 25 Ohms, 50 Ohms, 150 Ohms, 220 Ohms (all rated at 3 A)	Each 05 Nos.
9	Rheostat Loads s – 1 KW, 230 V	02 Nos.
10	Wire wound Resistors- 5 Ohms 2 Watts, 25 Ohms 5 Watts, 330 Ohms 2 Watts, 560 Ohms 2 Watts, etc.	Each 05 Nos.
11	Soldering Iron 60 W	05 Nos.
13	Single Phase Energy meter 10 A, 230 V, 50 Hz, Digital type	05 Nos.
14	Multi-meter Digital ¾”	06 Nos.
15	Duel Trace Oscilloscope – 30 MHz	02 Nos.
16	Three Phase Induction Motors :1 HP – 440 V 50 Hz,2 HP – 440 V 50 Hz.	Each 02 Nos.
17	Three phase DOL, Star-Delta, Auto transformer starter	Each 02 Nos.
18	UPS 1 KVA	01 Nos.
19	Battery Lead-Acid type, 140 A-hr and Hydrometers	02 Nos.

Sl. No.		**Name of Equipment and Specification**	**Quantity Required**
20		I C Trainer kit	05 Nos
21		Digital IC’s 7400, 7402, 7404, 7408, 7486 etc	Each 10 Nos.
22		Wooden Wiring board (2x3) ft	10
23		Wiring accessories	

	2	a) PVC conduit - ¾" - 10 lengths b) Cap and casing - ¾" - 10 lengths c) Switches Single Pole- 5A, 230 V d) Switches two way – 5 A, 230 V e) 3 Pin Sockets 5A, 230 V f) Bulb Holders – 5 A, 230 V g) 3 Pin Plug 5A, 230 V h) 60 Watts Lamps i) 100 Watts Lamps j) 15 W CFL lamps k) Copper Wires of sizes 1.5 mm^2, 2.5 mm^2, 4 mm^2 – 1 coil each l) Gang boxes (1+1, 2+1, 2+2) m) Kit –Kat fuses 5A, 15 A n) MCB 16 A & 32 A/ 230 V, Single and Double Pole o) ELCB 16 A & 32 A/ 230 V, Double Pole p) Neutral link- 16 A, 230 V q) Screws of assorted sizes r) Testers	Each 10 Nos.
24		Electronic Components a) Diodes - BY 127 and IN 4001 b) Zener Diodes – 6.2 V, 5.6 V, 7.8 V c) Relays – solid state Sugar cube type, SPST, Coil 6V, Power circuit 230 V, 5 A. d) Spring Boards e) Bread Boards f) Tag Boards.	Each 10 Nos.
25		Simple PANEL BOARD/ CUBICAL consisting of bus-bars, CB/MCB/ELCB, meters, HRC fuses, magnetic contactors, cables, earthing points.	1 No

Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20AU01T	**Semester**	I
Course Title	**ENVIRONMENTAL SUSTAINABILITY**	**Course Group**	Audit
No. of Credits	2	**Type of Course**	Lecture
Course Category	AU	**Total Contact Hours**	2Hrs Per Week
			26Hrs Per Semester
Prerequisites	Basic Environmental Science	**Teaching Scheme**	(L:T:P)= 2:0:0
CIE Marks	50	**SEE Marks**	No

COURSE OBJECTIVES:

Technicians working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

1. Solve various engineering problems applying ecosystem to produce eco – friendly products.
2. Use relevant air and noise control methods to solve domestic and industrial problems.
3. Use relevant water and soil control methods to solve domestic and industrial problems.
4. To recognize relevant energy sources required for domestic and industrial applications.
5. Solve local solid and e-waste problems.

COURSE OUTCOMES:

At the end of the course student will be able to know :

CO1	Importance of ecosystem and terminology.
CO2	The extent of air pollution, effects, control measures and acts.
CO3	The extent of noise pollution, effects, control measures and acts.
CO4	The water and soil pollution, effects, control measures and acts
CO5	Different renewable energy resources and efficient process of harvesting.
CO6	Solid Waste Management and Environmental acts.

