



ಕರ್ನಾಟಕ ಸರ್ಕಾರ

GOVERNMENT OF KARNATAKA

ಕಾಲೇಜು ಮತ್ತು ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ಇಲಾಖೆ

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

**C-20
2020-21**

Diploma in Automobile 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 globally competitive Automobile technologists with social and moral values to work successfully in the fields of integration, production and maintenance of Automobiles.

Mission

(To be drafted individually at institution level)

(The mission of the Automobile Engineering Program is to benefit the society at large by)

- ✚ **M1:** To produce Automobile diploma graduates who are trained in integration, production, testing and maintenance of Automobiles through Outcome Based curriculum in collaboration with industry and other stake holders
- ✚ **M2:** To equip students with the fundamental concepts, practical knowledge and professional ethics through innovative practices leading to proficiency in the field of Automobile Engineering.
- ✚ **M3:** To provide Computer Aided Engineering software skills and knowledge on pollution, safety and alternate renewable energy resources for sustainable industrial growth.
- ✚ **M4:** To encourage Ethical values and Leadership abilities in the minds of students so as to work towards the growth of the society.

Programme Educational Objectives (PEOs)

(To be drafted individually at institution level)

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

1. Pursue a successful career in the field of Automobile Engineering or a related field utilizing his/her education and contribute to the profession as an excellent employee, or as an entrepreneur.
2. Be aware of the developments in the field of Automobile Engineering by continuously enhancing their knowledge informally.
3. Identify various short comings in the field of Automobile engineering and develop new innovative solutions and products to solve the same.
4. Be able to work effectively in multidisciplinary and multicultural environments contributing positively to the needs of an individual & society at large.

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:** Identify 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	Pursue a successful career in the field of Automobile Engineering or a related field utilizing his/her education and contribute to the profession as an excellent employee, or as an entrepreneur.	3		3		3		
2	Be aware of the developments in the field of Automobile Engineering by continuously enhancing their knowledge informally.		3		3			
3	Identify various short comings in the field of Automobile engineering and develop new innovative solutions and products to solve the same.		3		3		3	3
4	Be able to work effectively in multidisciplinary and multicultural environments contributing positively to the needs of an individual & society at large.	3	3	3	3	3	3	3

PROGRAM SPECIFIC OUTCOMES (PSOs)

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

1. To Apply knowledge of core areas of Automobile Engineering to solve technical issues of society and environment based on the facilities available in Institutions.

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 prescribed syllabus, 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 and adopt 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 Automobile Engineering, which is of three years duration.

2.0 PROGRAMME STRUCTURE

- Course:** A Course is a component (a paper) of a Programme. All the courses need not carry same 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.
- Course Code:** Each course shall have an alphanumeric code, which includes last two digits of year of introduction such as 20 subject code AT (AT for Automobile 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 ...).
- 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.
 - 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.
 - 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:

Cours e 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, HoD's etc.	Playground 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 Bharath abhiyan-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.	<ul style="list-style-type: none"> 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 exam 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 exam duration). 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)=	$\frac{\sum[(\text{Course Credits earned}) \times (\text{Grade Points})] \text{ for all the courses in that semester}}{\sum[\text{Total Course credits applied}] \text{ for all the courses in that semester}}$
Cumulative Grade Point Average (CGPA)=	$\frac{\sum[(\text{Course Credits earned}) \times (\text{Grade Points})] \text{ for all courses, excluding those with F*/F** grades until that semester}}{\sum[\text{Total Course Credits earned}] \text{ for all Courses excluding those with F*/F** grades until that semester}}$
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

Semest er	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 1 st semester grade/marks card only SGPA is reported. From 2 nd semester onwards both SGPA & CGPA will be reported in the grade/marks card.								
Semest er	Course Code	Credits Applied (CA)	Result Grade	Grade Points (GP)	Credits Earned (CE)	Credit points(CP=C E x GP)	SGPA, CGPA	
II	Course 1	4	B	7	4	4x7=28	SGPA=CP/CA =100/19 = 5.26	
II	Course 2	4	A	9	4	4x9=36		
II	Course 3	3	D	4	3	3x4=12		
II	Course 4	3	Absent (F)	0	0	0x0=00		
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
ΣCP	110	136	184	155	191	188	964

$$CGPA = \frac{[110+136+184+155+191+188]}{22+19+22+24+24+24} = \frac{964}{137} = 7.04$$

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 $P \geq 70\%$
- (ii) First Class (FC) if $P \geq 60\%$ but $<70\%$ and
- (iii) Second Class (SC) if $P < 60\%$.

**SCHEME OF STUDIES
DIPLOMA IN AUTOMOBILE
ENGINEERING
(C-20)**

CURRICULUM STRUCTURE

I Semester Scheme of Studies - Diploma in Automobile Engineering [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 1 st Semester
1	BS/SC	20SC01T	Engineering Mathematics	4	0	0	4	4	50	20	50	20	100	40			
2	ES/AT	20AT11T	Mechanical Science & Engineering	4	0	0	4	4	50	20	50	20	100	40			
PRACTICAL COURSES																	
3	EG/SC/AT	20EG01P	Communication Skills	2	0	4	6	4	60	24	40	16	100	40			
4	ES/ME/AT	20ME01P	Computer Aided Engineering Drawing	2	0	4	6	4	60	24	40	16	100	40			
AUDIT COURSES																	
5	AU/SC	20AU01T	Environment 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 1 st 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	8	22	18	270	108	180	72	450	180			

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

Note:

- Assigned Grade, Grade Point, SGPA and CGPA to be recorded in the Grade/Marks card.
- 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).
- Theory course Semester End Examination (SEE) is conducted for 100 marks (3 Hours duration)
- Practical course CIE and SEE is conducted for 100 marks (3 hours duration)

II Semester Scheme of Studies - Diploma in Automobile Engineering [C-20]

Sl. No	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 marks)	Assigned Grade	Grade Point	SGPA and CGPA	
				L	T	P			Max	Min	Max	Min						
THEORY COURSES																		
1	SC/AT	20PM01T	Project Management Skills	2	0	4	6	4	50	20	50	20	100	40			SGPA & CGPA of 2 nd Semester	
PRACTICAL COURSES																		
2	BS/SC	20SC02P	Statistics and Analytics	2	0	4	6	4	60	24	40	16	100	40				
3	ES/EE	20EE01P	Fundamentals of Electrical & Electronics Engineering	2	0	4	6	4	60	24	40	16	100	40				
4	ES/CS	20CS01P	IT Skills	2	0	4	6	4	60	24	40	16	100	40				
5	ES/AT	20AT21P	Automotive Engines	2	0	4	6	4	60	24	40	16	100	40				
AUDIT COURSES																		
6	AU/KA	20KA21T	Kannada-I/ಸಾಹಿತ್ಯ ಸಿಂಚನ - I /ಬಳಕೆ ಕನ್ನಡ - I	2	0	0	2	2	50	20	-	-	50	20				
Total				12	0	20	32	22	340	136	210	84	550	220				

T:- Theory P:- Practical D:- Drawing E:- Elective BS- 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. Theory course Semester End Examination (SEE) is conducted for 100 marks (3 Hours duration)
3. 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	20SC01T	Semester	I/II
Course Title	ENGINEERING MATHEMATICS	Course Group	Core
No. of Credits	4	Type of Course	Lecture
Course Category	Theory	Total Contact Hours	4Hrs Per Week
			52Hrs Per Semester
Prerequisites	10 th Level Mathematics	Teaching Scheme	(L:T:P) = 4:0:0
CIE Marks	50	SEE Marks	50

RATIONALE

Engineering Mathematics specification provides students with access to important mathematical ideas to develop the mathematical knowledge and skills that they will draw on in their personal and work lives. The course enable students to develop mathematical conceptualization, inquiry, reasoning, and communication skills and the ability to use mathematics to formulate and solve problems in everyday life, as well as in mathematical contexts. At this level, the mathematics curriculum further integrates the three content areas taught in the higher grades into three main learning areas: Algebra; Measurement of angles and Trigonometry and Calculus.

1. COURSE SKILL SET

Student will be able to:

1. Solve system of linear equations arise in different engineering fields
2. Incorporate the knowledge of calculus to support their concurrent and subsequent engineering studies
3. Adept at solving quantitative problems
4. Ability to understand both concrete and abstract problems
5. Proficient in communicating mathematical ideas
6. Detail-oriented

2. COURSE OUT COMES

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

CO1	Determine the inverse of a square matrix using matrix algebra. Apply the concepts of matrices and determinants to solve system of linear equations and find eigen values associated with the square matrix.
CO2	Find the equation of straight line in different forms. Determine the parallelism and perpendicularity of lines.
CO3	Calculate trigonometric ratios of allied angles and compound angles. Transform sum or difference of trigonometric ratios into product and vice versa.

CO4	Differentiate various continuous functions and apply the concept in real life situations.
CO5	Integrate various continuous functions and apply the concept in evaluating the area and volume through definite integrals.

3. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS

UNIT NO	UNIT TITLE	TEACHING HOURS	DISTRIBUTION (THEORY)			
			R LEVEL	U LEVEL	A LEVEL	TOTAL
1	Matrices and Determinants	10	8	20	12	40
2	Straight lines	10	8	20	12	40
3	Trigonometry	10	8	20	12	40
4	Differential Calculus and applications	11	8	20	12	40
5	Integral Calculus and applications	11	8	20	12	40
	Total	52	40	100	60	200

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

4. 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 MATRICES AND DETERMINANTS	➤ Use algebraic skills which are essential for the study of systems of linear equations, matrix algebra and eigen values	1.1 Matrix and types 1.2 Algebra of Matrices (addition, subtraction, scalar multiplication and multiplication) 1.3 Evaluation of determinants of a square matrix of order 2 and 3. Singular matrices 1.4 Cramer's rule for solving system of linear equations involving 2 and 3 variables 1.5 Adjoint and Inverse of the non-singular matrices of order 2 and 3 1.6 Characteristic equation and Eigen values of a square matrix of order 2	10-0-0

UNIT-2 STRAIGHT LINES	<ul style="list-style-type: none"> ➤ Able to find the equation of a straight line in different forms ➤ Determine whether the lines are parallel or perpendicular 	2.1 Slope of a straight line 2.2 Intercepts of a straight line 2.3 Intercept form of a straight line 2.4 Slope-intercept form of a straight line 2.5 Slope-point form of a straight line 2.6 Two-point form of a straight line 2.7 General form of a straight line 2.8 Angle between two lines and conditions for lines to be parallel and perpendicular 2.9 Equation of a straight line parallel to the given line 2.10 Equation of a straight line perpendicular to the given line	10-0-0
UNIT-3 TRIGONOMETRY	<ul style="list-style-type: none"> ➤ Use basic trigonometric skills in finding the trigonometric ratios of allied and compound angles ➤ Able to find all the measurable dimensions of a triangle 	3.1 Concept of angles, their measurement, Radian measure and related conversions. 3.2 Signs of trigonometric ratios in different quadrants (ASTC rule) 3.3 Trigonometric ratios of allied angles (definition and the table of trigonometric ratios of standard allied angles say $90^\circ \pm \theta$, $180^\circ \pm \theta$, $270^\circ \pm \theta$ and $360^\circ \pm \theta$) 3.4 Trigonometric ratios of compound angles (without proof) 3.5 Trigonometric ratios of multiple angles 3.6 Transformation formulae	10-0-0
UNIT-4 DIFFERENTIAL CALCULUS AND APPLICATIONS	<ul style="list-style-type: none"> ➤ Able to differentiate algebraic, exponential, trigonometric, logarithmic and composite functions ➤ Able to find higher order derivatives ➤ Understand and work with derivatives as rates of change in mathematical models ➤ Find local maxima and minima of a function 	4.1 Derivatives of continuous functions in an interval (List of formulae) 4.2 Rules of differentiation 4.3 Successive differentiation (up to second order) 4.4 Applications of differentiation	11-0-0
UNIT-5 INTEGRAL CALCULUS AND APPLICATIONS	<ul style="list-style-type: none"> ➤ Understand the basic rules of integration and Evaluate integrals with basic integrands. 2. Identify the methods to evaluate integrands 3. Apply the skills to evaluate integrals representing areas and volumes 	5.1 List of standard integrals and Basic rules of integration 5.2 Evaluation of integrals of simple function and their combination 5.3 Methods of integration 5.4 Concept of definite integrals 5.5 Applications of definite integrals	11-0-0

5. MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	UNIT Linked	CL R/U/A	Theory in Hrs	TOT AL
C01	Determine the inverse of a square matrix using matrix algebra. Apply the concepts of matrices and determinants to solve system of linear equations and find eigen values associated with the square matrix.	1, 7	1	R/U/A	10	40
C02	Find the equation of straight line in different forms. Determine the parallelism and perpendicularity of lines.	1, 7	2	R/U/A	10	40
C03	Calculate trigonometric ratios of allied angles and compound angles. Transform sum (difference) of trigonometric ratios into product and vice versa.	1, 7	3	R/U/A	10	40
C04	Differentiate various continuous functions and apply the concept in real life situations.	1, 3, 7	4	R/U/A	11	40
C05	Integrate various continuous functions and apply the concept in evaluating the area and volume through definite integrals.	1, 3, 7	5	R/U/A	11	40
					52	200

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
ENGINEERING MATHEMATICS	C01	3	1	0	0	0	0	3
	C02	3	1	0	0	0	0	3
	C03	3	1	0	0	0	0	3
	C04	3	1	3	0	0	0	3
	C05	3	1	3	0	0	0	3
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped								

7. INSTRUCTIONAL STRATEGY

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes

1. Explicit instruction will be provided in intervention classes or by using different differentiation strategies in the main classroom.
2. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching method and media that are employed to develop the outcomes.
3. Observing the way their more proficient peers use prior knowledge to solve current challenges and persevere in problem solving will help struggling students to improve their approach to engaging with rich contextual problems.
4. Ten minutes a day in homeroom, at the end of class, or as a station in a series of math activities will help students build speed and confidence.
5. Topics will be introduced in a multiple representation.
6. The teacher is able to show different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. In a perfect world, teacher would always be able to demonstrate how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding. When a concept cannot be applied in that manner, we can still share how it might be applied within mathematics.

8. SUGGESTED LEARNING RESOURCES:

Sl. No.	Author	Title of Books	Publication/Year
1	B.S. Grewal	Higher Engineering Mathematics	Khanna Publishers, New Delhi, 40th Edition, 2007
2	G. B. Thomas, R. L. Finney	Calculus and Analytic Geometry	Addison Wesley, 9th Edition, 1995
3	S.S. Sabharwal, Sunita Jain, Eagle Parkashan	Applied Mathematics, Vol. I & II	Jalandhar.
4	Comprehensive Mathematics	Comprehensive Mathematics Vol. I & II	Laxmi Publications, Delhi
5	Reena Garg & Chandrika Prasad	Advanced Engineering Mathematics	Khanna Publishing House, New Delhi

9. COURSE ASSESSMENT AND EVALUATION CHART

Sl.No.	Assessment	Duration	Max marks	Conversion
1	CIE Assessment 1 (Written Test -1) At the end of 3 rd week	80 minutes	30	Average of three written tests 30
2	CIE Assessment 2 (Written Test -2) At the end of 7 th week	80 minutes	30	
3	CIE Assessment 3 (Written Test -3) At the end of 13 th week	80 minutes	30	
4	CIE Assessment 4 (MCQ/Quiz) At the end of 5 th week	60 minutes	20	Average of three 20
5	CIE Assessment 5 (Open book Test) At the end of 9 th week	60 minutes	20	
6	CIE Assessment 6 (Student activity/Assignment) At the end of 11 th week	60 minutes	20	
Total Continuous Internal Evaluation (CIE) Assessment				50
8	Semester End Examination (SEE) Assessment (Written Test)	3 Hours	100	50
Total Marks				100

Note:

1. SEE (Semester End Examination) is conducted for 100 Marks theory courses for a time duration of 3 Hours.
2. Three CIE (written test), each of 30 marks for a time duration of 80 minutes shall be conducted. Also, three CIE (MCQ or Quiz/Open book test/student activity or assignment) each of 20 marks for the time duration of 60 minutes shall be conducted. Any fraction at any stage during evaluation will be rounded off to the next higher digit
3. 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.

10 DETAILED COURSE CONTENT

UNIT NO AND NAME	DETAILED COURSE CONTENT	CO	PO	CONTACT HRS	TOTAL
1 MATRICES AND DETERMINANTS	Definition and types of matrices	1	1,7	1	10
	Algebra of Matrices (addition, subtraction and scalar multiplication) problems	1	1,7	1	
	Multiplication of Matrices(problems)	1	1,7	1	
	Evaluation of 2x2 ,3x3 determinants and Singular matrices and problems in finding unknown variable	1	1,7	1	
	Cramer's rule to solve system of linear equation with 2 and 3 variables	1	1,7	1	
	Cramer's rule to solve system of linear equation with 2 and 3 variables.problems	1	1,7	1	
	Minors, Cofactors of elements of square matrices of order 2 and 3	1	1,7	1	
	Adjoint of a square matrix(2x2 and 3x3),Inverse of a non singular square matrix	1	1,7	1	
	Adjoint of a square matrix(2x2 and 3x3),Inverse of a non singular square matrix and problems	1	1,7	1	
	Characteristic equation and eigen values of a 2x2 matrix and problems	1	1,7	1	
2 STRAIGHT LINES	Slope of the straight line(provided with inclination and two points on the line as well) and problems	2	1,7	1	10
	Intercepts of a straight line and problems	2	1,7	1	
	Intercept form of a straight line and problems	2	1,7	1	
	Slope-intercept form of a straight line and problems	2	1,7	1	
	Slope-point form of the straight line and problems	2	1,7	1	
	Two-point form of a straight line and problems	2	1,7	1	
	General form of a straight line.problems on finding slope and intercepts.	2	1,7	1	
	Angle between two straight lines and conditions for the lines to be parallel and perpendicular and problems	2	1,7	1	
	Equation of a line parallel to the given line and problems	2	1,7	1	
	Equation of a line perpendicular to the given line.problems	2	1,7	1	

3	TRIGONOMETRY	Concept of angles and their measurement. Radian measures and related conversions (degree to radian and vice-versa) and problems	3	1,7	1	10
		Signs of trigonometric ratios in different quadrants (ASTC rule)	3	1,7	1	
		Trigonometric ratios of allied angles (definition and the table of trigonometric ratios of standard allied angles say $90^\circ \pm \theta$, $180^\circ \pm \theta$, $270^\circ \pm \theta$ and $360^\circ \pm \theta$)	3	1,7	1	
		Problems on allied angles. (proving identities)	3	1,7	1	
		Problems on allied angles. (Finding values of x in an identity)	3	1,7	1	
		Trigonometric ratios of compound angles (without proof)	3	1,7	1	
		Trigonometric ratios of multiple angles ($\sin 2A$, $\cos 2A$, $\tan 2A$, $\sin 3A$, $\cos 3A$ and $\tan 3A$)	3	1,7	1	
		Problems on multiple angles $\sin 2A$, $\cos 2A$, $\tan 2A$, $\sin 3A$, $\cos 3A$ and $\tan 3A$	3	1,7	1	
		Transformation formulae (without proof) as sum to product. (Simple problems)	3	1,7	1	
		Transformation formulae (without proof) as product to sum. (Simple problems)	3	1,7	1	
4	DIFFERENTIAL CALCULUS AND APPLICATIONS	Definition of a derivative of a function. Listing the derivatives of standard functions. (Algebraic, trigonometric, exponential, logarithmic and inverse trigonometric functions)	4	1,3,7	1	11
		Addition and subtraction rule of differentiation and problems	4	1,3,7	1	
		Product rule and quotient rule of differentiation and problems	4	1,3,7	1	
		Product rule and quotient rule of differentiation and problems	4	1,3,7	1	
		Composite functions and their derivatives. (CHAIN RULE)	4	1,3,7	1	
		Composite functions and their derivatives. (CHAIN RULE). Problems	4	1,3,7	1	
		Successive differentiation up to second order	4	1,3,7	1	
		Slope of the tangent and normal to the given curve and their equations and problems	4	1,3,7	1	

	Rate measure: velocity and acceleration at a point of time and problems	4	1,3,7	1	
	Local Maxima and Minima of a function	4	1,3,7	1	
	Local Maxima and Minima of a function. Problems	4	1,3,7	1	
5 INTEGRAL CALCULUS AND APPLICATIONS	Definition of an indefinite integral. Listing the Integrals of standard functions. (Algebraic, trigonometric, exponential, logarithmic and inverse trigonometric functions)	5	1,3,7	1	11
	Rules of Integration. Evaluation of integrals with simple integrands and their combinations	5	1,3,7	1	
	Rules of Integration. Evaluation of integrals with simple integrands and their combinations. Problems	5	1,3,7	1	
	Evaluation of integrals with simple integrands and their combinations. Problems	5	1,3,7	1	
	Evaluation of integrals by Substitution method	5	1,3,7	1	
	Evaluation of integrals by Integration by parts	5	1,3,7	1	
	Evaluation of integrals by Integration by parts. Problems	5	1,3,7	1	
	Definition of definite integrals and their evaluation	5	1,3,7	1	
	Evaluation of Definite integrals. Problems	5	1,3,7	1	
	Area enclosed by the curves by integral method	5	1,3,7	1	
	Volume generated by the curve rotated about an axis by integral method	5	1,3,7	1	

First Semester Examination, Model Question Paper – 2020

Engineering Mathematics

Duration: 3Hours]