COURSE CONTENT:

Marks: 15	***Unit-1 Ecosystem***	*Allotted Hrs: 03*
Structure of ecosystem, Biotic & Abiotic components, Aquatic (Lentic and Lotic) and terrestrial ecosystem. Global warming - Causes, effects, Green House Effect, Ozone depletion.		
Marks: 20	***Unit-2Air Pollution***	*Allotted Hrs: 03*
Air pollution, Natural and manmade sources of air pollution, Effects of air pollution.Air Pollutants and Types. Control of air pollutants by Cyclone separator and Electrostatic Precipitator, Air (prevention and control of pollution) act 1981		
Marks: 10	***Unit-3 Noise Pollution:***	*Allotted Hrs: 02*
Noise pollution: sources of pollution, measurement of pollution level, Effects and Control of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000		
Marks: 20	***Unit- 4Water and Soil Pollution:***	*Allotted Hrs: 06*
Water pollution and Sources of water pollution, Types of water pollutants, Characteristics of water pollutants,control measures of water pollution. Definition and list unit operations in water and WasteWater Treatment process,Water (prevention and control of pollution) act 1974, Water conservation – Importance of Rain Water Harvesting. Soil pollution, Causes, Effects and Preventive measures of Soil Pollution due to Excessive use of Fertilizers, Pesticides and Insecticides		
Marks: 20	***Unit-5 Renewable sources of Energy***	*Allotted Hrs: 07*
Solar Energy: Basics of Solar energy. Definition and advantages of advanced solar collectors. Solar water heater and Solar stills and their uses. *Biomass:* Overview of biomass as energy source. Thermal characteristics of biomass as fuel. *Wind energy:* Current status and future prospects of wind energy. Wind energy in India. Need of new Energy sources, Different type's new energy sources. Environmental benefits of New Energy Sources-Hydrogen energy, Ocean energy resources, Tidal energy conversion.		
Marks: 15	***Unit-6 Solid Waste Management and Environmental Acts***	*Allotted Hrs: 05*
Solid waste generation, Sources and characteristics of Municipal solid waste, Solid Waste Management rules 2016- 3R in SWM. E- Waste generation, Sources and characteristics, E waste management rules 2016 Plastic Waste generation, Sources and characteristics, Recycled plastic rules 2016 Importance of Environment (protection) act 1986 Occupational health and safety measures.		

Unit No & Name	Detailed Course Content	CO	PO	Contact Hrs
1. Ecosystem	Structure of ecosystem, Biotic & Abiotic components, Aquatic (Lentic and Lotic) and terrestrial ecosystem.	CO1	1,5,7	1
	Global warming - Causes, effects.	CO1	1,5,7	2
	Green House Effect, Ozone depletion - Causes, effects	CO1	1,5,7	3
2. Air and Pollution	Air pollution, Natural sources of air pollution, Man Made sources of air pollution	CO2	1,5,7	4
	Air pollutants and Types, Effects of Particulate Pollutants and control by Cyclone separator	CO2	1,5,7	5
	Effects of Particulate Pollutants and control by Electrostatic Precipitator, Air (prevention and control of pollution) act 1981.	CO2	1,5,7	6
3. Noise Pollution	Noise pollution: sources of pollution, Measurement of Noise pollution level.	CO3	1,5,7	7
	Effects and Control of Noise pollution. Noise pollution (Regulation and Control) Rules, 2000	CO3	1,5,7	8

4. Water and Soil Pollution:	Sources of water pollution. Types of water pollutants, Characteristics of water pollutants.	CO4	1,5,7	9
	Control measures of water pollution.	CO4	1,5,7	10
	Definition and list unit operations in water and WasteWater Treatment process, Water (prevention and control of pollution) act 1974.	CO4	1,5,7	11
	Water conservation – Importance of Rain Water Harvesting	CO4	1,5,7	12
	Soil pollution, Causes and Effects due to Fertilizers, Pesticides and Insecticides	CO4	1,5,7	13
	Preventive measures of Soil Pollution due to Excessive use of Fertilizers, Pesticides and Insecticides.	CO4	1,5,7	14
5. Renewable sources of Energy	Solar Energy: Basics of Solar energy. Solar collectors and advantages of Advanced solar collectors.	CO5	1,5,7	15
	Solar water heater, Solar stills and their uses.	CO5	1,5,7	16
	Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel.			17
	Wind energy: Current status and future prospects of wind energy. Wind energy in India.	CO5	1,5,7	18
	Need of new Energy sources, Different type's new energy sources. Environmental benefits of New Energy Sources-Hydrogen energy	CO5	1,5,7	19
	Environmental benefits of New Energy Sources- Ocean energy resources	CO5	1,5,7	20
	Environmental benefits of New Energy Sources-Tidal energy conversion.	CO5	1,5,7	21
6. Solid Waste Management and Environmental Acts	Solid waste generation, Sources, Characteristics of solid waste Solid Waste Management rules 2016	CO6	1,5,7	22
	E- Waste generation Sources and characteristics, E waste management rules 2016	CO6	1,5,7	23
	Plastic Waste generation Sources and characteristics, Plastic Waste Sources and characteristics	CO6	1,5,7	24
	Recycled plastic rules 2016,Importance of Environment (protection) act 1986,	CO6	1,5,7	25
	Occupational health and safety measures.	CO6	1,5,7	26
			Total	**26**