Subject Code: 20SC01T

[Max. Marks:100

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

SECTION – 1

- 1**
- a** If the matrix $\begin{bmatrix} 2 & 4 & 6 \\ 2 & x & 2 \\ 6 & 8 & 14 \end{bmatrix}$ is singular then find x . **4**
- b** Find the A^2 for the matrix $\begin{bmatrix} 1 & 3 & 4 \\ -1 & 2 & 1 \\ 0 & 3 & 3 \end{bmatrix}$. **5**
- c** Solve $2x - y = 3$ and $x + 2y = 4$ by using determinant method. **5**
- d** Find the inverse of the matrix $\begin{bmatrix} 2 & 3 & 1 \\ -1 & 2 & 1 \\ 5 & 4 & 3 \end{bmatrix}$. **6**
- 2**
- a** If $A = \begin{bmatrix} 2 & -1 \\ 4 & 0 \\ 1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -3 & 4 \\ -1 & -1 & 1 \\ 0 & 4 & 2 \end{bmatrix}$ then find $(AB)^T$. **4**
- b** Verify whether $AB=BA$ for the matrices $A = \begin{bmatrix} 1 & 0 & 5 \\ -1 & 2 & 1 \\ 5 & 4 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 & 4 \\ 0 & -1 & 1 \\ 2 & 4 & -2 \end{bmatrix}$. **5**
- c** Find the Adjoint of the matrix $A = \begin{bmatrix} 1 & 3 & 4 \\ -1 & 2 & 1 \\ 0 & 3 & 3 \end{bmatrix}$. **5**
- d** Find the characteristic equation and eigen values for the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix}$. **6**

SECTION – 2

- 3**
- a** If the straight line is passing through the points (1, 2) and (3, 5) then find the slope of the line. **4**
- b** Write the standard intercept form of the straight line and hence find the equation of the straight line whose x and y intercepts are 2 and 3 respectively. **5**
- c** Write the standard slope-intercept form of a straight line. Find the equation of the straight line passing through the point (3, 5) and slope 4 units. **5**
- d** Find the equation of the straight line parallel to the line passing through the points (1, 3) and (4, 6). **6**
- 4**
- a** i) If a line inclined at 45° with x-axis find its slope. ii) Write the x and y intercept of the line $2x+3y=10$. **2+2**
- b** Find the equation of the straight line whose angle of inclination is 45° and passing through the origin. **5**
- c** Find the equation of the straight line perpendicular to the line $2x+6y=3$ and with the y intercept 2 units. **5**
- d** Find the acute angle between the lines $7x-4y=0$ and $3x-11y+5=0$. **6**

SECTION – 3

- 5**
- a** Express 75° in radian measure and $3\pi/2$ in degree. **4**
- b** Prove that $\cos(A+B)\cos(A-B) = \cos^2 A - \sin^2 B$. **5**
- c** Show that $\cos 2\theta = 2\cos^2 \theta - 1$. **5**

- d** Find the value of $\sin 120^\circ \cdot \cos 330^\circ - \sin 240^\circ \cdot \cos 390^\circ$ without using calculator. **6**
- 6 a** Find the value of $\sin 15^\circ$. **4**
- b** Simplify $\frac{\cos(360^\circ - A) \tan(360^\circ + A)}{\cot(270^\circ - A) \sin(90^\circ + A)}$. **5**
- c** Prove that $\sin 3\theta = 3\sin \theta - 4\sin^3 \theta$. **5**
- d** Prove that $\sin 20^\circ \cdot \sin 40^\circ \cdot \sin 80^\circ = \frac{\sqrt{3}}{8}$. **6**

SECTION – 4

- 7 a** Find the derivative of $y = x^2 + e^{2x} + \cos 2x - 2 \log x$ with respect to x . **4**
- b** Find dy/dx of $y = \frac{\sec x + \tan x}{\sec x - \tan x}$. **5**
- c** Find dy/dx of $y = \tan^{-1} \left(\frac{1+x}{1-x} \right)$. **5**
- d** If the $s = 2x^3 + 3x + 4$ represents the displacement of the particle in motion at time x , then find the velocity of the particle at $x = 2$ secs and acceleration at $x = 3$ secs. **6**
- 8 a** Find $\frac{dy}{dx}$ of $y = 3x^4 + 4 \log x + 2e^{3x} + \tan^{-1} x$. **4**
- b** If $y = e^{2x} \sin 3x$ then find $\frac{dy}{dx}$. **5**
- c** Find $\frac{d^2 y}{dx^2}$ if $y = 3 \sin x + 4 \cos x$ at $x = 1$. **5**
- d** Find the equation of tangent and normal to the curve $y = x^2$ at the point $(1, 1)$. **6**

SECTION – 5

- 9 a** Evaluate $\int (x-1)(x+1)dx$. **4**
- b** Evaluate $\int_0^{p/2} \sin^2 x \, dx$ **5**
- c** Evaluate $\int x \sin x \, dx$. **5**
- d** Find the area bounded by the curve $y = 4x - x^2 - 3$, x-axis and ordinates $x = 1$ and $x = 3$. **6**
- 10 a** Evaluate $\int_0^2 e^x \, dx$. **4**
- b** Evaluate $\int \frac{4 \cos(\log x)}{x} \, dx$. **5**
- c** Evaluate $\int x e^x \, dx$. **5**
- d** Find the volume of the solid generated by revolving the curve $y = \sqrt{x^2 + 5x}$ between $x = 1$ and $x = 2$. **6**

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

Course Code	20AT11T	Semester	I
Course Title	MECHANICAL SCIENCE & ENGINEERING	Course Group	Core
No. of Credits	4	Type of Course	Lecturing & Practice
Course Category	PC	Total Contact Hours	4Hrs. Per Week
			52Hrs. Per Semester
Prerequisites	Basic sciences at matriculation level	Teaching Scheme	(L: T:P) = 4:0:0
CIE Marks	50	SEE Marks	50

RATIONALE:

Mechanical Sciences and Engineering play a critical role in manufacturing technologies, from cars to airplanes to refrigerators. It applies the principles of engineering to the design, analysis, manufacturing and maintenance of machines. It paves the way to have a lucrative career that benefits the society. Therefore, an engineering diploma student must be conversant with the behavior and mechanism of the materials from the point of view of reliability, sustainability and performance of the product. The study of basic concepts of mechanical sciences and engineering will help the students in understanding engineering subjects where the emphasis is laid on the application of these materials.

1. 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

- i. Select engineering materials based on properties, behavior and environmental effect for given engineering application.
- ii. Explore different shafts, keys, couplings, bearings and illustrate various types of drives and fastenings used in engineering/automobile application.
- iii. Understand different engine terminologies and working of 2-stroke and 4-stroke engine used in an automobile.

2. COURSE OUTCOMES

On successful completion of the course, the students will be able to demonstrate industry-oriented COS associated with the above-mentioned competency:

CO1	Discuss the various engineering materials with their properties and also different heat treatment processes
CO2	Explore the different types of shafts, keys, couplings and bearings
CO3	Describe different types of belt drives, chain drives and gear drives
CO4	Illustrate the different types of fastenings used in machine parts
CO5	Explain various engine terminologies of IC engines, different powers and efficiencies
CO6	Classify IC engines on various parameters and demonstrate working of 2 and 4 stroke SI and CI engines.

3. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

SL. No.	CO's	Units Mapped	Teaching Hours	Distribution of Theory Marks			
				R Level	U Level	A Level	Total
1	CO1 - Discuss the various engineering materials with their properties and also different heat treatment processes	1	12	25	10	10	45
2	CO2 - Explore the different types of shafts, keys, couplings and bearings	2	12	15	25	5	45
3	CO3 - Describe different types of belt drives, chain drives and gear drives	3	10	10	20	10	40
4	CO4 - Illustrate the different types of fastenings used in machine parts	4	06	5	10	5	20
5	CO5- Explain various engine terminologies of IC engines, different powers and efficiencies	5	06	10	10	5	25
6	CO6 - Classify IC engines on various parameters and demonstrate working of 2 and 4 stroke SI and CI engines.	6	06	5	15	5	25
		Total	52	70	90	40	200

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

4. 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 ENGINEERING MATERIALS AND THEIR PROPERTIES	<ol style="list-style-type: none"> Classify engineering materials with their properties. Identify and compare ferrous and nonferrous materials. Select relevant cast iron for the given job with justification. Select relevant steel for the given application. Describe the properties and application of the given copper alloy. Compare and explain different heat treatment processes. Select relevant Heat treatment process for the given material with justification. 	<ol style="list-style-type: none"> Classification of engineering materials. Selection of materials for engineering purposes. Physical properties of metals. Mechanical properties of metals. Ferrous metals - Cast Iron- Types of Cast Iron- Alloy cast iron. Effect of impurities on cast iron. Steel - Effect of impurities on steel-alloy steels. Stainless Steel - Types of stainless steel. Non-ferrous Metals - Types- Aluminum - Aluminum alloys. Copper - Copper Alloys, types. Bearing Metals – Types, properties. Non-metallic Materials - Rubber, glass, ceramics, polymers, composite materials - properties and application of each. Heat treatment - Aim of heat treatment. Heat treatment techniques. Annealing and its types. Normalising, hardening, tempering. Martempering, austempering, hardenability, surface hardening. Carburizing, nitriding, cyaniding, flame hardening and induction hardening. 	12-0-0

<p align="center">UNIT-2 SHAFTS, KEYS, COUPLINGS AND BEARINGS</p>	<ol style="list-style-type: none"> Describe the materials used for shafts and type of shafts used for specific application. Describe the applications of different types of keys used in automobile application. Explain different applications of couplings used for specific application. Describe the properties and application of the given bearing material. Demonstrate different types of bearings used in automobile. 	<ol style="list-style-type: none"> Introduction to shafts - Material used for shafts. Types of Shafts. Standard sizes of transmission shafts. Introduction to Keys - Types of Keys – Sunk keys - Types of Sunk keys. Saddle keys, tangent keys, round keys Construction and working of each type with neat sketch. Woodruff keys and splines –Construction and working of each type with sketch. Introduction to shaft couplings – Requirements of a good shaft coupling - Types of shaft couplings. Sleeve or Muff couplings - Construction and working with sketch. Flange Coupling - Construction and working with sketch. Introduction to bearings. Classification of bearings. Types of sliding contact bearings with advantages and disadvantages. Shell bearings - Roller contact bearings - Advantages and disadvantages. Ball bearings - Construction and working. Roller bearings - Construction and working. Thrust bearings - Construction and working. 	<p align="center">12-0-0</p>
<p align="center">UNIT-3 BELT DRIVES, CHAIN DRIVES AND GEAR DRIVES</p>	<ol style="list-style-type: none"> Select a belt drive system for specific application. Calculate the velocity ratio for the given belt drive. Describe the application of chain drive in automobile. Conceptualize with sketches the different gear trains used. 	<ol style="list-style-type: none"> Introduction to belt drives - Selection of belt drives - types of belt drives - types of belts- Materials used for belts. Types of flat belt drives - open belt drive, crossed or twist belt drive, belt drive with idler pulleys and compound belt drive. Velocity ratio of belt drive - Slip and creep of belt. V- belt drives Cross section of a V-belt with sketch - advantages and disadvantages of V-belt over flat belt drives. Chain drives - Advantages and disadvantages. Gears or Toothed wheels- advantages and disadvantages of gear drives. Types of gears- spur gears, bevel gears, helical gears, worm and worm wheel, rack and pinion with simple sketches. Velocity ratio in gear drive. Gear trains- Types of gear trains-, simple and compound gear trains Simple line sketch-speed ratio or velocity ratio of simple and compound gear trains. 	<p align="center">10-0-0</p>
<p align="center">UNIT-4 FASTENERS</p>	<ol style="list-style-type: none"> Distinguish between temporary and permanent fasteners with specific applications. 	<ol style="list-style-type: none"> Introduction to Fasteners - Types- Temporary and permanent. Screwed joint- advantages and disadvantages of screwed joint. Screw thread terminology or terms used in screw threads - Types of screw fastenings. Locking devices - Types of locking devices 	<p align="center">06-0-0</p>

	<ol style="list-style-type: none"> Analyze the different types of locking devices used in automobiles. Distinguish between Lap joint and Butt joint with their specific applications. 	<p>or lock nuts with sketches.</p> <ol style="list-style-type: none"> Permanent fastenings - Types of riveted joints. Lap joint - types- single riveted –double riveted-simple sketch. Butt joint-types-single strap-double strap butt joint with simple sketch. 	
UNIT-5 ENGINE TERMINOLOGIES	<ol style="list-style-type: none"> Compare EC and IC engines with specific applications. Discuss engine terminologies used in different vehicles. Differentiate between speed and torque with their units. Explain BP, IP, FP & Mechanical efficiency. 	<ol style="list-style-type: none"> Definition - types - IC and EC engines-comparison. Engine terminologies - bore – stroke– TDC – BDC - mean effective pressure. Clearance volume - swept volume - total volume - compression ratio. Mean effective pressure – indicated power – brake power - friction power. Engine speed engine torque, specific fuel consumption. Brake thermal efficiency, indicated thermal efficiency and mechanical efficiency. 	06-0-0
UNIT-6 I.C. ENGINES	<ol style="list-style-type: none"> Classify IC engines based on different parameters. Demonstrate working of stroke SI₂ engine using section model. Demonstrate working of 2-stroke CI engine using section model. Demonstrate working of 4-stroke SI engine using section model. Demonstrate working of 4-stroke CI engine using section model. Explain the advantages of 2-stroke and 4-stroke engines considering specific example. 	<ol style="list-style-type: none"> Classification of IC engines with respect to different parameters. Two stroke SI Engine - Construction and working. Four stroke SI Engine - Construction and working. Two stroke & Four stroke CI engines - construction – working. Comparison of SI and CI engines. Comparison of Two stroke and Four stroke engines. 	06-0-0

5. SUGGESTED PRACTICAL SKILL EXERCISES

The suggested practical activities (TABLE-I) in this section are demonstrated for the attainment of the competency. These practical activities can also be used for the student assessment in portfolio mode for awarding CIE marks.

TABLE-I

SL.No.	Practical Outcomes/Practical exercises	Unit No.	PO	CO
1	Prepare specimen of a given material for Microscopic examination (This may be covered during industrial visit).	1	1,4	1
2	Analyze content of ferrous/nonferrous material using photo spectrometer. (This may be covered during industrial visit).	1	1,4	1
3	Analyze the properties of nonmetallic materials & prepare and chart by performing Google search.	1	2	1
4	Analyze the various types of shafts and keys used in an automobile (This may be covered by visiting a nearest workshop)	2	1,4	2
5	Explain different types of belt, chain and gear drives employed in different machines (This may be covered during nearby workshop visit).	3	1,4	3
6	Demonstrates various types of fastenings in an automobile (This may be demonstrated on a vehicle present in Automobile workshop).	4	1,4	4
7	Explain the different engine terminologies with the help of a given engine (This may be explained with the help of already dismantled engine/cut-section model in Automobile workshop).	5	1,4	5
8	Demonstrate working of a 2-stroke SI/CI engine with the help of a cut-section model (This may be demonstrated using a cut-section model in Automobile workshop).	6	1,4	6
9	Demonstrate working of a 4-stroke SI/CI engine with the help of a cut-section model (This may be demonstrated using a cut-section model in Automobile workshop).	6	1,4	6
10	PROBLEM BASED LEARNING: Group of 4-5 students will identify and collect five machine / product components which are made from different engineering materials and which are also failed in their applications. Students will measure and sketch the components (freehand-orthographic views) with dimensions. Students in group will also discuss the reasons of failure and will note down the discussion and outcome.	ALL		

NOTES:

1. It is compulsory to prepare logbook of exercises. It is also required to get each exercise recorded in logbook, checked and duly dated signed by the teacher.
2. Student activities are compulsory and are also required to be performed and noted in logbook.
3. Term work report includes term work, objects taken for identification for laboratory work, student activity; parts experimented as student activity and logbook along with student activities.
4. Term work report is compulsory part to be submitted at the time of practical ESE.
5. Term work report must not include any photocopy/ printed manual/pages, lithos, etc. It must be hand written / hand drawn by student only.
6. For CIE, students are to be assessed for Skills/competencies achieved. Students are to be asked to identify materials, select proper materials, etc.

CO	Course Outcome	PO Mapped	UNIT Linked	Cognitive Level R/U/A	Tutorial & Practical Sessions in Hrs	TOTAL
CO1	Discuss the various engineering materials with their properties and also different heat treatment processes	PO1, PO4	1	A	12	
CO2	Explore the different types of shafts, keys, couplings and bearings	PO1, PO4	2	A	12	
CO3	Describe different types of belt drives, chain drives and gear drives	PO1, PO4	3	A	10	
CO4	Illustrate the different types of fastenings used in machine parts	PO1, PO4	4	A	6	
CO5	Explain various engine terminologies of IC engines, different powers and efficiencies	PO1, PO4	5	A	6	
CO6	Classify IC engines on various parameters and demonstrate working of 2 and 4 stroke SI and CI engines.	PO1, PO4	6	A	06	
					52	

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
FUNDAMENTALS OF MECHANICAL SCIENCES AND ENGINEERING	CO1	3	0	0	0	1	0	0
	CO2	3	0	0	0	0	0	0
	CO3	3	0	0	0	0	0	0
	CO4	3	0	0	0	0	0	0
	CO5	3	0	0	0	1	0	0
	CO6	3	0	0	0	1	0	
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped								

6. INSTRUCTIONAL STRATEGY

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

1. Massive Open online courses (MOOCS) may be used to teach various topics/subtopics.
2. Lecturer method(L) does not mean only traditional lecture method, but different type of teaching method and media that are employed to develop the outcomes
3. About 15 to 20% of the topics/subtopics which is relative simpler or descriptive in nature is to be given to the students for self-directed learning
4. Arrange visits to nearby Industries/Workshops/Academic institution having research center facility or research labs for understanding of the workflow process/assembly/servicing/testing of vehicles.
5. Show Video/animation films to explain the construction and working of different engines.
6. Use different instructional strategies in classroom teaching.

7. SUGGESTED LEARNING RESOURCES:**A. List of Books:**

S. No.	Author	Title of Books	Publication/Year
1	R.S.Khurmi J.K.Gupta	A Textbook of Machine Design	S. Chand & Co
2	R.S.Khurmi J.K.Gupta	Theory of Machines	S. Chand & Co
3	Dr. Kirpal Singh	Automobile Engineering vol 2	Standard publishers Distributors
4	Mathur & Sharma	I C Engines	Danapat Rai & Sons
5	V. Ganeshan	I C Engines	Tata McGraw-Hill
6	K.R.Gopalkrishana	Mechanical engineering Science	
7	K.R.Gopalkrishana	Machine Drawing	
8	Anil chikara	Automobile Engineering Vol I	Satya Prakashan
9	K.M.Gupta	Automobile Engineering Vol I	Umesh publications
10	Er.A.K.BabuEr.Ajitpal Singh	Automobile Engineering	S. Chand & Co

B. List of Major Equipment/Instruments:

1. Metallurgical Microscope.
2. Standard specimens.
3. Furnaces to perform heat treatment process.
4. Hardness testers-to check Rockwell hardness-scales A,B and C.
5. Cut-section models of 2-stroke and 4-stroke (Diesel and Petrol) engines.
6. A dismantled 2-stroke/4-stroke engine.
7. Other consumables.

C. List of Software/Learning Websites

1. <http://vimeo.com/32224002>
2. http://www.substech.com/dokuwiki/doku.php?id=iron-carbon_phase_diagram
3. <https://www.youtube.com/watch?v=S8Qmy4fGnnE>
4. <https://www.youtube.com/watch?v=Mybf-XCA4H4>
5. <https://www.youtube.com/watch?v=WoWzUPIR8i0>
6. <https://www.youtube.com/watch?v=cFdmnvIP-PI>
7. <https://www.youtube.com/watch?v=SvJM4e1OotE>
8. <https://www.youtube.com/watch?v=rIK7JIAz9WY>
9. <https://www.youtube.com/watch?v=xiGIMmB2NyE>
10. <https://www.youtube.com/watch?v=rIK7JIAz9WY>
11. https://www.youtube.com/watch?v=KFIw_zVKspQ

8. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

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

1. Select any five objects (3 metallic and 2 non-metallic) which will be used in laboratory and list the material of selected objects.
2. Prepare the material list of given tools and commonly used consumable items such as spanners, screw drivers, various types pliers, cotton waste, oil, grease, etc. Also give reason(s) for using such material and discuss your answers with the teacher.
3. Take dilute acid which is commonly used at our home for cleaning purpose and put one scrap iron piece and one nonferrous metal piece in it for minimum 12 hours. Take out these two pieces by following all safety norms/steps (without touching acid) and observe the changes. Discuss with your teacher.
4. Group of 3-5 students will visit LOCAL AUTOMOBILE REPAIR SHOP and will identify at least 5 different types of fasteners and locking devices used for a given AUTOMOBILE / assembly. Also list the material of identified machine / assembly components.
5. List atleast three questions individually which you would like to ask for followings:
 - i. Comparison of iron and fiber reinforced plastic.
 - ii. Comparison for strength of wood and cast iron.
 - iii. Technical specification of any vehicle.
 - iv. Materials used for construction of any two-wheeler.
 - v. Materials used for construction of any automobile.
 - vi. Any other relevant activity added by teacher including preparing industrial visit report.

9. 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	Three Unit Tests (Average of all units will be Computed)	30	Blue Books	1,2,3,4,5,6
				MCQ/Quiz + Open book test + Activity	20	-	-
				TOTAL	50		
	SEE (Semester End Examination)	End Exam		End of the course	50	Answer Scripts by BTE	1,2,3,4,5,6
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3,4,5,6 delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of demonstrations& Assessment Methods

Assessment Methodology

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.