References:

(a) Suggested Learning Resources:

Books:

1. S.C. Sharma & M.P. Poonia, Environmental Studies,Khanna Publishing House,NewDelhi
2. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
3. Arceivala, Soli Asolekar, Shyam, Wastewater Treatment for Pollution Control and Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099.
4. Nazaroff, William, Cohen, Lisa, Environmental Engineering Science, Willy, New York, 2000, ISBN 10: 0471144940.
5. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi

6. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.
1. Rao, M. N.Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988, ISBN: 0-07- 451871-8.
2. Frank Kreith, Jan F Kreider, Principles of Solar Engineering, McGraw-Hill, New York ; 1978, ISBN: 9780070354760.
7. Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK; 2013. ISBN: 9780123978257.
3. Patvardhan, A.D, Industrial Solid Waste, Teri Press, New Delhi, 2013, ISBN:978-81-7993-502-6
4. Metcalf & Eddy, Waste Water Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.
5. Keshav Kant, Air Pollution & Control, Khanna Publishing House, New Delhi (Edition 2018)

(b) Open source software and website address:

1) www.eco-prayer.org
2) www.teriin.org
3) www.cpcp.nic.in
4) www.cpcp.gov.in
5) www.indiaenvironmentportal.org.in
6) www.whatis.techtarget.com
7) www.sustainabledevelopment.un.org
8) www.conserve-energy-future.com

Teachers should use the following strategies to achieve the various outcomes of the course.

• Different methods of teaching and media to be used to attain classroom attention.
• Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
• 15-20% of the topics which are relatively simpler or descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
• Micro-projects may be given to group of students for hand-on experiences
• Encouraging students to visit sites such as Railway station and research establishment around the institution.

Mapping of Course Outcomes with Programme Outcomes

CO	Course Outcome	PO Mapped	Cognitive Level R/U/A	Theory Sessions In Hrs	Allotted marks for CIE on cognitive levels		TOTAL
					R	U	
CO1	Importance Of ecosystem and terminology	1,5,7	R,U	03	02	02	04
CO2	The extent of air pollution, effects, control measures and acts.	1,5,7	R,U	03	03	02	05
CO3	The extent of noise pollution, effects, control measures and acts.	1,5,7	R,U	02	03	02	05
CO4	The water and soil pollution, effects, control measures and acts	1,5,7	R,U	06	03	02	05

CO5	Different renewable energy resources and efficient process of harvesting.	1,5,7	R,U	07	03	02	05
CO6	Solid Waste Management and Environmental acts.	1,5,7	R,U	05	02	04	06
Total Hours of instruction				**26**	**30**		

R-Remember; U-Understanding;.

Level of Mapping PO's with CO's

Course	**CO's**	**Programme Outcomes (PO's)**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Environmental Science	**CO1**	3	0	0	0	2	0	1
	CO2	3	0	0	0	2	0	1
	CO3	3	0	0	0	2	0	1
	CO4	3	0	0	0	2	0	1
	CO5	3	0	0	0	2	0	1
	CO6	3	0	0	0	2	0	1

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped

Method is to relate the level of PO with the number of hours devoted to the CO s which maps the given PO.
If ≥50% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 3
If 30 to 50% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 2
If 5 to 30% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 1
If < 5% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is considered not mapped i.e. Level 0