Sl.No	Assessment	Mode of Assessment	Schedule of Assessment	Duration	Max marks	Conversion after taking Average
1	CIE Assessment 1	Written Test-1	End of 3 rd week	80 minutes	30	30
2	CIE Assessment 2	Written Test-2	End of 7 th week	80 minutes	30	
3	CIE Assessment 3	Written Test-3	End of 13 th week	80 minutes	30	
4	CIE Assessment 4	MCQ/Quiz	End of 5 th week	60 minutes	20	20
5	CIE Assessment 5	Open Book Test	End of 9 th week	60 minutes	20	
6	CIE Assessment 6	Student Activity / Assignment	End of 11 th week	-	20	
Total Continuous Internal Assessment (CIE) Marks						50
7	SEE- Semester End Examination	Written Examination	As per BTE	3 Hours	100	50
Total Marks						100

Note:

1. Assessment of student activity / Assignment is to be evaluated through appropriate rubrics by the respective course coordinator.

RUBRICS FOR ACTIVITY -Example only (Faculty need to develop appropriate rubrics for assessment)						
Dimension	Unsatisfactory	Developing	Satisfactory	Good	Exemplary	Student Score
	2	4	6	8	10	
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
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	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

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)					

**Model Question Paper
Semester End Examination**

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

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)				

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

Course Code	20EG01P	Semester	I/II
Course Title	COMMUNICATION SKILLS	Course Group	Core
No. of Credits	4	Type of Course	Lecture + Practice
Course Category	Workplace Skills / Humanities & Social Sciences	Total Contact Hours	6Hrs Per Week
			78Hrs Per Semester
Prerequisites	Nil	Teaching Scheme	(L: T:P) = 0:1:2
CIE Marks	60	SEE Marks	40

Preamble

Today, Communication is a very important skill for the success of every millennial student. Millennials affinity to use digital media for communication, changing career and working landscapes, and greater competition in colleges and workplaces makes enhancing student communication skills beyond language a must. Rote learning a few tips or tricks the night before an interview or performance review won't do the job if students are trying to make an impression in highly collaborative workplaces of the future. Expectations from students aspiring to be part of such future workplaces are that they have not just good verbal and non-verbal communication skills but also a good understanding of how to use modern tools for effective communication.

Scope

To enable students to communicate clearly and effectively, by improving their verbal and non-verbal communication skills, as well as enhancing interpersonal skills and knowledge of appropriate tools for specific communication strategies.

Course Objectives

The objectives of communication skills course are:

- Build better communication skills: oral and written expressions and body language
- Enable critical thinking
- Empower with active listening skills
- Enable team work/collaboration

Instructional Strategy

To achieve course objectives, it is important to provide the blended mode of instruction for each of the concepts. This blended mode of instruction enables and empowers students with:

- **Understanding of Concept (Theory):**
 - Through definitions, discussions, explanation, conclusions.
 - Through demonstrations: Show films or other workplace clips that model various conversation skills. This provides greater clarity of the concept by

- Enabling observation skills
- Helping in expression of gesture
- building confidence
- **Application of Concept (Learning by doing):** It is imperative that to become a good communicator, the skills have to be built by applying the concept in the hypothetically created real life situations. Students are encouraged to participate in each of these activities during lab session to help build the effective communication skills.
 - Use of technology tools like audio books, apps like voice thread or paper telephone, etc.
 - To help in workplace conversions.
 - To increase active listening, pronunciation
 - To help in voice modulation
 - Group discussion
 - Reinforce active listening
 - Enable group debate to imbibe healthy communication strategies
 - Sharpen the skills of “Asking clarifying questions”
 - Sharpen Feedback / Response skills
 - Time management skills
 - Group presentations/peer reviews
 - Enable team work
 - Assess concept understanding
 - Sharpen both oral and written communication skills
 - Group activities:
 - foster critical thinking
 - enable reflective learning
 - Tools usage:
 - Understand the difference between a Dictionary and a Thesaurus
 - Understand “When” and “How” to use these tools for communication

Course Outcomes

After completion of this course, the student shall be able to;

- Communicate
 - Identify audience (colleagues, management, customers/vendors) and use the right methodologies for communication using the right terminology, names, grades and other nomenclature pertaining to the trade, tools and specific equipment.
- Write
 - in at least one language correctly
 - basic level notes and observations
 - job cards, work sheets, basic report writing and responding to emails, simple presentations, job applications, resume
- Read
 - Technical manuals, task sheets/job orders, policies and regulations pertinent to the job, including OEM guidelines.
 - all instructions given in memos, manuals, documents or those put up as posters across the premises
 - safety precautions mentioned in equipment manuals and panels to understand the potential risks associated
- Question
 - Ask right questions
 - Use different ways of asking questions
 - Clarifying/Open ended (What, Why, When, Who, Where, How)

- Close ended
- Present
 - With right Posture & Gesture
 - With greater concept/content clarity
 - With high confidence
 - With voice modulation to capture the attention of audience
- Use technology tools
 - Office productivity
 - Word : Report writing
 - PowerPoint : Creating effective presentations
 - Excel : Data handling/Charts

Course Content

The following are the various units to be taught and assessed in order to ensure the student is able to demonstrate the Course Outcomes mentioned in the **Course Outcome** section.

Pre-assessment:

Teachers are required to administer pre-assessment before starting the actual instruction. This helps in gathering information about students' like their attitude, beliefs, interests, and learning abilities.

Pre assessment expectations:

- To assess current language skill (Pronunciation, usage, sentence formation)
- To assess their ability to comprehend and respond to the instruction
- To assess their interest towards accepting ideas and learning
- To assess their current communication skills: asking questions, listening, communicating with confidence

UNIT 1: English – Introduction Learning outcome: Learn English pronunciation, functional grammar concepts & Reading. To gain confidence in spoken English. This section also covers phonemic awareness, grammar rules to set a strong base for application mode of communication.			
Phonemic awareness	Going over 42 sounds	<i>Examining the understanding of sounds</i> <i>Spelling patterns (Consonant and Vowel blending: CVC words)</i> Pronunciation <ul style="list-style-type: none"> ○ List of words given above (Commonly used words) ○ Diction (speech) 	0:2:2
Functional Grammar Concepts	Revision of Grammar concepts	Parts of speech	2:0:0
		Sentence structure	0:1:0
		Examples of right sentences	
		Gender, Singular, Plural	0:1:0
		Usage of voice (active and passive) and tenses	0:2:0

Comprehension activities	Reading conversations (check the unit wise activity table)	<i>Written test for each comprehension</i>	0:0:2
UNIT 2: Communication Lesson outcome: At the end of the session: <ul style="list-style-type: none"> Students should be able to <ul style="list-style-type: none"> Understand the communication process, influence of voice/tone, logical organization of thought, comprehension, listening skills. Understand the basic building blocks of communication and strategies for working with each of these blocks. Learn about carrying self, etiquettes of communication. Build positive attitude about self and towards handling communication. Learn the process for effective communication, problem solving techniques, to be confident communicator. 			
INTRODUCTI ON:	What is communication? Why communication? How do we communicate? Communication Theory and Process	<i>How communication happens?</i> <ul style="list-style-type: none"> Pictorial representation of communication framework Elements of communication: sender, receiver, message Refer to activity in Unit activity section. 	1: 2:0
	Barriers to communication	<i>Language</i> <ul style="list-style-type: none"> Lack of linguistic ability Grammar <i>Context</i> <ul style="list-style-type: none"> Psychology Physiology <i>Systematic</i> <ul style="list-style-type: none"> inefficient or inappropriate information systems Lack of communication channel 	0:2:2 0:2:2 (video clip play, content tutorial, role play)

		<ul style="list-style-type: none"> lack of understanding of the roles and responsibilities <p>Attitude</p> <ul style="list-style-type: none"> Perceptions Preconceived notions 	
Building blocks of communication	People Message Context Listening	<p>People:</p> <ul style="list-style-type: none"> Empathising with sender's or receiver's perception Intent & Impact on the sender/receiver Think – Feel – Do model <p>Message:</p> <p>Message channels:</p> <ul style="list-style-type: none"> Inperson, email, memo, report <p>Be aware of Mental Filters</p> <ul style="list-style-type: none"> Level of understanding/knowledge Personal concerns Pre conceived notions <p>Organize message:</p> <ul style="list-style-type: none"> Critical thinking: organize your thoughts? <p>Use following strategy:</p> <ul style="list-style-type: none"> Who What When Why How <ul style="list-style-type: none"> Bundle Primary and Secondary information Mindful about non-verbal message Tone of voice <p>Examples of Types of messages:</p> <ul style="list-style-type: none"> Inform Persuade Cyclical <p>Avoiding Miscommunication:</p> <ul style="list-style-type: none"> Evaluate (Checking for) understanding of the intent of the message with the receiver – by asking clarifying questions? <p>Context:</p>	0:4:4

		<p>Define context</p> <p>Importance of context</p> <p>Tune into context</p> <ul style="list-style-type: none"> • Timing • Location • Relationship <p>Listening:</p> <p>Importance of listening</p> <p>Barrier to listening:</p> <ul style="list-style-type: none"> • Mental filters • Multitasking • Information overload <p>Strategies for listening:</p> <ul style="list-style-type: none"> • Recall • Acknowledge • Summarize • Listen with eyes for connecting to non-verbal connection • Empathize • Pay attention • Ask clarifying questions <p>Effective Listening Behaviors:</p> <ul style="list-style-type: none"> • Maintaining relaxed body posture • Leaning slightly forward if sitting • Facing person squarely at eye level • Maintaining an open posture • Maintaining appropriate distance • Offering simple acknowledgements • Reflecting meaning (paraphrase) • Reflecting emotions • Using eye contact • Providing non-distracting environment <p>Behaviors that hinder effective listening</p> <ul style="list-style-type: none"> • Acting distracted • Autobiographical (Telling your own story without acknowledging theirs first) • No response • Invalidating response, put downs • Interrupting • Criticizing • Judging • Giving advice/solutions • Changing the subject • Reassuring without acknowledgment 	
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[illegible]

Using technical Jargons:	<p><i>Assignment based project encouraging pupil to use the technical terms in the written and verbal communication.</i></p> <p>This requires understanding of the core concepts (from subject teacher) and integrating the concept with communication concepts to gain the real time application knowledge.</p>	<ul style="list-style-type: none"> • Judging • Giving advice/solutions • Changing the subject • Reassuring without acknowledgment 	
<p>UNIT4: Non-Verbal Communication:</p> <p>Lesson outcome:</p> <p>At the end of this unit, students should be able to:</p> <ul style="list-style-type: none"> • Understand the importance of Body language and its impact. • Use the strategies for effective body language. • Understand the relevance of different elements of emails and how to use them. • Develop the confidence in presenting written content in logical and organized manner with a definitive email framework. • Write different email formats confidently: Job application, Request email, apology email, email responses/feedback. • Confidently write Resume/Curriculum-vitae, Reports, Formal letters and portfolio. • Confidently communicate using technical jargons and with increased vocabulary. 			
Body Language	Strategies	<p>Body language tips:</p> <ul style="list-style-type: none"> • Keep appropriate distance • Take care of your appearance • Maintain eye contact • Smile genuinely <p>Do's and Don'ts:</p>	0:3:4

<p>Art of Professional writing:</p>	<p>Written communication</p> <p>Emails:</p> <ul style="list-style-type: none"> Structured framework for writing formal emails to emphasize on professional communication in English 	<p>dos:</p> <ul style="list-style-type: none"> smile stand up confident and straight use appropriate hand gestures Make eye contact with audience Hold neat note cards while presenting content <p>Don'ts</p> <ul style="list-style-type: none"> point at anyone rock backwards and forwards pace across front of room read off slides <p>read off notes</p> <p>Different types of emails: Job application, request letter, letter writing and quick notes</p> <p>Structure of email text:</p> <ul style="list-style-type: none"> Introduction – Beginning of the letter and this plays crucial role as it provides first impression to the reader. <ul style="list-style-type: none"> Who: author (name + position and organisation) what: purpose - controlling idea (what author does or feels) Development: Expand on the Controlling Idea/purpose of the email by answering relevant WH questions <ul style="list-style-type: none"> what, when, where, who, whom, which, whose, why, and how Conclusion: Positive words <ul style="list-style-type: none"> Verb: thank, appreciate, hope, wish Phrases: be glad about, look forward to <p>Email writing samples and practice content in the activity section.</p>	<p>0:2:4</p>
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		<p>Additional essential writing skills – Framework will be provided and assignments will be advised:</p> <ul style="list-style-type: none"> • Resume writing /CurriculumVitae • Report Writing • Portfolio writing • Formal letters 	
UNIT5: English - Reading Skills, Grammar & Vocabulary Lesson Outcome: At the end of the session, student should be able to: <ul style="list-style-type: none"> • Read sentences with punctuation. • Understand the techniques of reading complex words. • Understand and apply the reading techniques for efficient reading. • Understand the usage of communication tools like Thesaurus and Dictionary that aids in improving vocabulary and reading. • Understand and apply the functional grammar aspects in day today communication. 			
Reading skills	<i>Comprehension activities</i> <i>Techniques for smart reading</i>	Passage comprehension Conversation comprehension Strategies for smart reading: <ul style="list-style-type: none"> • Skimming and scanning through the text, inferring the meaning • Questioning, summarizing 	0:2: 2
Functional Grammar	<i>List of Commonly confused words and how to use/avoid them</i>	Set of words to accelerate the English language learning and usage. Strategies to use these words effectively	0:1: 2
Vocabulary	<i>Sentences:</i> <ul style="list-style-type: none"> ○ Declarative sentence ○ Imperative sentence ○ Interrogative sentence ○ Exclamatory sentence 	Techniques of categorizing sentences, understanding how to build with punctuation and effectively use in the verbal and non-verbal communication. This involves more of hands on activities.	0:1: 2

	<p>Punctuation, Content organization and Comprehension</p> <p>Techniques:</p> <ul style="list-style-type: none"> • Learning new words from comprehension by way of repetition and usage of these words in communication • Listing technical jargons and repeatedly using in the communication with peers and teachers • Chunking and reading words <p>Tools</p> <ul style="list-style-type: none"> • Understand the difference between a Dictionary and a Thesaurus • Understand “When” and “How” to use these tools for communication 	<p>Comprehension remains as a main activity to accelerate the learning of spoken and written English language</p> <p>Increases vocabulary, builds confidence and helps in becoming a good communicator.</p> <p>Activities are done, tips are provided to efficiently implement these strategies.</p>	<p>0:1: 2</p> <p>0:1:0</p>
<p>Unit 6 - Communication Tools</p> <p>Lesson Outcome:</p> <p>At the end of the session, student should be able to:</p> <ul style="list-style-type: none"> • Use Email technology efficiently for communication • Present content in the PPT format efficiently • Understand different platforms available for web conferencing and efficiently work with them. • Create reports and data management. 			
Introduction	Evolution of communication tools	Traditional vs. modern communication tools Advantages and Disadvantages	1:0:0
One-to-One	Email using Gmail	How to use the tools effectively? Formatting, layout Including attachment	0:1:1

		Working with "To, CC, BCC" and Subject fields effectively Using signature	
One-to-Many	<i>Presentation using PowerPoint</i>	Creating, Editing, Saving slides Using Animation Formatting options	0:1:2
	<i>Webinar / Web Presentation (zoom, Google meet, Skype)</i>	Hosting online meeting using online meeting tools Inviting people Sharing screen	0:1:1
Other	<i>Reports using MS Word</i>	Open, close, Edit and Save usage with documents Layout and strategies for creating report Sample report creation demo with follow on assignment Core subject project report submission assignment	0:1: 2
	<i>Data & Graphs using MS Excel</i>	Open, close, save and edit the excel document Creating data Using basic maths operation in Excel for working with data Creating simple graphs Assignment: For example, creating statistics of subject wise activities completed for 6 months in the credit course	0:1: 2
			4:34:40

Course Class Activity List (Unit-wise)

The following are the various activities that faculty could conduct for each unit are presented below;

Unit No.	Unit Title	Unit Activities
UNIT 1: Activities:	English – Introduction	1. 42 sounds revision: 1. s, a, t, i, p, n 2. c k, e, h, r, m, d 3. g, o, u, l, f, b 4. ai, j, oa, ie, ee, or 5. z, w, ng, v, oo, oo 6. y, x, ch, sh, th, th 7. qu, ou, oi, ue, er, ar

		<ul style="list-style-type: none"> • This helps in reducing the native language impact • Helps in understanding Short and Long vowel words • Helps in spelling • Helps in pronunciation <p>2. Reading commonly used words loud from the list (list will be provided in the workbook):</p> <ul style="list-style-type: none"> • This helps in getting familiarity with the word pronunciation and helps in reading. <p>3. Blending words activity:</p> <ul style="list-style-type: none"> • Write simple three letter words (CVC/CVCC/CVCV) pattern words: Can, Cap, Snap, cape (list will be provided in the workbook) • Show how to blend with the sound. • Starting with 3 letter words and continuing to 6 to 8 letter words. <i>Note: Remember before going through big words, it is always important to assess and ensure the student is aware of all the 42 sounds and are comfortable making small words.</i> <p>Parts of Speech:</p> <p>building sentence using parts of speech: Demonstration by teacher: (Will be explained in the book as an example)</p> <p>Jumbled parts of speech: Student should pick the right order to build meaningful sentence:</p> <p>(More samples will be provided in the workbook)</p> <ul style="list-style-type: none"> • College go to you every day. • Makes spider web the a <p>Gender, Singular and Plurals:</p> <ul style="list-style-type: none"> • Match the following activity for singular and plural • Fill in the blanks activity for genders <p>Reading & Comprehension: Conversation</p> <ul style="list-style-type: none"> • Conversation at the bank (provided in the workbook along with few more conversation samples) • Questions based on this conversation will be provided in the workbook
		<p>Oral:</p> <ul style="list-style-type: none"> • Introduce yourself?

Unit 2	Communication	<p>Visual:</p> <ul style="list-style-type: none"> • Video clip on communication etiquette • Pictures (in addendum section): do's and don'ts of communication <p>Group of students, one participant whispers in another participant's ear, and this message has to be passed on in a circle until it reaches back the sender. Making a note of process of message conveyed and how it was perceived.</p> <ul style="list-style-type: none"> ○ Identify the communication gap if any. ○ Discuss and conclude the communication framework importance ○ Discuss/reiterate how to make communication framework strong. <ol style="list-style-type: none"> 1. Role play to assess the understanding of building blocks of communication: (can be tapered to the core skills of diploma courses, following are just few of the examples) <ol style="list-style-type: none"> a. Announcing the result of students in the class or b. Announcing the job placement of students (people, context, message, form of message) c. Discussing the guidelines of examination (listening skills) d. Listening to the weather forecast without seeing and making note of the listening ability (play video of weather forecast) – Assess based on how much the student is able to recall. 2. Run National geography/Discovery Video clip/subject related technical video clip on YouTube: Check: <ul style="list-style-type: none"> ○ if the student has not understood what a speaker expressed
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		<ul style="list-style-type: none"> ○ about work or safety related issues ○ seeking clarification or advice appropriately from colleague, customer, management or vendor
Unit 3	Verbal communication	<p>1. Voice/tone modulation: Showcase video Discussion: What was right? What was wrong? How it should have been better?</p> <p>2. Picture description activity (memory test): Class split into groups A, B C,D: (two or four groups of at least 5 people each): Teacher shows different picture to each group for three minutes. Now each group has to remember what was on the picture and discuss with each other, write down the elements on a piece of sheet and share it with the teacher. Group that remembers more will be the winner.</p> <p>Teacher to observe the body language of a student in the group, listening skills of a student, presentation skill, comprehension skill, content delivery skill, confidence level, team work. And reiterate the concepts, dos and don'ts, and discuss what could have been done better. (details of pictures will be given in the workbook)</p> <p>3. Telephonic conversation: Role play by a teacher: Call Airtel/Vodafone department and asking for the phone number portability process.</p> <p>After teacher demonstrates, teacher divides the class in to small groups of three people.</p> <ul style="list-style-type: none"> • Each group will be given a different telephone conversation assignment (samples will be provided in workbook). • Two people in the group pretend to converse over the phone, and the third person makes a note of right and wrong approaches during the communication.

Unit 4:	Non-verbal communication	<p>Body language</p> <p>Simon Says:</p> <p>Instructions and set up :</p> <p>1. Series of instructions to the group that are to be copied/reproduced. Start slowly and increase the pace</p> <p>2. State the following actions as YOU do them:</p> <ul style="list-style-type: none"> ○ Put your hand to your nose ○ Clap your hands ○ Stand up ○ Turn around ○ Touch your shoulder ○ Sit down ○ Stamp your foot ○ Cross your arms ○ Put your hand to your forehead – <u>BUT WHILE SAYING THIS PUT YOUR HAND TO YOUR NOSE</u> <p>3. Observe the number of group members who copy what you did rather than what you said.</p> <p>Outcome of this activity:</p> <p>Discuss how body language can reinforce/influence verbal communication and drive the importance of body language and how to work on it</p> <ul style="list-style-type: none"> • Email communication & Using technical jargons: <p>Sample letter writing as assignment to students. (list will be provided in the text book – Request, apology, job application and relevant email formats that are useful for students post diploma course)</p> <ul style="list-style-type: none"> • There will be at least one assignment that utilizes technical jargons in email communication.
UNIT 5:	English - Reading Skills, Grammar & Vocabulary	<ul style="list-style-type: none"> • Reading passage (Provided in workbook) • Reading passage from the text book • Comprehension: Passage & Conversation (will be provided in workbook) • Chunking words and reading activities

Unit 6:	Communication tools	<ul style="list-style-type: none"> Email writing activities: Writing emails using email provider. Theme based email writing Report writing assignment <p>Writing about a machinery tool/interior designing plan? Related to the diploma stream.</p> <ul style="list-style-type: none"> Resume writing assignment Data handling: Collecting data about machines/number of students passed out of college for last three years and creating graph about it. Presentation: <ul style="list-style-type: none"> About learning in the communication class Concept presentation

Course Assessment Strategies

Assessment Methodology

- Observation (role play activities, team activities, demonstration)
- Questions & Answer – Periodic Assessment

Assessment Grading RUBRICS

Language Basics	
Beginner	Doesn't know / understand
Intermediate	can read and identify commonly used words
Good	Confident , able to communicate well with known people
Advanced	Confident , able to communicate well with anyone using a English
Expert	Can read, understand; Also comprehend & can train others
Reading	
Beginner	Beginning to read, has native language impact
Intermediate	can read, identify words, build simple 3/4/5 letter words easily
Good	Can read, understand, build words, read simple sentences ; Also comprehend
Advanced	Can read, understand, build words, read simple sentences ; Also comprehend
Expert	Confident , read simple and complex sentences with punctuation, comprehend, spell also build words
Inter personal communication	
Beginner	is shy, doesn't talk/express
Intermediate	hesitates to communicate – due to lack of confidence / ability, can talk to known people

Good	can talk to unknown people, less confident, does not express, has hard time working as a team
Advanced	can talk to unknown people, confident, can't express, has hard time working as a team
Expert	confident, can talk to anyone, express well, works well in the team
Body language	
Beginner	Is shy, not open to communicate, has hard time making friends
Intermediate	Knows basics of Body language, practices sometimes
Good	Knows basics of Body language, practices most times, has less confidence in presenting content
Advanced	Knows and practices good body language all times, can present content
Expert	Knows and practices good body language all times, is an example, Leads the pack to get better
Listening Skills	
Beginner	Just hears, no attention
Intermediate	Listens, pays attention, does not ask any question
Good	Listens, pays attention, ask questions
Advanced	listens, pays attention, asks questions, cannot empathize
Expert	Listens, pays attention, asks clarifying questions, able to understand the message communicated
Acceptability to Learn	
Low	is not receiving to information
Average	receives information but resists to implement
Good , Above Average	receives information and implements per instructions
Strong	receives information and proactively implements and seeks feedback
Verbal Communication	
Beginner	Does not communicate, shy, low on confidence: has problem expressing in his/her native language or English language
Intermediate	Can communicate in native language, low confidence, shy, yet to try in English language
Good	Can communicate in native language, good confidence, tries to communicate in English language
Advanced	Can communicate in native language, express view points, good confidence, comfortable talking to people in the team, tries to communicate in English language as well
Expert	Can communicate in native language, express view points, very good confidence, can communicate with anyone without any fear, asks clarifying questions, communicates well in English, or tries hard to communicate in English language as well
Non-Verbal Communication	
Beginner	Struggles to understand the non-verbal cues, has to work on body language, has hard time understanding the written communication aspects

Intermediate	Can understand the non-verbal cues, has to practice, tries to apply written communication aspects
Good	Can understand non-verbal cues, practices well, works hard to get hold on written communication skills, exhibits confidence in whatever task is given
Advanced	Can understand non-verbal cues, can work on written communication aspects, exhibits confidence, practices well, help others to identify non-verbal cues
Expert	Can understand non-verbal cues, train others, confident, exhibits good non-verbal cues at all times, can train the pack, has good hold on written communication as well.
Comprehension	
Beginner	Tries to read the passage, has hard time to comprehend
Intermediate	Can read the conversation passage, has hard time understanding the regular passage
Good	Can read the conversation passage, regular passage, but stutters in answering questions if there are technical jargons
Advanced	Can read the conversation passage, comprehend but regular passage comprehension is good
Expert	Can read the conversation passage, comprehend but regular passage comprehension is good, explain better to others, help others, lead the pack
Writing Communication	
Beginner	Has trouble forming right sentences for written communication
Intermediate	Can form sentences, has problem with the layout, gets confused between layout for different form of written communication
Good	Can form sentences, has fair understanding of the layout to be used for particular type of written communication, but stutters for words and expression
Advanced	Can form sentences, has good understanding of the layout to be used for particular type of written communication, confident, can express thoughts well
Expert	Can form sentences, has good understanding of the layout to be used for particular type of written communication, confident, can express thoughts well and train others and lead the pack

Recommended Learning Resources

<https://www.englishclub.com/grammar/parts-of-speech.htm>

Watch Amy Cuddy's TED Talk: [Your Body Language Shapes Who You Are](#)

Additional Reading: http://money.cnn.com/2000/05/03/career/q_body_language/

Pre-assessment:

Activity 1:

Make a group, read random words from the list, build sentence for few words from the list.

Create a group of 3 or 5 students. Randomly pick 5 words from the word list write down on the board/show them as a chart if you have created a word chart/make chart of words and ask them to pick one chart and READ the word.

Main idea: Testing the pronunciation ability, language ability, confidence in speaking, ability to understand and accept the instruction

Activity 2:

Simple reading test – Reading passages (Simple passage from the current course book)

Show the reading passage, let each one of them read 2 lines, after first student is done with reading two lines, then the next student must pick up from there and read next two lines. This process has to be followed until the entire class is done with reading or at least ten students are done with reading.

Main idea: Testing listening skills, attentiveness, language ability, pronunciation ability

Activity 3:

Students getting to know each other. Create a group of 3 or 5 students. Each student gets chance to talk to another student, introduce him/herself to the student, ask question, make a note of the answer against the name of the student who is answering the question on a sheet of paper.

Main idea: To assess current communication level, body language when students talk with each other, and confidence.

Commonly Used Word List

When	Today	For	Off	Her	Thought	So	Into
Give	Stop	There	Often	Time	Better	Them	Away
Again	Little	Than	Myself	Long	Many	Does	No
Do	Large	At	Over	Had	Get	Always	Other
From	Both	Like	Along	Word	Please	These	With
Him	Name	Said	Why	Very	Ask	Last	An
Can	Few	They	Has	Your	Say	Got	What
Go	Home	Look	Bring	Make	Ten	Next	Come
But	Big	Know	Part	Day	I	Those	Would
Old	Should	Done	By	Each	Show	Play	Who
Not	Once	High	As	Yes	To	Girl	This
				On	Am	A	Could

Been	Where	You	Now	
Of	Way	Be	Fun	
He	Which	Were	Only	
It	Write	Or	Much	
More	Goes	One	Tell	
My	Great	All	Out	
Any	Number		That	Fast
Their	First	Cat	Is	
We	Find	His	Small	
She	Me	Have	Dog	
Did	In	How	See	
Went	Before	Water	Here	
Full	Saw	And	People	
Some	Never	Use	School	
Then	Boy	Take	Two	
If	Right	The	Call	
Night	After	Will	Might	
Made	About	Was	May	
Up	Far	Are	Walk	

To assess current communication skill: Activity based

Activity 3:

Making a group of students and getting to know each other with a predefined expectation for example:

Name:

I have performed on stage:

I'm good at sports:

I can speak more than 3 languages:

I'm always cheerful:

I like my mother tongue:

Course Assessment and Evaluation**Continuous Internal Evaluation (CIE)**

Sl.No	Assessment	Schedule	Duration	Max. Test marks
1	Skill Test 1	At the end of 3 rd week of the sem	2 Hrs	20
2	Skill Test 2	At the end of 7 th week of the sem	2 Hrs	20
3	Skill Test 3	At the end of 13 th week of the sem	2 Hrs	20
Total				60

Scheme of Valuation for CIE

Serial no	Assessment	Marks
1	Portfolio Evaluation of activities / exercises conducted upto the schedule of Skill Test. (Work Book Based)	10
2	Assessment of any one through qualitative assessment (Rubrics)	10
	TOTAL	20

RUBRICS FOR ASSESSMENT OF ACTIVITY (10marks)
(Qualitative Assessment)

Dimension	Beginner	Intermediate	Good	Advanced	Expert	Student Score
	2	4	6	8	10	
	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	
	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	
	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	
	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	
Average / Total Marks:						

<p align="center">Example Only</p> <p align="center">RUBRICS FOR ASSESSMENT OF ACTIVITY (10marks)</p> <p align="center">Faculty need to develop appropriate rubrics as per the assigned activity for assessment</p>						
Dimension	Beginner	Intermediate	Good	Advanced	Expert	Student Score
	2	4	6	8	10	
Language Basics	Doesn't know / understand	Can read and identify commonly used words	Confident , able to communicate well with known people	Confident , able to communicate well with anyone using a English	Can read, understand; Also comprehend & can train others	8
Reading	Beginning to read, has native language impact	Can read, identify words, build simple 3/4/5 letter words easily	Can read, understand, build words, read simple sentences ; Also comprehend	Can read, understand, build words, read simple sentences ; Also comprehend	Confident , read simple and complex sentences with punctuation, comprehend, spell also build words	6
Inter personal communication	Is shy, doesn't talk/express	Hesitates to communicate – due to lack of confidence / ability, can talk to known people	Can talk to unknown people, less confident, does not express, has hard time working as a team	Can talk to unknown people, confident, can't express, has hard time working as a team	Confident, can talk to anyone, express well, works well in the team	8
Body language	Is shy, not open to communicate, has hard time making friends	Knows basics of Body language, practices sometimes	Knows basics of Body language, practices most times, has less confidence in presenting content	Knows and practices good body language all times, can present content	Knows and practices good body language all times, is an example, Leads the pack to get better	8
Average / Total Marks: (8+6+8+8)/4						7.5 = 8 marks

Scheme of Valuation for Semester End Examination (SEE)

Serial no	Assessment	Evidence	Marks	Conversion
1	Portfolio Evaluation- UNIT 1: English – Introduction	Work Book	15	40 Marks
2	Portfolio Evaluation- UNIT 2: Communication	Work Book	15	
3	Portfolio Evaluation- UNIT 3: Verbal Communication	Work Book	15	
4	Portfolio Evaluation- UNIT-4: Non-Verbal Communication:	Work Book	15	
5	Portfolio Evaluation- UNIT-5: English - Reading Skills, Grammar & Vocabulary	Work Book	15	
6	Any one activity through communication tools- By qualitative assessment (Rubrics).	BTE Answer scripts	25	
	TOTAL		100	

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

Course Code	20ME01P	Semester	I/II
Course Title	Computer Aided Engineering Drawing	Course Group	Mechanical and Allied courses
No. of Credits	4	Type of Course	Lecture & Practice
Course Category	PC	78Hrs Per Semester (L:T:P)= 1:0:2	6Hrs Per Week
Prerequisites	Enthusiasm to learn the subject/Visualizing/Creativity	Teaching Scheme	Practical
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:

C01	Able to use drawing instruments and Adopt the standards, dimensioning and construct appropriate drawing scales, in technical drawing development.
C02	Able to draw the projections of objects in all planes and learn displaying techniques for graphical communication in design process.
C03	Able to Sketch orthographic projections into isometric projections and vice versa.
C04	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-a 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

5-b COURSE CONTENT DETAILS:

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 1.5 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 equipments, instruments and materials. 2. Equipments-types, specifications, method to use them, applications. 3. Instruments-types, specifications, methods to use those and applications. 4. Pencils-grades, applications, Different types of lines. 5. Scaling technique used in drawing. 6. Dimensioning methods.- Aligned method. Unilateral with chain, parallel dimensioning. 7. Constructions of geometrical figures	4-0-8
UNIT-2 Introduction to Projections	2.1 Introduction to Projections-Principle Planes of Projection and Principle Views 2.2 Introduction to First angle and Third angle method, their symbols 2.3 Projection of points in All 4 Quadrants	1. Reference planes, orthographic projections. 2. Concept of quadrant, 1st angle and 3rd angle projection and their symbols. 3. Projection of points.	8-0-16
	2.4 Projection of Lines a) Parallel to both the planes b) Parallel to one and Perpendicular to another c) Parallel to one and Inclined to another	1. Projection of lines determination of true length and inclinations for following cases. (a) Line parallel to one or both the plane. (b) Line perpendicular to one of the plane. (c) Line inclined to one plane and parallel to another.	
	2.5 Projection of plane surfaces. a) Parallel to one plane and Perpendicular to other two b) Planes Perpendicular to one plane and inclined to the other (Resting on Edge, Corner, Inclined to HP And VP)	1. Projection of Planes. (a) Types of planes. (b) Projection of planes parallel to one of the reference planes. (c) Projection of plane inclined to one reference plane and perpendicular to another. Note: <i>Triangle, Square / rectangle, pentagon, hexagon and circle shape should be included in various plane problems.</i>	

	2.6 Projection of Solids for the above conditions	1. Projections of solids in various positions with respect to the reference planes. (Parallel, perpendicular and inclined to HP and / or VP.)	
UNIT-3 EXPOSURE TO CAD	<p>3.1 Introduction to CAD- Hardware requirements.</p> <p>3.2 Various CAD software available</p> <p>3.3 Familiarization of CAD window - Commands like New file, Saving the file, Opening an existing drawing file, Creating templates</p> <p>3.4 Setting up new drawing: Units, Limits, Grid, Snap. Standard sizes of sheet.</p> <p>3.5 Selecting Various plotting parameters such as Paper size, paper units, Drawing orientation, plot scale, plot offset, plot area, print preview</p> <p>3.6 Draw basic entities like Line, Circle, Arc, Polygon, Ellipse, Rectangle, Multiline, Dimensioning, Inserting text</p> <p>Applying constraints - horizontal, vertical, parallel, concentric, perpendicular, symmetric equal, collinear</p> <p>3.7 Insert title block for the drawing and take the Print out</p> <p>3.8 Create objects by applying constraints and convert the objects to full scale , reduced scale and enlarged scale</p> <p>3.9 Apply copy, mirroring, array, fillet and trim on the object created</p>	<p>1. Computer graphics & its terminology.</p> <p>2. CAD definition, concept & need.</p> <p>3. Commands used in CAD</p> <p>4. Functional areas of CAD. - Coordinate systems.</p> <p>5. Familiarization of Cad commands</p> <p>6. Draw simple Geometrical figures using CAD</p>	3-0-6

UNIT-4 Orthographic projections	4.1 Introduction to orthographic, Isometric projections 4.2 Conversion of pictorial view into Orthographic Views (USING SKETCH BOOK AND CAD)	1. Types of projections-orthographic, isometric projections: concept and applications. 2 Various term associated 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.	2-0-4
UNIT-5 Isometric projections	5.1 Introduction to Isometric Projections 5.2 Isometric Scales and Natural Scale 5.3 Isometric View and Isometric Projection 5.4 Conversion of Orthographic Views into Isometric (USING SKETCH BOOK AND CAD)	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	2-0-4
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 Thread profiles,nuts,bolts,studs,setscrews,was her,Locking arrangements. (USING CAD)	1 Difference between 2D & 3D models. 2.2D/3D modeling – concept, Simple objects	7-0-14
		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.

Sl. 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.(Drawing sheet)	
		Problem – 2 Indicate different convention of lines on the drawing. .(Drawing sheet)	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.(Drawing sheet)	1-0-2
		Problem 4. Draw regular geometric constructions Pentagon, Hexagon, Square, circle, Triangle and other shapes. .(Drawing sheet)	1-0-2
2	2	First angle Projection symbol Problem 5: Draw Projection of points in 1 st , 2 nd , 3 rd and 4 th Quadrants.(Drawing sheet)	2-0-4
		Problem 6: Draw Projection of Lines a) Parallel to both the planes b) Parallel to one and Perpendicular to another c) Parallel to one and Inclined to another. .(Drawing sheet)	1-0-2
		Problem 7: Draw Projection of plane surfaces. a) Parallel to one plane and Perpendicular to other two (Resting on Edge, Corner, Inclined to HP And VP)	1-0-2
		Problem 8: Planes Perpendicular to one plane and inclined to the other (Resting on Edge, Corner, Inclined to HP And VP) (Drawing sheets)	1-0-2
2	2	Problem 9: Draw Projection of Solids for the above conditions (Resting on Edge, Corner, Inclined to HP And VP) (Drawing sheet)	3-0-6
3	3	Use of CAD commands , plotting the drawing	1-0-2
		Problem 10:Drawing basic entities : Circle, Arc, Polygon, Ellipse, Rectangle, Multiline	1-0-2
		Applying constrains draw basic entities Insert title Block (CAD Drawings and Printout)	1-0-2
4	4	Problem 11: Draw Orthographic views for the given object. (Sketch book and CAD Drawing)	2-0-4
5	5	Problem 12: Draw Isometric projections for the given Orthographic views (Sketch book and CAD Drawing)	2-0-4
6	6	Problem 13:Produce Orthographic (2D) Drawings in CAD-Chap 3 Problem 14:Produce Isometric and 3D Drawings in CAD – Chap 4(CAD Drawings and Printout)	5-0- 10
		Problem 15:create 3D models of Mechanical Elements such as Hexagonal headed bolt, Simple toy, ball bearing (CAD Drawings and Printout)	2-0-4
TOTAL			26-0-52

Note: Use both sides of sheet. For example, draw sheet number 2 on back side of sheet number 1, 4 on back of 3, and likewise.

- 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. A hand out containing applicable standards from IS codes including title block as per IS standard should be given to each student by concerned teacher.
- 5 End Semester Examination will be conducted in practical mode for 100marks and weightage is reduced for 40 marks.
- 6 Students are to be assessed for competencies achieved.

7.SUGGESTED LIST OF STUDENT ACTIVITIES:

SL.NO.	ACTIVITY
1	Sketch the combinations of set squares to draw angles in step of 15°.(15°, 30°, 45°, 60°, 75°, 90°, 105°, 120°, 135°, 150°, 165°, 180°).
2	Take two simple objects. Sketch isometric of them. Also draw orthographic projections of them (all views).
3	Take one circular shape. Assume one point on circumference and mark it. Roll that shape on flat and circular surface. Observe the path of point.
4	List at least two questions individually which you would like to ask for followings:
5	Prepare a 2D drawing using AutoCAD and 2D parametric sketcher environment.
6	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, Gujarat 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. Jeyapooan, T. *Essentials of Engineering Drawing and Graphics using AutoCAD*. Vikas Publishing House Pvt. 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 $\geq 50\%$ 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(Manual Drawings - drawing sheet mode)	Semester	-	20	20
2	Skill Test-1 (unit 1 and 2- Manual based)	At the end of 4 th week	3 Hrs	100	Skill tests-1 is to be reduced to wieghtage of 20
3	Skill Test-2 (Skill test 2 is of CAD based from Unit 4,5)	At the end of 8 th week	3 Hrs	100	Average of two skill tests 2 and 3 (Both skill tests are to
4	Skill Test-3	- At the end of 13 th week	3 Hrs	100	

	(Skill test 3 is CAD based-Unit 6)				be reduced to wieghtage of 20 indepen dently) 20
5	Total Continuous Internal Evaluation (CIE) Assessment			60	
6	Semester End Examination(SEE) Assessment conducted for 100 marks, finally reduced to 40 marks wieghtage	3 Hrs	100	40	
	TOTAL				100

Scheme of Valuation for End Examination

SL NO	QUESTIONS	MARKS
1.	One Problems from Geometrical constructions/Projection of points (Answer Sheet)	25
OR		
	One Problems from Projection of lines (Answer Sheet)	25
2.	One Problems from Projection of planes (Answer Sheet)	25
OR		
	One Problems from Projection of solids (Answer Sheet)	25
3	Create 3D drawing for the given Sketch and Dimensioning(CAD)	40+10=50
	TOTAL	100

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

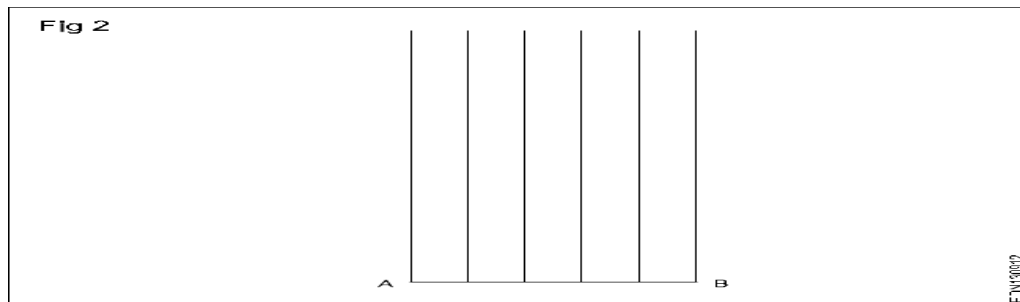
1. Latest Configuration Computers which can be able to run latest any Computer Aided Drafting Software. (At least One Computer per student in practical session.)-30 no
2. Any latest Authorized Computer Aided Drafting Software (30 user licenses)
3. Plotter of size A2/A3
4. LCD Projector

MODEL QUESTION BANK (Suggestive only)

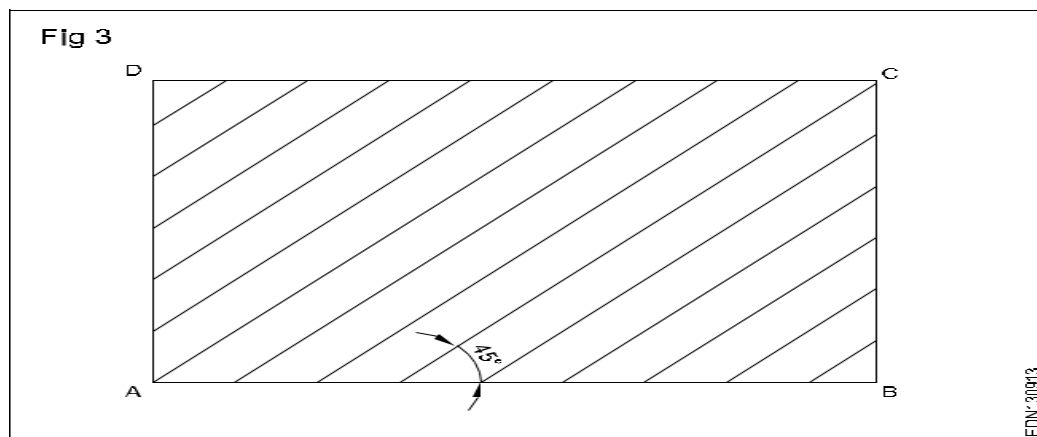
1. a) Illustrate the elements of dimensioning with the help of a sketch.
b) Illustrate the dimensioning of given common features: diameter, radius, chord, Arc and angle.
2. a) Mention the uses of the following drawing instruments.
i) T-square ii) Set square iii) Bow compass iv) Clinograph v) Minidrafter
b) Mention the uses of the following drawing instruments.
i) French curves ii) Protractor iii) Clips iv) Erasing Shield v) Drafting machine
3. Define RF. Mention the types of scales based on RF.
4. Draw the conventional representation of lines
5. Draw six horizontal parallel lines of 50 mm long with 10 mm intervals (Fig 1).