Course Assessment and Evaluation Chart

Sl. No	**Assessment**	**Duration**	**Max marks**	**Conversion**
1.	CIE Assessment 1 (Written Test -1 - At the end of 3 d week	80 minutes	30	Average of three written tests 30
2.	CIE Assessment 2 (Written Test -2) - At the end of 7 week	80 minutes	30	
3.	CIE Assessment 3 (Written Test -3) - At the end of 13 week	80 minutes	30	
4	CIE Assessment 4 (MCQ/Quiz) - At the end of 5 week	60 minutes	20	Average of three 20
5	CIE Assessment 5 (Open book Test) - At the end of 9 week	60 minutes	20	
6	CIE Assessment 6 (Student activity/Assignment)- At the end of 11 week	60 minutes	20	
7.	Total Continuous Internal Evaluation (CIE) Assessment			50
Total Marks				**50**

Note:

1. Average marks of Three CIE shall be rounded off to the next higher digit.
2. Assessment of assignment and student activity is evaluated through appropriate rubrics by the respective course coordinator. The secured mark in each case is rounded off to the next higher digit.

MANDATORY STUDENT ACTIVITY: EACH STUDENT HAS TO SELECT ANY ONE OF THE LISTED

1. Students chose one thing to reduce at home each week and write journal entries about their successes and challenges implementing the change. In class, they form groups and create "Do You Know?" posters.
2. Students pretend they are architects, and come up with a series of design changes to make their school more environmentally friendly. They then grade their projects according to a rubric.
3. A presentation for Green Team Club members to introduce themselves and the purpose of their club. They explain how to use their new recycling bins, in the classroom and in the cafeteria.
4. Ever wonder what's in your school's waste? This hands-on activity helps students assess their school's waste in order to think of ways to reduce it. The results can be incorporated into the school's recycling plan.
5. How do we measure climate change? What activities contribute to climate change?
6. 6. Start a compost or worm bin. Composting is a hands-on way to learn about important life science concepts such as ecosystems, food webs and biodegradation. Students experience how worms and other decomposers recycle fruits and vegetable scraps into compost. Use the compost in your college garden! Have green team students make up a skit and present details about the new composting program to all classrooms. Have them make signs for the bins (compost, recycle, and landfill), monitor the waste collection at lunchtime, cart the food waste to the compost, and decide how and where the compost will be used.
7. Paint posters and decorate bulletin boards or the doors to the cafeteria with waste- free lunch messages to announce or support a waste-free event, and have students vote for their favorite poster.
8. Conduct a classroom audit to identify waste and look for ideas to reduce and reuse. Empower the student to set goals, search for solutions and review progress.
9. Go on a field trip. Visit your local landfill, recycling center, or a nearby composing facility where the students can see first-hand what is happening to waste, and learn about the lifecycle of waste and its affect on the environment.
10. Home energy audit:Have students make a list of all the appliances and light bulbs in their house. How much energy does their house use if all the lights are on for 4 hours per day? If their appliances are on for 2 hours per day? How much energy could they save if they switched to energy-efficient appliances or lightbulbs?
11. Use recycled material in art projects:Recycled materials can make beautiful art projects such as jewelry, planters, and bird houses. Incorporating materials that would otherwise be thrown away into art projects can show your students how to find new uses for these items.

12. Life cycle :One way to show students what happens when you put something in the trash versus recycling or reusing the object is to do a life cycle analysis. This is a flow chart that shows the environmental impacts of an object, from extracting the raw materials to decomposition and everything in between. When something is put in the trash instead of being reused or recycled, the life cycle assessment will show a bigger environmental impact. When something is reused or recycled, the environmental impact is less because raw materials don't need to be extracted to create something new.

Model Question Paper
I A Test (CIE)

Programme :	**Semester: I**
Course :	**Max Marks : 30**
Course Code :	**Duration : 1 Hr 20 minutes**
Name of the course coordinator:	**Test : I/II/III**

Note: Answer one full question from each section. One full question carries 10 marks.

Qn.No	Question	CL	CO	PO	Marks
	Section-1				
1.a)					
b)					
c)					
2.a)					
b)					
c)					
	Section-2				
3.a)					
b)					
c)					
4.a)					
b)					
c)					
	Section-3				
5.a)					
b)					
c)					
6.a)					
b)					
c)					