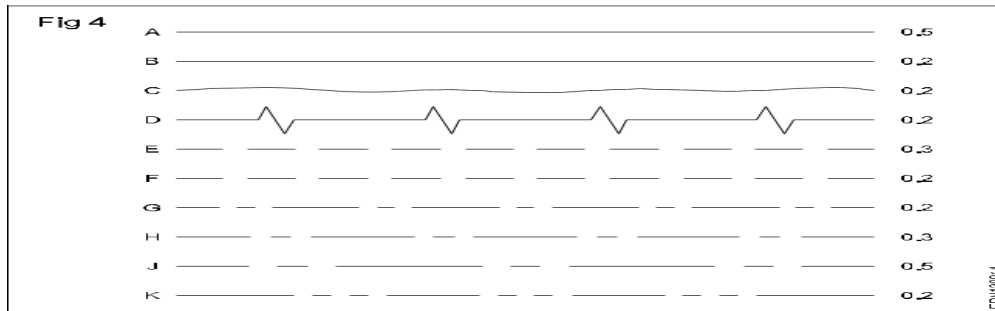
6. Draw six vertical parallel lines of 50 mm length with 10 mm intervals (Fig 2)



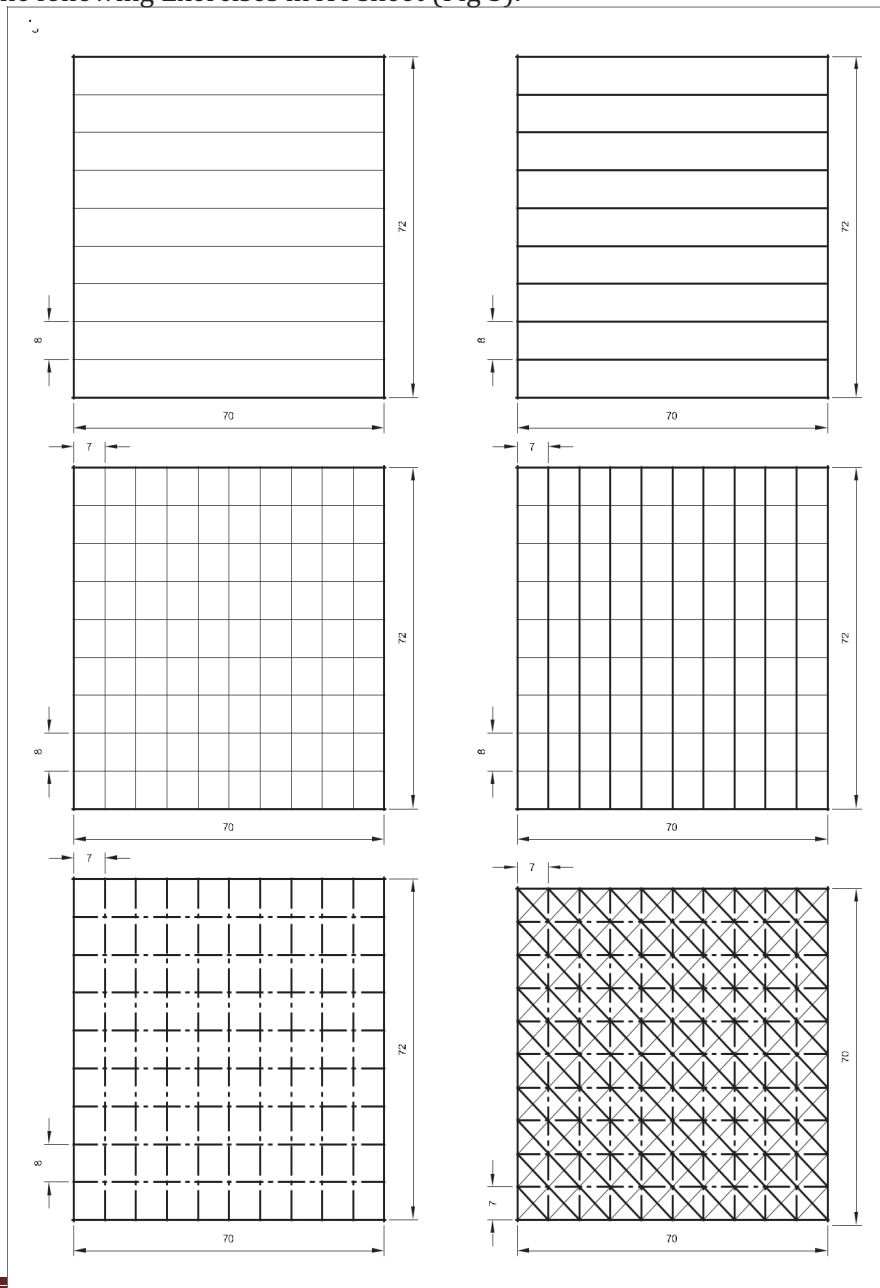
7. Draw 45° inclined lines (Fig 3).



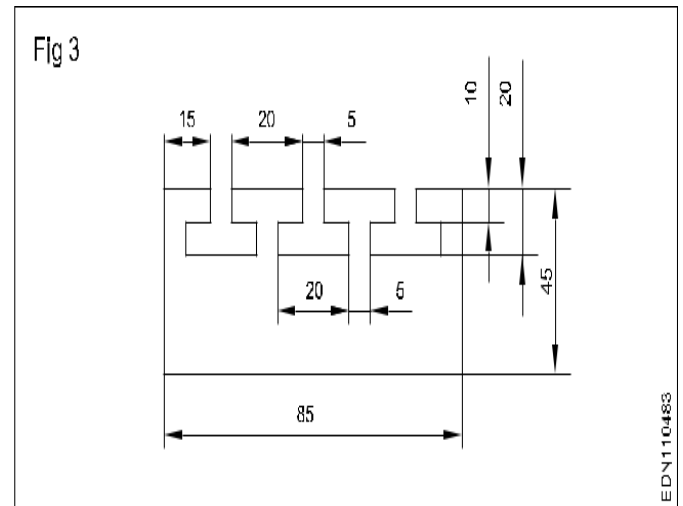
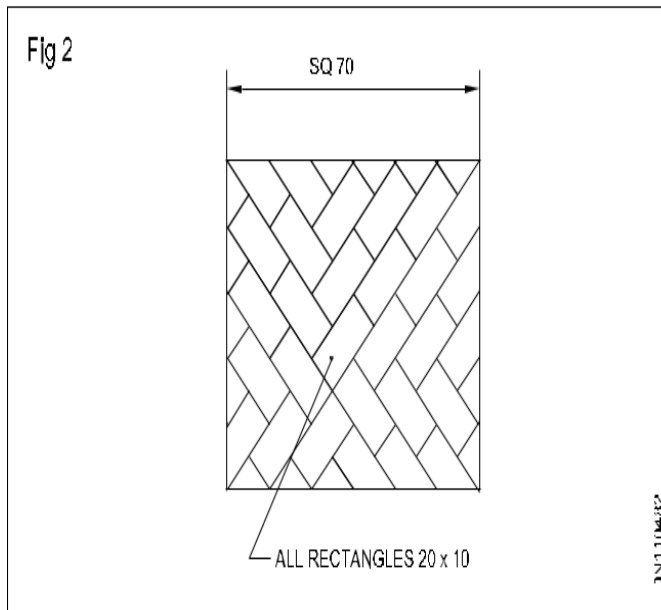
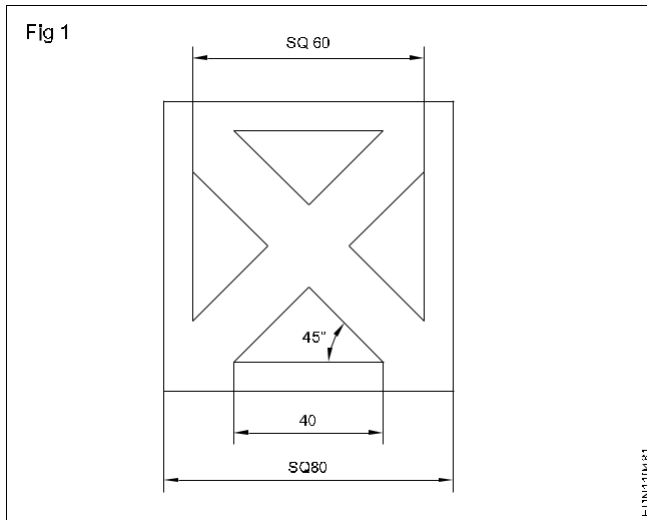
8 Draw the given types of lines using 0.5 range thickness of line according to the specification (Fig 4)



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



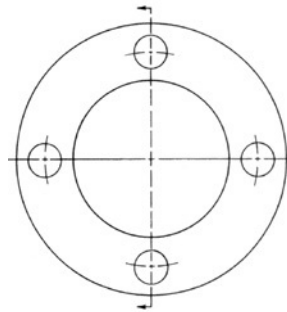
10 Draw the pattern drawing given Figure1,2,3



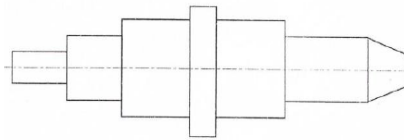
11 a) Illustrate the elements of dimensioning with the help of a sketch.

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

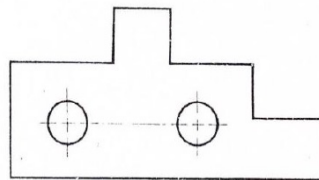
12 Copy the sketch to 1:1 scale and dimension it using Aligned system.



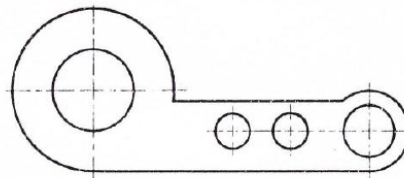
13 Copy the sketch to 1:1 scale and dimension it using unidirectional system with Parallel dimensioning method.



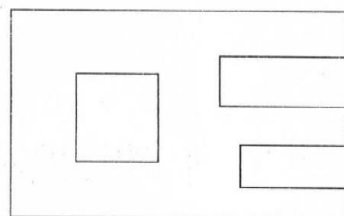
14 Copy the sketch to 1:1 scale and dimension it using Aligned system with Chain dimensioning method.



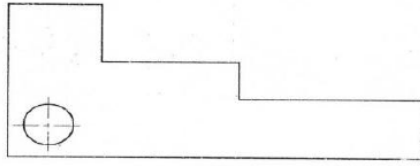
15 Copy the sketch to 1:1 scale and dimension it using Aligned system with Parallel dimensioning method.



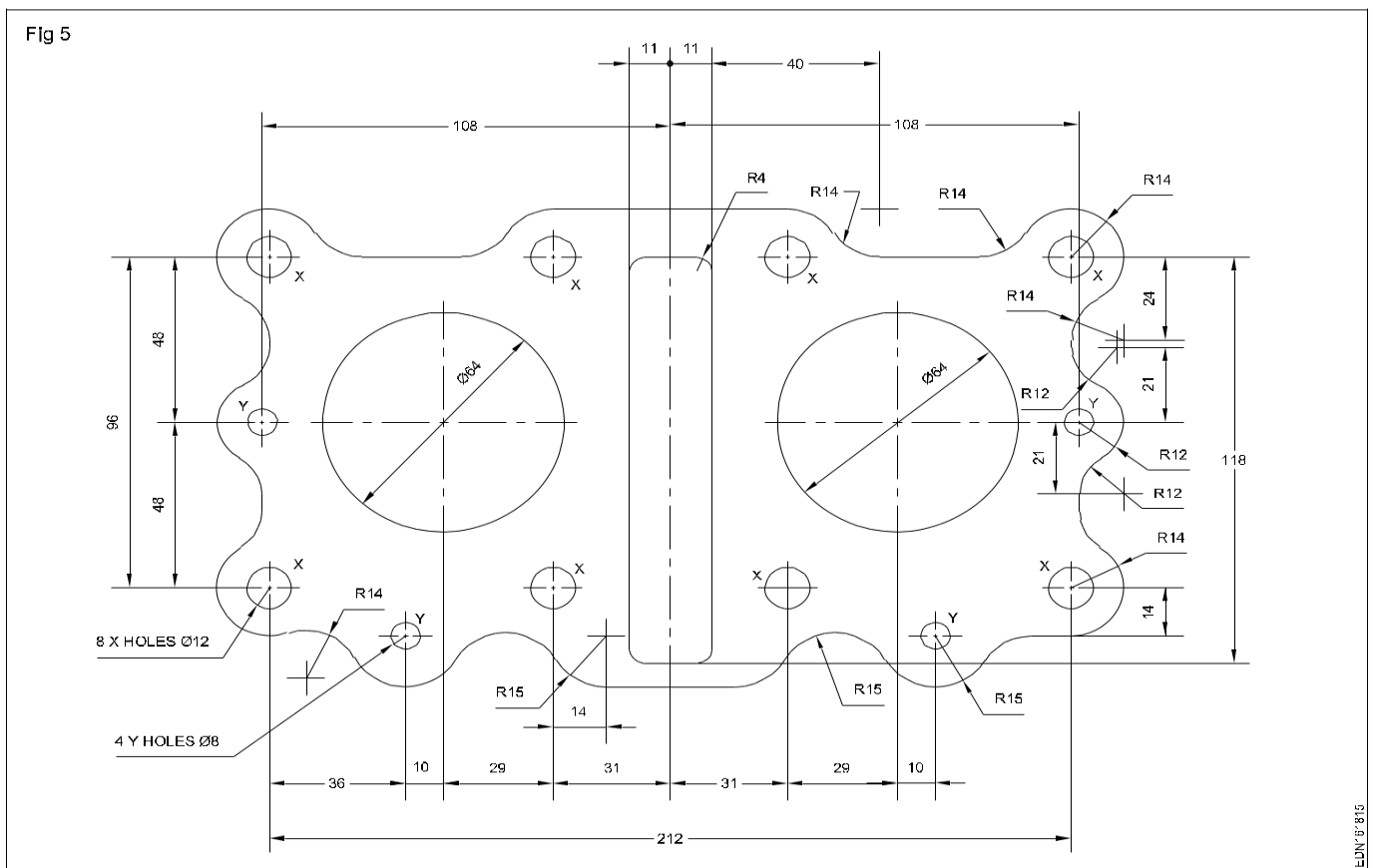
16 Copy the sketch to 1:1 scale and dimension it using unidirectional system with Chain dimensioning method



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



15 Copy the sketch as shown in figure below dimension it in a Chain and parallel dimensioning



UNIT 2 PROJECTIONS

PROJECTIONS OF POINTS

Draw the symbolic representation of First and Third angle projection method.

1. Draw the projections of the following points:
 - i. A is 25mm above the HP and 30mm in front of the VP.
 - ii. B is lying on HP and 45mm in front of VP.
 - iii. C is lying on VP and 50mm above HP.
 - iv. D lies in both HP and VP.
2. A point P is 40 mm in front of VP; 50 mm above HP and 30 mm in front of left PP. Draw the three principal views of the point.
3. A point Q is 30mm in front of VP, 40mm above HP and 35mm in front of right PP. Draw the three principal views of the point.
4. Draw the projections of the following points on a common reference line:
 - a) Point P is 25mm above the HP and 40mm behind the VP
 - b) Point Q is 30mm below the HP and 40mm behind the VP
 - c) Point R is 25mm above the HP and in the VP.
 - d) Point S is 30mm below the HP and in the VP
 - e) Point T is 35mm in front of the VP and in the HP.

PROJECTIONS OF LINES

1. Draw the three views of a line 70mm long when it is parallel to both HP and VP.
The line is 20mm in front of VP and 30mm above HP.
1. Draw the three views of a line 80mm long is perpendicular to VP and parallel to HP. The end nearer to VP is 20mm above HP and 25mm in front of VP.
2. Draw the projections of a line 80mm long placed parallel to VP, perpendicular to HP. The line is 70mm in front of VP and 60mm in front of right PP. the lower end of the line is 30mm above HP. (Ref: KRG Ed 2018 P151)
3. Draw the projections of a line 80mm long placed parallel to HP, perpendicular to VP with the rear end of the line 30mm in front of it. The line is 55mm above HP and 50mm in front of the right PP. (Ref: KRG Ed 2018 P152)
4. Draw the three principal views of a line 80 mm long placed parallel to VP and perpendicular to HP. The line is 70mm in front of VP and 60mm in front of right PP. The lower end of the line is 30mm above HP.
5. Draw the three principal views of a line 80 mm long when it is placed parallel to both HP & VP. One of the ends of the line is 70 mm above HP, 60 mm in front of VP and 30mm in front of the right PP.
6. A line AB 80 mm long is inclined at 30° to HP and parallel to VP. The line is 90 mm in front of VP. The lower end A is 35 mm above HP, 110 mm in front of the right PP and is away from it than the higher end. Draw the three principal views of the line.
7. Draw the projections of a line AB, 80 mm long inclined at 30° to HP and parallel to VP. The line is 40 mm in front of VP. The lower end A is 20 mm above HP.

PROJECTIONS OF PLANE SURFACE

1. A regular triangular lamina of side 30mm is placed with one its corner on HP such that the surface is inclined at 40° to HP and perpendicular to VP. Draw its Top and Front views.
2. A regular square lamina of side 40mm is placed with one its side on HP such that the surface is inclined at 30° to HP and perpendicular to VP. Draw its Top and Front views.
3. A regular pentagonal lamina of side 30mm is placed with one its side on HP such that the surface is inclined at 45° to HP and perpendicular to VP. Draw its Top and Front views.
4. A regular hexagonal lamina of side 30mm is placed with one its corner on HP such that the surface is inclined at 45° to HP and perpendicular to VP. Draw its Top and Front views.
5. A circular lamina of 40mm diameter lies on HP such that its surface is inclined at 40° to HP. Draw its front and top.
6. An equilateral triangular lamina of side 40mm rests with one its sides on HP so that the surface of the lamina is inclined at 30° to HP. The side on which the lamina rests is inclined at 45° to VP. Draw the projections of the lamina.
7. An equilateral triangular lamina of sides 30mm is resting with one of its corners on HP. The surface of the lamina is inclined at 45° to HP and the side opposite to the corner on which the lamina rests is inclined at 45° to VP. Draw the projections of the lamina.
8. A square lamina of 40mm side rests with one of its sides on HP so that the surface of the lamina is inclined at 30° to HP. The side on which the lamina rests is inclined at 45° to VP. Draw the top and front views of the square lamina in this position.
9. A square lamina of 40mm sides rests with one of its corner on HP. The diagonal passing through this corner is inclined at 45° to HP and appears to be inclined at 45° to VP. Draw its projections.

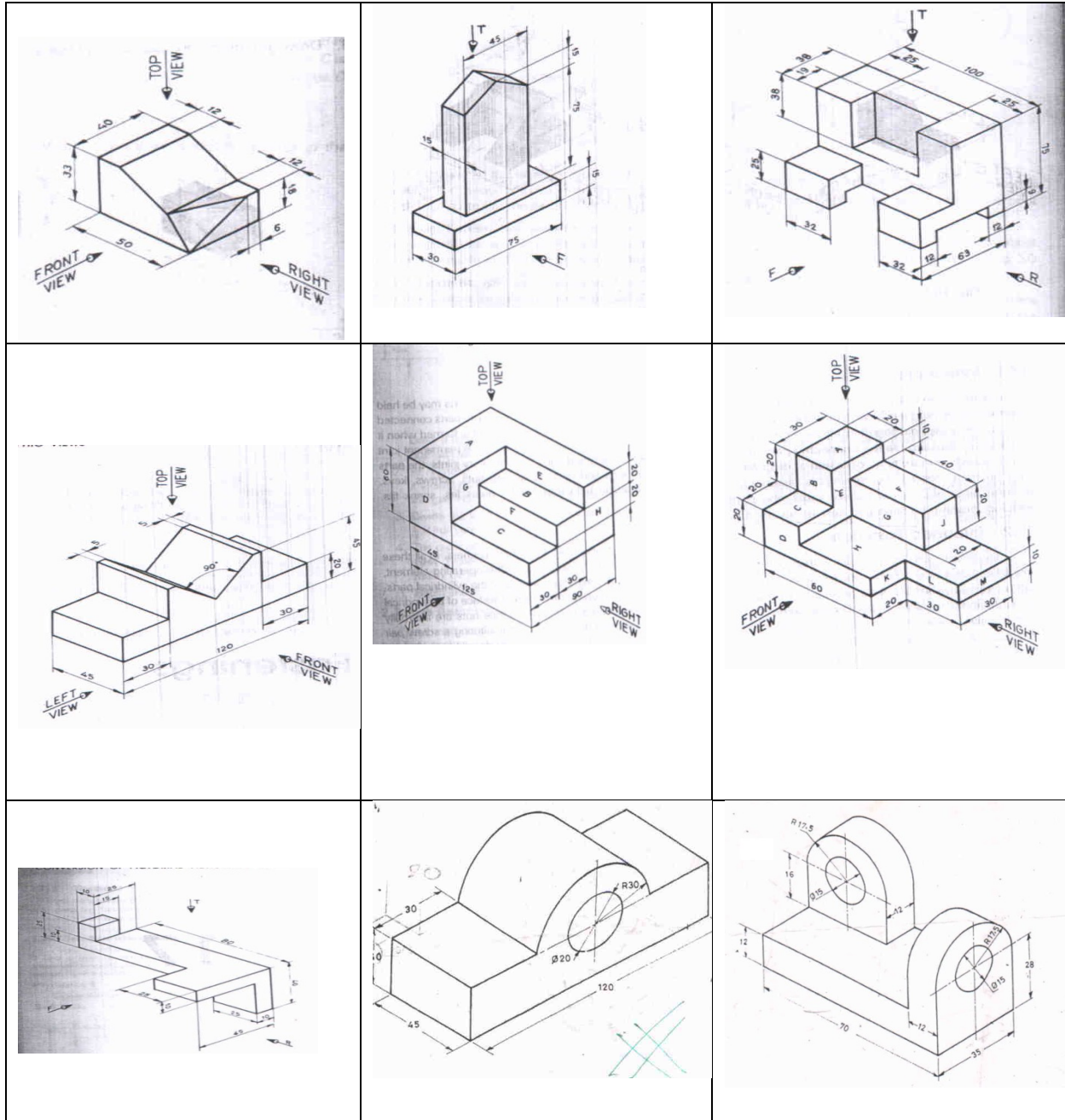
PROJECTIONS OF SOLIDS

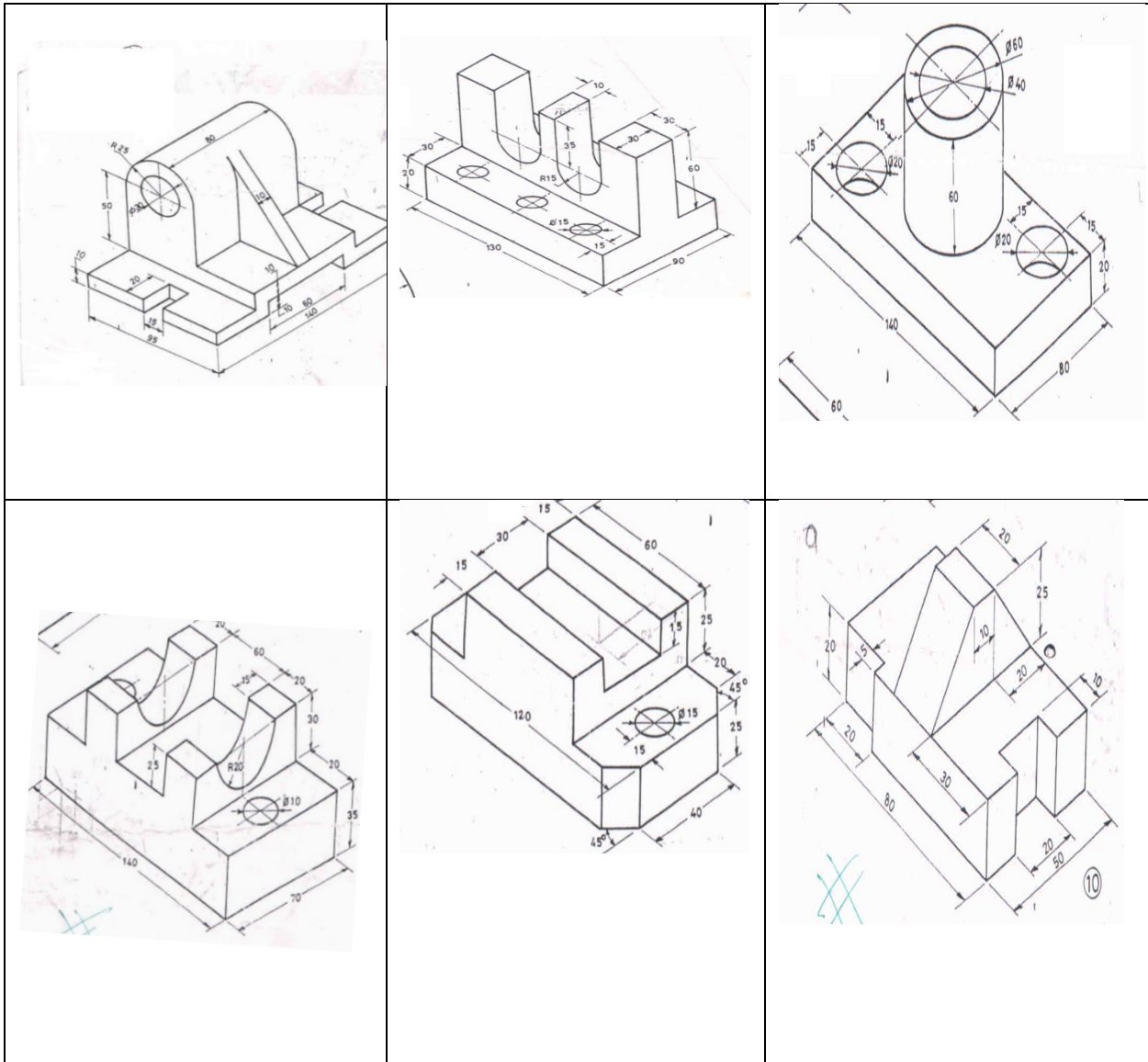
1. A triangular prism of base edge 40mm and height 65mm rests with one of its base edges on HP so that the axis of the prism is inclined at 30° with HP. Draw the top and front views when the axis of the prism is parallel to VP.
2. A square prism of base edge 40mm and height 70mm rests with one of its base edges on HP. The axis of the prism is inclined at 45° to HP and parallel to VP. Draw the top and the front views of the prism.
3. A pentagonal prism of base 35mm and height 60mm has its base edge on HP. Draw the top and front views, if the base of the prism is inclined at 30° to the HP. The axis of the prism is parallel to the VP.
4. A Hexagonal prism of base 35mm and height 60mm is resting with its base edge on HP so that the axis is inclined at 45° and parallel to VP. Draw its top and front views.
5. A triangular pyramid of base edge 40mm and height 65mm is resting with one of its base corner on HP so that the axis of the pyramid is parallel to VP and inclined at 45° to HP. Draw the top and front views.
6. Draw the top and front views of a hexagonal pyramid resting with one of its base corner on HP such that the axis of the pyramid is inclined at 30° to HP. The hexagonal pyramid has its base edges as 30mm and axis height as 60mm.
7. A pentagonal pyramid of base edge 30mm and axis height 65mm rests with one of its base corners on HP so that the base of the pyramid is inclined at 45° to the HP. Draw the projections if the axis of the pyramid is parallel to the VP.

8. A cylinder of 40mm diameter and axis height 65mm rests with its points of the circumference on HP so that the axis is inclined at 45° to the HP and parallel to the VP. Draw the top and front views.
9. A cone of 40mm diameter and axis height 65mm is resting with points of the circumference on HP. Draw the top and front views, if the axis of the cone is inclined at 30° with HP and parallel to VP.

UNIT 3 ORTHOGRAPHIC REJECTIONS

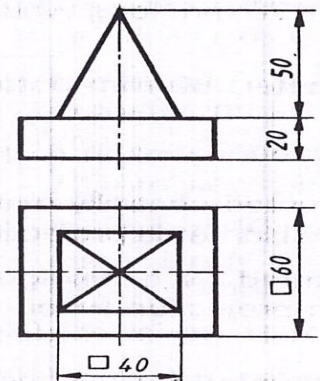
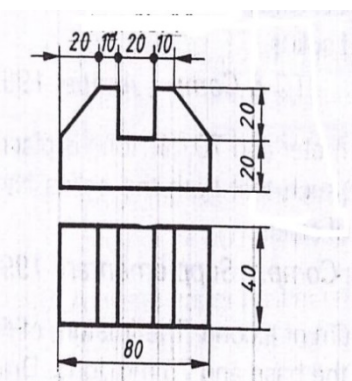
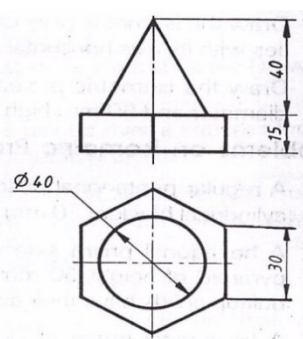
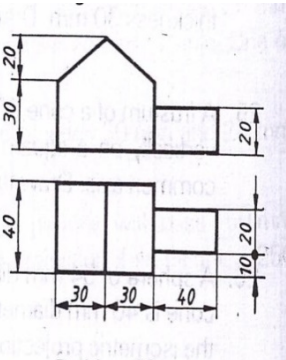
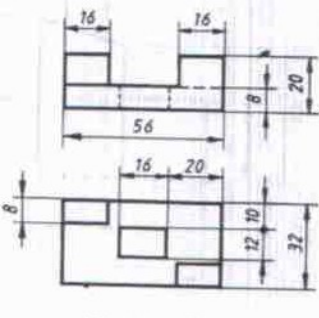
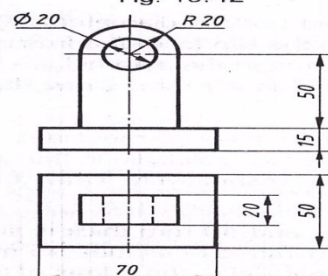
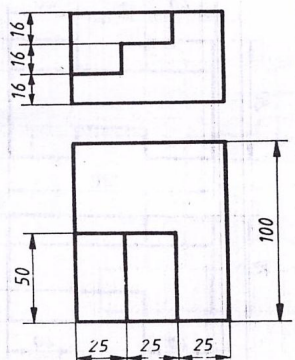
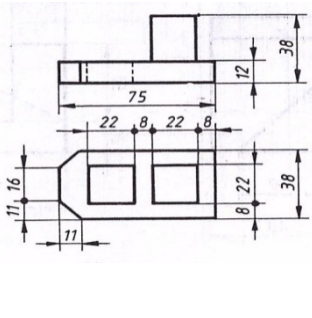
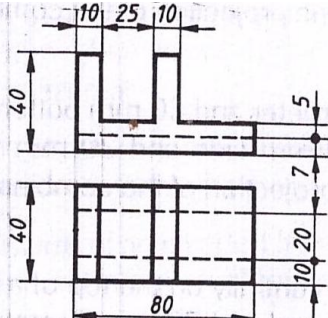
Draw the three principal views of the component as shown in the figure.



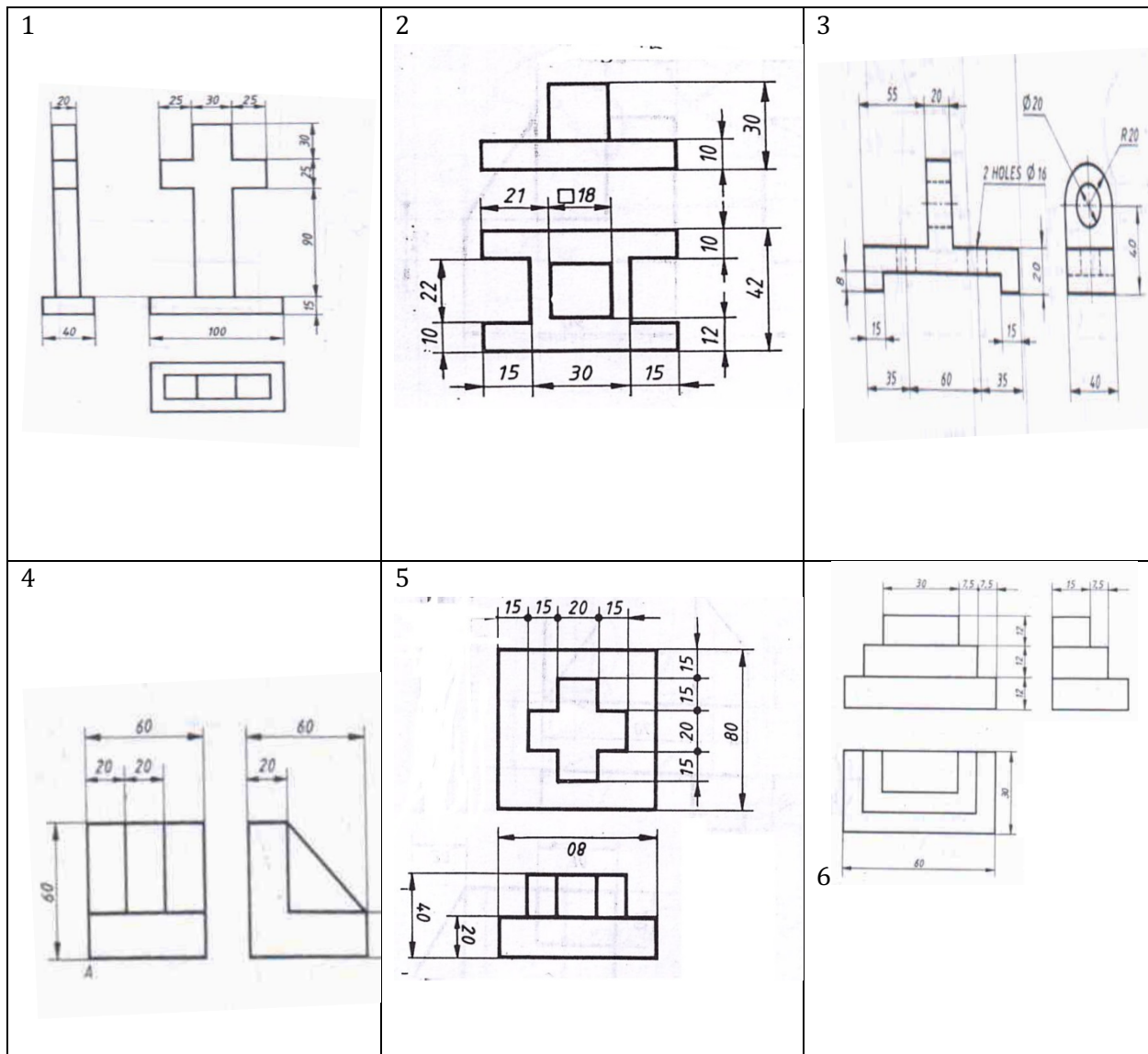


UNIT 4 ISOMETRIC PROJECTIONS

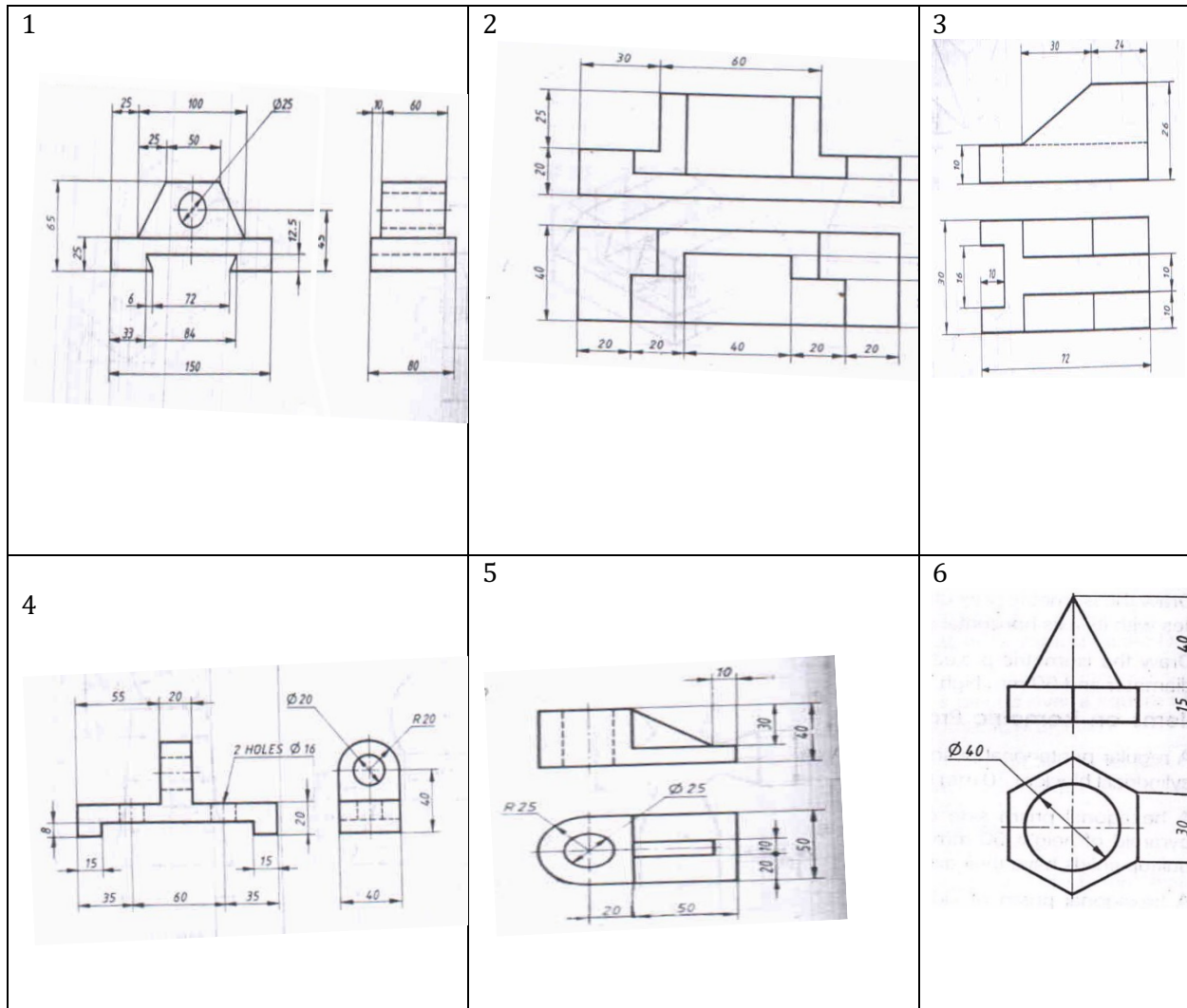
1. Draw the isometric view of the machine component whose orthographic views are given below:

<p>1.</p> 	<p>2.</p> 	<p>3.</p> 
<p>4.</p> 	<p>5.</p> 	<p>6.</p>  <p>All dimensions in mm</p>
<p>7.</p> 	<p>8.</p> 	<p>9.</p>  <p>All dimensions in mm</p>

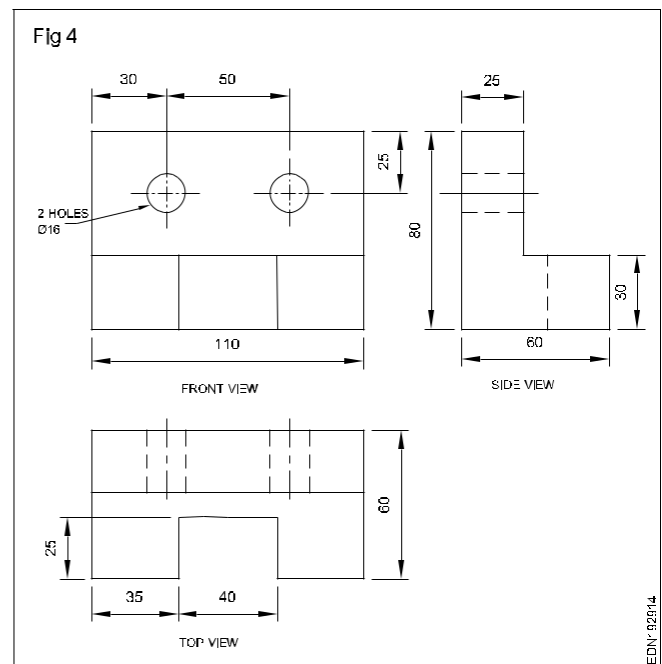
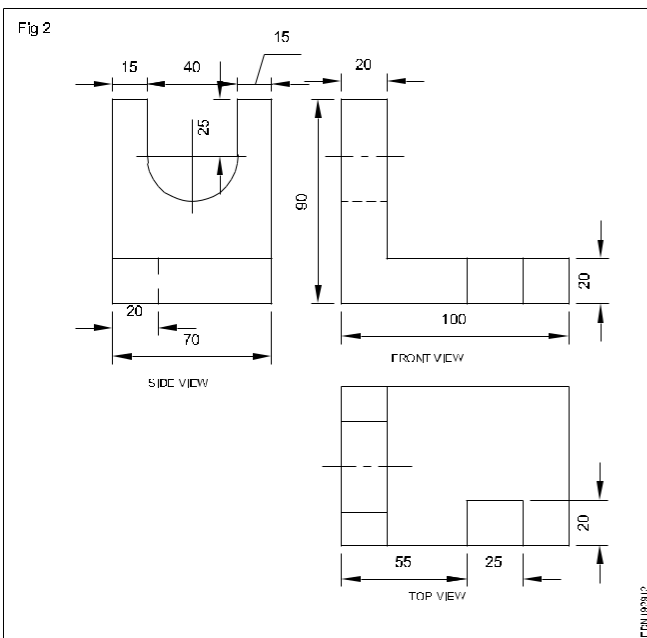
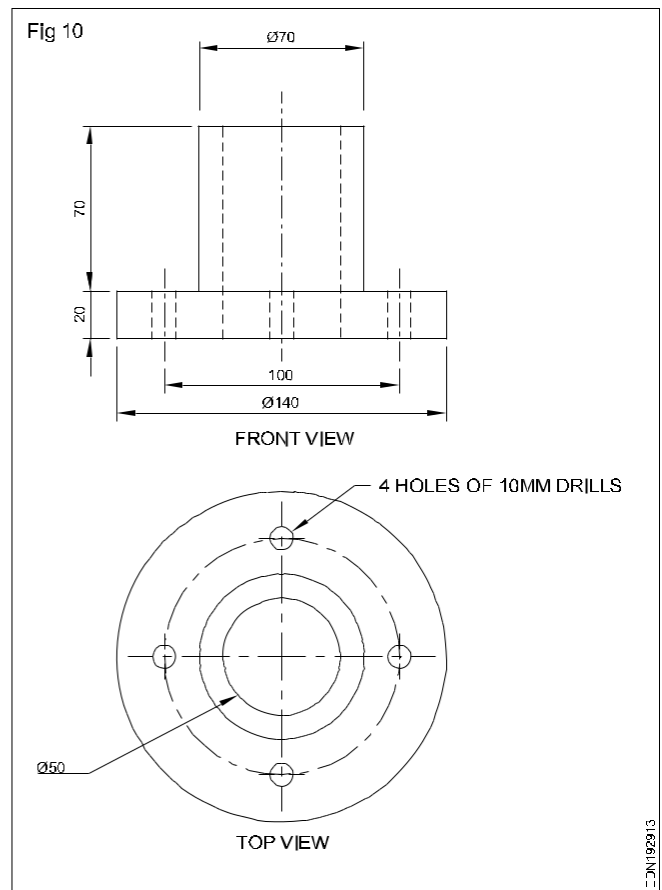
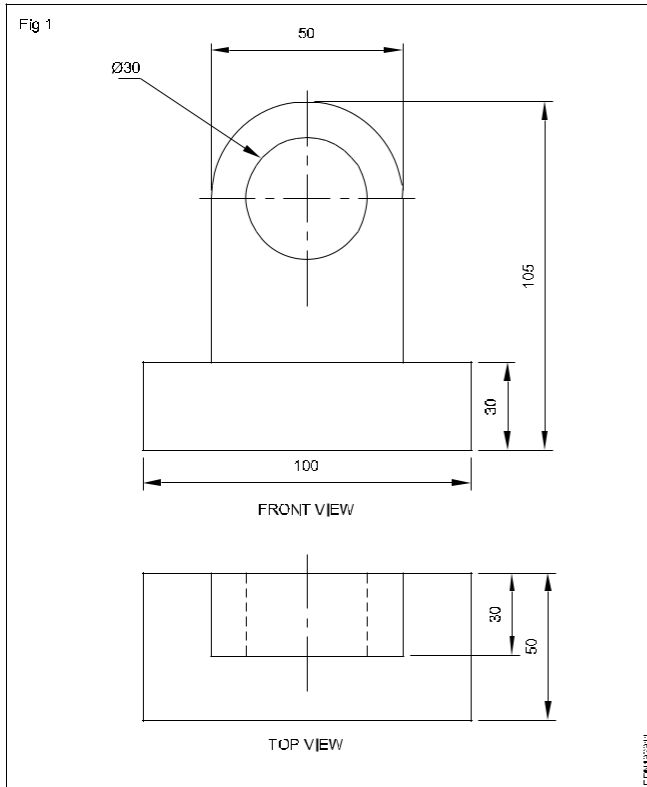
2. Draw the isometric Projection of the machine component whose orthographic views are given below:



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



4. Create 3D model using CAD of the machine component whose orthographic views are given below



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 :

C01	Importance of ecosystem and terminology.
C02	The extent of air pollution, effects, control measures and acts.
C03	The extent of noise pollution, effects, control measures and acts.
C04	The water and soil pollution, effects, control measures and acts
C05	Different renewable energy resources and efficient process of harvesting.
C06	Solid Waste Management and Environmental acts.

COURSE CONTENT:

<i>Marks: 15</i>	<i>Unit-1 Ecosystem</i>	<i>Allotted Hrs: 03</i>
Structure of ecosystem, Biotic & Abiotic components, Aquatic (Lentic and Lotic) and terrestrial ecosystem. Global warming - Causes, effects, Green House Effect, Ozone depletion.		
<i>Marks: 20</i>	<i>Unit-2 Air Pollution</i>	<i>Allotted Hrs: 03</i>
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		
<i>Marks: 10</i>	<i>Unit-3 Noise Pollution:</i>	<i>Allotted Hrs: 02</i>
Noise pollution: sources of pollution, measurement of pollution level, Effects and Control of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000		
<i>Marks: 20</i>	<i>Unit- 4 Water and Soil Pollution:</i>	<i>Allotted Hrs: 06</i>
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 Rainwater Harvesting. Soil pollution, Causes, Effects and Preventive measures of Soil Pollution due to Excessive use of Fertilizers, Pesticides and Insecticides		
<i>Marks: 20</i>	<i>Unit-5 Renewable sources of Energy</i>	<i>Allotted Hrs: 07</i>
<i>Solar Energy:</i> Basics of Solar energy. Definition and advantages of advanced solar collectors. Solar water heater and Solar stills and their uses. <i>Biomass:</i> Overview of biomass as energy source. Thermal characteristics of biomass as fuel. <i>Wind energy:</i> 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.		
<i>Marks: 15</i>	<i>Unit-6 Solid Waste Management and Environmental Acts</i>	<i>Allotted Hrs: 05</i>
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.	C01	1,5,7	1
	Global warming - Causes, effects.	C01	1,5,7	2
	Green House Effect, Ozone depletion - Causes, effects	C01	1,5,7	3
2. Air and Pollution	Air pollution, Natural sources of air pollution, Man Made sources of air pollution	C02	1,5,7	4
	Air pollutants and Types, Effects of Particulate Pollutants and control by Cyclone separator	C02	1,5,7	5
	Effects of Particulate Pollutants and control by Electrostatic Precipitator, Air (prevention and control of pollution) act 1981.	C02	1,5,7	6
3. Noise Pollution	Noise pollution: sources of pollution, Measurement of Noise pollution level.	C03	1,5,7	7
	Effects and Control of Noise pollution.	C03	1,5,7	8
	Noise pollution (Regulation and Control) Rules, 2000	C03	1,5,7	8
4. Water and Soil Pollution:	Sources of water pollution. Types of water pollutants, Characteristics of water pollutants.	C04	1,5,7	9
	Control measures of water pollution.	C04	1,5,7	10
	Definition and list unit operations in water and Wastewater Treatment process, Water (prevention and control of pollution) act 1974.	C04	1,5,7	11
	Water conservation – Importance of Rainwater Harvesting	C04	1,5,7	12
	Soil pollution, Causes and Effects due to Fertilizers, Pesticides and Insecticides	C04	1,5,7	13
	Preventive measures of Soil Pollution due to Excessive use of Fertilizers, Pesticides and Insecticides.	C04	1,5,7	14
5. Renewable sources of Energy	Solar Energy: Basics of Solar energy.	C05	1,5,7	15
	Solar collectors and advantages of Advanced solar collectors.	C05	1,5,7	16
	Solar water heater, Solar stills and their uses.	C05	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.	C05	1,5,7	18
	Wind energy in India.	C05	1,5,7	18
	Need of new Energy sources, Different type's new energy sources.	C05	1,5,7	19
6. Solid Waste Management and Environmental Acts	Environmental benefits of New Energy Sources-Hydrogen energy	C05	1,5,7	19
	Environmental benefits of New Energy Sources- Ocean energy resources	C05	1,5,7	20
	Environmental benefits of New Energy Sources-Tidal energy conversion.	C05	1,5,7	21
	Solid waste generation, Sources, Characteristics of solid waste	C06	1,5,7	22
	Solid Waste Management rules 2016	C06	1,5,7	22
	E- Waste generation Sources and characteristics,	C06	1,5,7	23
	E waste management rules 2016	C06	1,5,7	23
	Plastic Waste generation Sources and characteristics,	C06	1,5,7	24
	Plastic Waste Sources and characteristics	C06	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:**

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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.
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9. 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.
10. Patvardhan, A.D, Industrial Solid Waste, Teri Press, New Delhi, 2013, ISBN:978-81-7993-502-6
11. Metcalf & Eddy, Wastewater Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.
12. 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	
C01	Importance Of ecosystem and terminology	1,5,7	R, U	03	02	02	04
C02	The extent of air pollution, effects, control measures and acts.	1,5,7	R, U	03	03	02	05
C03	The extent of noise pollution, effects, control measures and acts.	1,5,7	R, U	02	03	02	05
C04	The water and soil pollution, effects, control measures and acts	1,5,7	R, U	06	03	02	05
C05	Different renewable energy resources and efficient process of harvesting.	1,5,7	R, U	07	03	02	05
C06	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	C01	3	0	0	0	2	0	1
	C02	3	0	0	0	2	0	1
	C03	3	0	0	0	2	0	1
	C04	3	0	0	0	2	0	1
	C05	3	0	0	0	2	0	1
	C06	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 $\geq 50\%$ 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 rd week	80 minutes	30	Average of three written tests 30
2.	CIE Assessment 2 (Written Test -2) - At the end of 7 th week	80 minutes	30	
3.	CIE Assessment 3 (Written Test -3) - At the end of 13 th week	80 minutes	30	
4	CIE Assessment 4 (MCQ/Quiz) - At the end of 5 th week	60 minutes	20	Average of three 20
5	CIE Assessment 5 (Open book Test) - At the end of 9 th week	60 minutes	20	
6	CIE Assessment 6 (Student activity/Assignment)- At the end of 11 th 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 composting 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)			

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Course Code	20PM01T	Semester	II
Course Title	Project Management Skills	Course Group	PM
No. of Credits	4	Type of Course	Activity based study
Course Category	Theory with Activities	Total Contact Hours	6 Hrs Per Week (2Theory +4 hrs of classroom activities)
			78 Hrs Per Semester
Prerequisites	10 th Level Mathematics	Teaching Scheme	4 hrs per week classroom sessions dedicated to case studies & activities
CIE Marks	50	SEE Marks	50

RATIONALE

Project Management is a confluence of Management principles and Engineering subject area. This course enables the students to develop conceptualisation of Engineering Management principles and apply the same for their engineering projects, in their domains, example, Software Development project or Construction Project and so on. The course integrates three core areas of Planning, Execution and Auditing of Projects.

1. COURSE SKILL SET

Student will be able to:

1. Understand what constitutes a project, Plan for the execution of the project by breaking into manageable work units, and Prepare necessary project artifacts
2. Track and control the Project while preparing verifiable records for Project Inspections and Audits
3. Inspect and Audit projects for Milestones or other project completion criteria and other metrics, Defects and remediation, Project learnings
4. Gain knowledge and develop curiosity on latest technology trends in Project management

2. COURSE OUT COMES

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

C01	Apply the concepts of Project Management to real projects which are expressed in the form of the Project reports or Engineering drawings
C02	Estimate Project resources needed – Time, Material and Effort, and Plan for execution
C03	Understand, analyse and assess the risks involved in a project and plan for managing them
C04	Use Project Management Software and processes to track and control Projects
C05	Conduct inspection of Projects and audit progress and bills
C06	Understand the Digital Technology trends in Project management and concepts like Smart cities

3. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS

UNIT NO	UNIT TITLE	TEACHING HOURS (L-T-P)	MARKS DISTRIBUTION(THEORY)			
			R LEVEL	U LEVEL	A LEVEL	TOTAL
1	Introduction	02-00-04	8	8	4	20
2	Project Administration	06-00-12	8	12	20	40
3	Project Lifecycle	04-00-08	8	12	20	40
4	Project Planning, Scheduling and Monitoring	06-00-12	8	12	20	40
5	Project Control, Review and Audit	06-00-12	8	12	20	40
6	Digital Project Management	02-00-04	8	8	4	20
	Total	26-00-52=78	48	64	88	200

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

4. 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	Topics / Subtopics	Hours L-T-P
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	(In cognitive domain)		
1 Introduction	Use Basic Science, Maths skills to understand Project management and project planning, execution and control.	Introduction and definition, Features of a Project, Types of Projects, Benefits and Obstacles in Project Management, Project Management Profession, Role of Project manager, Consultants, Project and Operation, Project Management Process, Project Scope	02-00-04
2 Project Administration	Able to develop WBS, PEP and PM processes for Project with given inputs	Project Administration, Project Team, Project Design, Work Breakdown Structure (WBS), Project Execution Plan (PEP), Systems and Procedure Plan, Project Direction, Communication and Co-ordination, Project Success Case Study I	06-00-12
3 Project Lifecycle	Use project administration and project lifecycle knowledge to Assess and plan for project risk	Project Life Cycle, Phases - Project Planning, Project Execution, Project Closure, Project Risks, Project Cost Risk Analysis, Time and Cost overruns Case Study 2a	04-00-08
4. Project Planning, Project Scheduling and Project Monitoring and Implementation	Able to develop a detailed project plan given the inputs on manpower, funds availability and time availability	Project Planning Function, Structure, Project Scheduling, Project monitoring and Project evaluation Case Study 2b	06-00-12
5. Project Control, Review and Audit	Use Project Management lifecycle knowledge to Control project parameters, review and audit project performance	Project Control, Problems of Project Control, Gantt Charts, Milestone Charts, Critical Path Method (CPM), Network Technique in Project Scheduling, Crashing Project Duration through Network, Project Review, Initial Review, Performance Evaluation, Abandonment Analysis, Project Audit	06-00-12

		Case Study 2c	
6.Digital Project Management	Understand latest trends of digital technologies impacting the domain of project management and application of the same in multiple scenario	Digital Technology trends in Project management, Cloud Technology, IoT, Smart cities, Data and analytics, case studies Case study 3	02-00-04

1. MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	UNIT Linked	CL R/U/A	Sessions in Hrs	TOTAL - Marks
CO1	Understand the concepts of Project Management in relation to real projects which are expressed in the form of the Project reports or Engineering drawings Case Study - I	1, 2, 5, 7	1, 2	R/U/A	06	10
CO2	Estimate Project resources needed – Time, Material and Effort, and Plan for execution Case study – 2a	1, 2, 3, 7	2, 3	R/U/A	18	20
CO3	Evaluate the risks involved in a project and Plan for managing them Case Study - 2a	1,2,3,7	2,3	R/U/A	12	20

C04	Use Project Management methods with Software and/or processes to track and control Projects Case Study – 2b	1, 4, 6, 7	4	R/U/A	18	20
C05	Conduct inspection of Projects and audit progress and bills Case Study 2c	1, 2, 5, 7	5	R/U/A	18	20
C06	Understand the Digital Technology trends in Project management, and Engineering Industries Case Study 3	1, 5, 7	6	R/U/A	06	10
					78	100

	CO's	Programme Outcomes s) (PO						
		1	2	3	4	5	6	7
Project Management	CO1	3	3	0	0	2	0	1
	CO2	3	3	3	0	0	0	1
	CO3	3	0	0	3	0	3	1
	CO4	3	0	0	3	0	3	1
	CO5	3	2	0	0	2	0	1
	CO6	3	0	0	0	2	0	2
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0-Not Mapped								

7. INSTRUCTIONAL STRATEGY

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes

1. Explicit instruction will be provided in intervention classes or by using different differentiation strategies in the main classroom.

2. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching method and media that are employed to develop the outcomes.
3. Observing the way their more proficient peers use prior knowledge to solve current challenges and persevere in problem solving will help struggling students to improve their approach to engaging with rich contextual problems.
4. Topics be introduced always with a reallife example and then answering What, how, why and when.
5. The teacher is able to show different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
6. In a perfect world, teacher would always be able to demonstrate how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding. When a concept cannot be applied in that manner, we can still share how it might be applied within mathematics.

8. SUGGESTED LEARNING RESOURCES:

Sl No.	Author	Title of Books	Publication/Year
1	Dr. Lalitha Balakrishnan & Dr. Gowri Ramachandran	Project Management	Himalaya Publishing, 2019
2	Shailesh Kumar Shivakumar	Complete Guide to Digital Project Management	Apress, 2019
3	Prasanna Chandra	Project planning, analysis, selection, implementation and review	Tata McGraw Hill
4	Gopala Krishnan	Project Management	Mcmillan India Ltd.

9. COURSE ASSESSMENT AND EVALUATION CHART

Sl.No	Assessment	Duration	Max marks	Conversion
1	CIE Assessment 1 (Written Test -1) At the end of 3 rd week	80 minutes	30	Average of three written tests 30
2	CIE Assessment 2 (Written Test -2) At the end of 7 th week	80 minutes	30	

Sl.No	Assessment	Duration	Max marks	Conversion
3	CIE Assessment 3 (Written Test -3) At the end of 13 th week	80 minutes	30	
4	CIE Assessment 4 (Group Assignment -1) At the end of 5 th week	60 minutes	20	Average of three 20
5	CIE Assessment 5 (Group Assignment -2) At the end of 9 th week	60 minutes	20	
6	CIE Assessment 6 (Individual Student activity/Assignment) At the end of 11 th week	60 minutes	20	
Total Continuous Internal Evaluation (CIE) Assessment				50
8	Semester End Examination (SEE) Assessment (Written Test)	3 Hrs	100	50
Total Marks				100

Note:

- SEE (Semester End Examination) is conducted for 100 Marks theory course for a time duration of 3 Hrs
- Three CIE (written test), each of 30 marks for a time duration of 80 minutes shall be conducted. Also, three CIE (MCQ or Quiz/Group Assignment/Individual student activity or assignment) each of 20 marks for the time duration of 60 minutes shall be conducted. Any fraction at any stage during evaluation will be rounded off to the next higher digit
- 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.

10 DETAILED COURSE CONTENT

Unit No And Name	DETAILED COURSE CONTENT	CONTACT HRS	TOTAL
	1.1 Introduction	3	

Unit No And Name	DETAILED COURSE CONTENT	CONTACT HRS	TOTAL
1. Introduction	1.2 Meaning of Project		6
	1.3 Definition and No Change Mode		
	1.4 Features of a Project		
	1.5 Types of Projects		
	1.6 Benefits of Project Management		
	1.7 Obstacles in Project Management		
	1.8 Project Management – A Profession		
	1.9 Project Manager and His Role		
	1.10 Project Consultants		
	1.11 What is Operation?	3	
	1.12 Difference between Project and Operation		
	1.13 What is Process in Project Management and Process Groups?		
	1.14 What is Scope? Difference between Project Group Objectives and		
	1.15 Project Scope		
2. Project Administ ration	2.1 Essentials of Project Administration	3	18
	2.2 Project Team	6	
	2.3 Project Design		
	2.4 Work Breakdown Structure (WBS)		
	2.5 Project Execution Plan (PEP)	3	
	2.6 Contracting Plan		
	2.7 Work Packing Plan		
	2.8 Organisation Plan	3	
	2.9 Systems and Procedure Plan		
	2.10 Project Procedure Manual		
	2.11 Project Diary	3	
	2.12 Project Execution System		
	2.13 Project Direction		
	2.14 Communication in a Project	3	
	2.15 Project Co-ordination		

	2.16 Pre-requisites for Successful Project Implementation		
3. Project Lifecycle	3.1 Introduction	6	12
	3.2 Phases of Project Life Cycle		
	3.3 Project Management Life Cycle – General		
	3.4 Project Planning		
	3.5 Project Execution		
	3.6 Project Closure		
	3.7 Project Risks	3	
	3.8 Types of Risks: Illustrations		
	3.9 Risk Assessment Techniques with Illustrations		
	3.10 Project Cost Risk Analysis	3	
	3.11 Estimating Time and Cost Overrun Risks		
	3.12 Organisation/Procedural/Systemic Reasons for Project Cost Overruns		
	3.13 Time Overruns		
4. Project Planning, Scheduling and Monitoring	4.1 Introduction	6	18
	4.2 Nature of Project Planning		
	4.3 Need for Project Planning		
	4.4 Functions of Project Planning		
	4.5 Steps in Project Planning		
	4.6 Project Planning Structure		
	4.7 Project Objectives and Policies		
	4.8 Tools of Project Planning		
	4.9 Project Scheduling	6	
	4.10 Time Monitoring Efforts		
	4.11 Bounding Schedules		
	4.12 Scheduling to Match Availability of Manpower		
	4.13 Scheduling to Match Release of Funds		
	4.14 Problems in Scheduling Real-life Projects		
	4.15 Introduction	3	

	4.16 Situation Analysis and Problem Definition		
	4.17 Setting Goals and Objectives		
	4.18 Generating Structures and Strategies		
	4.19 Implementation		
	4.20 What is Project Evaluation?	3	
	4.21 Why is Project Evaluation Important?		
	4.22 What are the Challenges in Monitoring and Evaluation?		
5. Project Control, Review and Audit	5.1 Introduction	6	18
	5.2 Projected Control Purposes		
	5.3 Problems of Project Control		
	5.4 Gantt Charts		
	5.5 Milestone Charts		
	5.6 Critical Path Method (CPM)	6	
	5.7 Construction of a Network		
	5.8 Network Technique in Project Scheduling		
	5.9 Crashing Project Duration through Network		
	5.10 Project Review	3	
	5.11 Initial Review		
	5.12 Post Audit		
	5.13 Performance Evaluation		
	5.14 Abandonment Analysis	3	
	5.15 Objectives of Project Audit		
	5.16 Functions of Project Auditor		
	5.17 Project Audit Programme		
	5.18 Difficulties in Establishing Audit Purpose and Scope		
6. Digital Project Management	6.1 Digital Technology trends in Project management	1	6
	6.2 Cloud Technology, IoT, AR and VR applications in Project management, Smart Cities	1	

6.3 Data Science and Analytics in Project Management	1
6.4 Case Studies	3

Case Studies:

Please note: The Tutors can either use the following Case studies and activities or Design on their own, with the overall Learning Outcomes being met.

Case Study I: Residential House – Project Execution Plan

1. Dr. Sunil Kulkarni wants to build a house on his 9000 square feet (90x100) vacant plot in Bengaluru. His requirements were given below.
 - i) He lives with his wife, parents and two college going children.
 - ii) He likes open space around his house and likes to do gardening during free time
 - iii) His wife teaches Yoga and about 30 middle aged and old people attend the daily sessions.
 - iv) He has a budget limitation of INR 230,00,000 for this project and wants to present to his wife on their 20th wedding anniversary which is 18 months away.
 - v) His parents can not climb stairs and hence prefer a ground floor room
 - vi) All the rooms should have attached bathrooms

How-ever the Civil contractor who took the work, overshoot the time and money available and hence Dr Sunil was unhappy with the Architect firm who recommended the Contractor.

Task:

- Split the class into groups of three
- Ask them to prepare 2D drawings – with Plan, Elevation, Sections and perspectives.
- Prepare the detailed WBS, a Project execution plan and Project communication plan for contractors
- Estimate the quantities
- Discuss on the possible reasons for delay and methods with which performance to both time and budget could have been achieved
- Present it in a seminar, with each group getting 5-10 minutes to present their idea.

Case Study 2a:

The Columbus Hospital proposed in Hubli is a 200 bed speciality private hospital for treatment of Cancer. The hospital will come up on a 12 acre plot between Hubli-Dharwad. A leading construction company has come forward to complete the hospital works from concept to commissioning in 9 months. The promoters are willing to spend a premium to complete the hospital in 9 month time and are not particular about type of construction, ie, RCC, Steel frame etc. The key requirements are as follows:

- i) 200 bed hospital of which 40 are for critical care (ICU), 40 for pre and post Operative care
- ii) 4 Operation Theatres - 2 Major (Minimum 800 SFT each) and 2 minor (minimum 400 sft each)
- iii) One full fledged Diagnostic laboratory (1500 Sft)
- iv) One 24x7 pharmacy (360 Sft min)
- v) Doctors rooms, Nurses enclosures, Change rooms
- vi) Office with billing counters (min 2000 sft) for all administrative staff
- vii) Wheel chair parking bays, Stretcher parking bays in all floors
- viii) One Cafeteria with 50 person capacity
- ix) One conference room with Multimedia equipment (300 sft min)
- x) Parking for ambulances, 4 wheelers, two wheelers
- xi) Reception and enquiry counter
- xii) All amenities should be accessible for disabled persons
- xiii) Incinerator, Waste storage and disposal area
- xiv) Generator and fuel storage area

Discuss

- i) The various alternative approaches available to complete the hospital.
- ii) Look into National Building Code and BIS standards for arriving at approximate (+/- 10%) super built-up area required, amenities to be planned
- iii) The various phases of the project according to Project lifecycle and durations
- iv) Prepare the detailed WBS, Project Organisation required and Project Dairy template
- v) Prepare a Project Plan with risks involved and the risk management plan.
- vi) Estimate the cost of time overrun if the project is delayed by 114 calendar days due to issues with approvals

Case Study 2b:

For case study 2 above, prepare an Implementation Plan using a spreadsheet software.

Discuss

- i) What happens if a pandemic affects the project in its 7th Month. How do you mitigate the possible issues in implementation?
- ii) What happens if during the fourth month of projects the client decides to reduce funds for the month by 50% ?

Case Study 2c:

For case study 2 above, prepare a Critical Path method Chart (CPM) showing all main activities in the WBS with milestones.

Discuss

- i) What happens if the client decides to complete the ground floor roof 15 days earlier ?
- ii) What happens if the client reduces the inflow of project funds by 50% for the month 4 ?
- iii) Write an Audit report for the project at the end of 6th month

Case Study 3:

This will be done as a student activity and has two components.

- i) Research on 3D printing in any industry and prepare a three page article
- ii) Study usage of Drones in different Industries and evaluate the Cost benefits of using the same for any one scenario.

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)					

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)				

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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	10 TH 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

C01	Understand the tools of data collection, classification and cleaning of data.
C02	Able to summarize the given statistical data
C03	Understand the measure of location and dispersion of data.
C04	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	<ul style="list-style-type: none"> ➤ Able to collect statistical data. ➤ Able to distinguish the data types. ➤ Understands the usage of data collection tools ➤ Able to specify problem statement for data collection ➤ 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	<ul style="list-style-type: none"> ➤ Sketches bar, pie and histograms on Microsoft Excel spread sheet. ➤ Sketches frequency curve and frequency polygon for the data set on Microsoft Excel spread sheet. ➤ Sketches bar, pie and histograms on Microsoft Excel spread sheet. ➤ Sketches frequency curve and frequency polygon for the data set on Microsoft Excel spread sheet. 	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
UNIT-3 MEASURE OF LOCATION AND DISPERSION	<ul style="list-style-type: none"> ➤ Able to determine the descriptive statistical variables using Microsoft Excel. 	a Determination of central tendencies Range, Mean, Mode and Median for the data in Microsoft excel. b Determination of absolute	6-0-12

	<ul style="list-style-type: none"> ➤ Able to determine the absolute measures of dispersion of the given data set. ➤ Explain the symmetry and asymmetry of the distributed data. 	<p>measures of dispersion for data like range quartile deviation, mean deviation, standard deviation and variance in Microsoft Excel.</p> <p>c Skewness and kurtosis graphs in Microsoft excel and interpretations of results.</p>	
<p>UNIT-4 INTRODUCTION TO PYTHON PROGRAMMING</p>	<ul style="list-style-type: none"> ➤ 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. ➤ Learn loop constructs. 	<p>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.</p>	<p>8-0-16</p>

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 matplotlib. pyplot.	4	1,2,4,5,7	4	0:0:2
26	Write a python program to create a labeled pie chart using matplotlib. pyplot.	4	1,2,4,5,7	4	0:0:2
Total Hours					0:0:52=5 2

MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	Experiment Linked	Cognitive Level R/U/A	Tutorial & Practical Sessions in Hrs.	TOTAL
C01	Understand the tools of data collection, classification and cleaning of data.	1,2,4,5,7	1-4	A	12	12
C02	Able to summarize the given statistical data	1,2,4,5,7	5-12	A	33	33
C03	Understand the measure of location and dispersion of data.	1,2,4,5,7	13-18	A	12	12
C04	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	C01	3	3	0	3	3	0	3
	C02	3	3	0	3	3	0	3
	C03	3	3	0	3	3	0	3
	C04	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-zfkdw4y/lab>

SUGGESTED LIST OF STUDENT ACTIVITY

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

1	<p>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.</p> <p>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.</p> <p>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).</p>
2	<p>https://ils.unc.edu/courses/2013_spring/inls541_001/Assignments.html#Assignment_9</p>

	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 data and explain the inference.

COURSE ASSESSMENT AND EVALUATION CHART

Meth od	What		To whom	When/Wh ere (Frequenc y in the course)	Max Mar ks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	CIE (Continuo us Internal Evaluation)	Mode ls	Studen ts	Two IA Tests (Written)	20	Blue Book	1,2,3.
				Three Skill tests	20	Model	1,2,3
				Student Activity	20	Model/Rep ort	
				TOTAL	60		
	SEE (Semester End Examinati on)	End Exam		End of the course	100	Models	1,2,3
INDIRECT ASSESSMENT	Student Feedback on course		Studen ts	Middle of the course		Feedback forms	1,2,3, Delivery of course
	End of Course Survey			End of the course		Questionnai res	1,2,3 Effectiveness of Demonstratio ns& 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	20CS01P	Semester	I/II
Course Title	IT SKILLS	Course Group	ES/CS
No. of Credits	4	Type of Course	Lecture + Practice
Course Category	ES	Total Contact Hours	6Hrs Per Week
			78Hrs Per Semester
Prerequisites	Basic Computer Skills	Teaching Scheme	(L:T:P)= 1:0:2
CIE Marks	60	SEE Marks	40

1. RATIONALE

Information Technology is crucial to the majority of the business and has a great influence on innovation and engineering. Every branch of engineering and every organization opt for computers and IT skills for business automation, communication/connectivity, resource planning, work automation and securing information etc. All engineering diploma students must be conversant with the basic IT skills which empower them to learn new technologies, adapt to changes, business development, communication etc.

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.

Perform jobs related to web design and maintenance, business process automation tool management, cyber security and safety and program assistant.

3. COURSE OBJECTIVES

- 5) Demonstrate the basics of coding.
- 6) Design and develop web pages that include static and dynamic content.
- 7) Describe the basic concepts of Cloud and IoT.
- 8) Express the workflow and business automation
- 9) Recognize the best practices of Cyber Safety and security.

4. JOB ROLE

SL.NO	LEVEL	JOB ROLES
1	3	Junior software developer - web.
2	3	Junior Creative Designer/Digital Artist

5. PREREQUISITES

STUDENT	Basic Computer skills (Students without basic computer skills should be taught basic skills)
TEACHER	Computer science faculty with required knowledge of IT Skills.

6. COURSE OUT COMES

On successful completion of the course, the students will be able to demonstrate industry oriented Cos associated with the above mentioned competency:

COURSE OUTCOME		UNIT LINKED	CL	LINKED PO	TEACHING HOURS
CO1	Illustrate the basics of coding and develop simple applications for android phones.	1	U, A	1,4,7	15
CO2	Design and Develop websites.	2	U, A	1,4,7	30
CO3	Identify Cloud Services IoT applications	3	U	1,4,7	12
CO4	Apply workflow and use ERP for a simple project plan	4	U	1,4,7	09
CO5	Implement best practices of cyber safety and security in the workplace.	5	U, A	1,4,7	12
TOTAL					78

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

8. INSTRUCTIONAL STRATEGY

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

- 1) Lecturer method(L) does not mean only traditional lecture method, but different type of teaching method and media visual/graphical content that are employed to develop the outcomes
- 2) Massive Open on-line courses (MOOCS) can be used to teach various topics/sub topics.
- 3) Online coding platform wherever mentioned.
- 4) Hands on coding should be practiced.
- 5) About 15 to 20% of the topics/sub topics which are relatively simpler or descriptive in nature is to be given to the students for self-directed learning

9. DETAILS OF 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

UNIT NO	Topics/Sub topics	Unit skill set/Learning outcomes (In cognitive domain)	Hours L-T-P
1	UNIT 1 - INTRODUCTION TO BASICS OF CODING		05-0-10
	a) Introduction to computer programming b) Algorithms –With sufficient examples c) Flowcharts – With sufficient examples d) Execute simple programs Note: Below listed or any other suitable online/offline coding platforms should be used to demonstrate and provide coding experience to students. a. https://scratch.mit.edu/	1. Understand computer programming 2. Create and write Algorithm for programmable problems. 3. Design Flowchart for programmable problems. 4. Develop simple Android application.	

	<p>b. https://studio.code.org/projects</p> <p>Suggested programs are listed in Table 1</p> <p>e) Introduction to Application development</p> <p>f) Simple android application development (No knowledge of programming language is required).</p> <p>Note:</p> <p>i. <i>The purpose of application development is to ignite and promote programming skills.</i></p> <p>ii. <i>Application development should be done using any App builder platforms such as</i></p> <p>iii. <i>MITApp</i> <i>Inventor:</i> https://appinventor.mit.edu/</p> <p>iv. <i>Thunkable:</i> https://thinkable.com/</p> <p>v. <i>ibuildapp:</i> https://ibuildapp.com/</p> <p>vi. <i>The student should be introduced to the android application development environment for further research and learning</i>https://developer.android.com/</p> <p>g) Activity: create a simple Android application (Unique for each student) publish on the learning management system.</p>		
2	UNIT 2 - DESIGN AND DEVELOP WEB PAGES		10-0-20
2	<p>a) Basic web technologies</p> <ul style="list-style-type: none"> ▪ Browser ▪ Web -Server ▪ Client-Server Model ▪ URL ▪ SEO techniques ▪ Domain names and domain name system. <p>b) Creating Web-pages with HTML5 - Static</p>	<ol style="list-style-type: none"> 1. Understand and examine basic web technologies 2. Creating static web pages 3. Formatting Webpages with cascading style sheets (CSS) 4. Creating Dynamic web pages with JavaScript 	

<p>web pages.</p> <ul style="list-style-type: none"> ▪ Introduction, Editors ▪ Tags, Attributes, Elements, Headings ▪ Links, Images, List, Tables, Forms ▪ Formatting, Layout, Iframes. <p>2.3 Formatting web pages with style sheets (CSS3).</p> <ul style="list-style-type: none"> ▪ Introduction to CSS ▪ Inline CSS, Internal CSS, Classes and IDs ▪ div, Color, Floating, Positioning ▪ Margins, Padding, Borders ▪ Fonts, Aligning Text, Styling Links <p>2.4 Creating a web page dynamic using JavaScript.</p> <ul style="list-style-type: none"> ▪ Dynamic web page and Introduction to JS ▪ Basic syntax ▪ Functions ▪ Events <p>Note: Refer https://www.w3schools.com</p> <p>2.6 Creating dashboards in websites.</p> <p>2.6 Activity: Personal website design and launch with a free platform or Create a Blogging website.</p> <ul style="list-style-type: none"> ▪ Online platforms (Learning and executing) ▪ https://www.w3schools.com/ ▪ https://studio.code.org ▪ https://www.khanacademy.org <p>Note:</p> <p>1) The student must be introduced to website development platforms - wordpress.com.</p> <p>2) The student must be made familiar</p>	<p>5. Creating and launching dashboard based personal website.</p>	
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	with launching websites . Certification available: <ul style="list-style-type: none"> • HTML - W3schools • CSS - W3schools • JavaScript - W3schools 		
3	UNIT 3 -BUSINESS PROCESS AUTOMATION/ERP		03:0:06
3	<p>6.2 Introduction to business process automation.</p> <p>6.3 Organization structure and functions composition-Properties and applications</p> <ul style="list-style-type: none"> ▪ Structure ▪ Types ▪ Functional Units <p>Note: Students should be made familiar with organization, types and components of a big enterprise to make him understand the working of organization keeping him as part of org.</p> <p>6.4 Workflows</p> <ul style="list-style-type: none"> ▪ Introduction ▪ Components ▪ Use and use cases <p>Note: Use free and open-source platform to demonstrate and create workflows.</p> <p>Example:</p> <p>https://airflow.apache.org/</p> <p>https://taverna.incubator.apache.org/</p> <p>https://trello.com/</p> <p>https://www.processmaker.com/</p> <p>6.5 Enterprise resource planning</p> <ul style="list-style-type: none"> ▪ History ▪ Evolution ▪ Uses of ERP ▪ ERP software tools. 	<ol style="list-style-type: none"> 1. Identify and examine the needs of business process automation. 2. Understand Organization structure and functions 3. Create and use workflows 4. Use Enterprise resource planning in workplace. 	

	<p>Note: The student should be introduced into Enterprise resource planning software tools to understand importance of ERP.</p> <p>Examples:</p> <ul style="list-style-type: none"> ▪ https://erpnext.com/ ▪ www.bitrix24.com ▪ https://www.odoo.com/ <p>3.5 Activity:</p> <ul style="list-style-type: none"> ▪ Project plan for summer internship - use open source ERP Software ▪ Identify different components of nearby organization with recourse plan and workflow design. ▪ Identify types of ERP software available with their market share. 		
4	UNIT 4 - INTRODUCTION TO CLOUD AND IOT CONCEPTS		04-0-8
	<p>4.1 Fundamentals of cloud</p> <p>4.2 Cloud service models</p> <ul style="list-style-type: none"> ▪ IaaS (Infrastructure-as-a-Service) ▪ PaaS (Platform-as-a-Service) ▪ SaaS (Software-as-a-Service) <p>4.3 Cloud deployment types</p> <ul style="list-style-type: none"> ▪ Public, ▪ Private, ▪ Hybrid ▪ Community Cloud <p>4.4 Cloud services:</p> <ul style="list-style-type: none"> ▪ Google Drive - file storage and synchronization service developed by Google; ▪ Google docs- bring your documents to life with smart editing and styling tools to help you easily format text and paragraphs; ▪ Google Co-lab (Usage of Jupyter Notebook): <i>Colab</i> notebooks allow you to combine 	<ol style="list-style-type: none"> 1. Understand Cloud concepts 2. Identify and use Cloud services 3. Understand IoT concepts 4. Identify IoT applications 	

	<p>executable code and rich text in a single document, along with images, HTML, LaTeX, and more.</p> <ul style="list-style-type: none"> ▪ Google App Engine: Google App Engine is a Platform as a Service and cloud computing platform for developing and hosting web applications in Google-managed data centers. Applications are sandboxed and run across multiple servers. <p>Note: Above cloud services are not compulsory for all branches; teacher can recommend other cloud service based on need of engineering branch.</p> <p>4.5 Working of IoT and IoT components (Only brief introduction and demonstration through videos)</p> <p>4.6 Explain concept of Internet of Things with examples</p> <ul style="list-style-type: none"> ▪ Smart home ▪ Smart city ▪ Smart farming <p>Note:</p> <p>a. Teacher can also select specific area of work where Things (autonomous computing devices) could be interconnected over TCP/IP to establish IoT.</p> <p>b. The students should be introduced to the IoT environment for further research and study.</p> <p>Example:</p> <ul style="list-style-type: none"> ▪ https://www.raspberrypi.org/ ▪ https://www.arduino.cc/ 		
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	4.7 Activity: Create your cloud service account and demonstrate using cloud services. Identify cloud service provider with respect to service models and deployment types. Identify areas where Internet of Things could bring positive changes.		
5	UNIT 5 - CYBERSECURITY AND SAFETY		4-0-8
	<p>5.1 Introduction to Cyber security and cyber safety.</p> <ul style="list-style-type: none"> ▪ Brief awareness on cyber safety measures ▪ Identification of basic security issues in mobile phones and personal computers ▪ Installation of Antivirus software ▪ Firewall concepts ▪ Browser settings ▪ Importance of privacy and Password policy (Best practices). <p>5.2 Common threats - Demonstration</p> <ul style="list-style-type: none"> ▪ Phishing ▪ DoS attack ▪ Man in the middle attack ▪ Eavesdropping ▪ Spamming <p>5.3 Activity</p> <ul style="list-style-type: none"> ▪ Identification of basic security issues in computers of your college and fixing the same. ▪ Visit nearby government organization. <ul style="list-style-type: none"> ▪ Identify basic cybersecurity issues and fixing the same ▪ Demonstrate the importance of cybersecurity, password policy, and cyber safety. 	<ol style="list-style-type: none"> 1. Identify need for Cyber security and cyber safety 2. Identify basic security issues in mobile phones and personal computers 3. Examine Importance of privacy, Password policy 4. Implement best practices of cyber safety and security in work place 	

10. SUGGESTED PRACTICAL SKILL EXERCISES**TABLE-I**

Sl. No.	Practical Out Comes/Practical exercises	Unit No.	PO	CO
1	Write an algorithm for programmable problems Example for Reference: <ul style="list-style-type: none"> Add/subtract two numbers Find the largest/smallest of 3 numbers Calculate and print sum of 'N' numbers 	1	1,4,7	1
2	Design a flowchart for programmable problems Example for Reference: Add/subtract two numbers Find the largest/smallest of 3 numbers Calculate and print sum of 'N' numbers	1	1,4,7	1
3	Design and create simple game using MIT-scratch/Code.org	1	1,4,7	1
4	Design and create simple android application (MIT App Inventor)	1	1,4,7	1
5	Design and create webpage for displaying your poem (Title, header, paragraph, formatting tags)	2	1,4,7	2
6	Design and create webpage for your wish list (What you want to do). Also list challenges and opportunities along with images to present your dreams (List ordered and unordered, Image, table)	2	1,4,7	2
7	Design and create webpage using HTML and CSS about an awesome animal (Use necessary CSS tags)	2	1,4,7	2
8	Design and create web page for a travel book/recipe book with more than 3 pages, table to list places/recipes (iframe, hyperlink)	2	1,4,7	2
9	Design and create web page with JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient	2	1,4,7	2
10	Design and create a personal webpage with dashboard	2	1,4,7	2
11	Design and create web page about advantages of business process automation with respect to your branch of engineering	2,3	1,4,7	2,3

12	Create a workflow for education loan approval in bank/diploma admission process (Use any tool)	3	1,4,7	3
13	Demonstrate ERP with ERPNext Demo for manufacturing, retail and service sector (Use any other ERP tools)	3	1,4,7	3
14	Create user account and demonstrate use of Google drive, Google docs, Google Co-lab (Usage of Jupyter Notebook)	4	1,4,7	4
15	5.1 Demonstrate Internet of Things using with examples a. Smart home b. Smart city c. Smart farming Note: Teacher can also select specific area of work where Things (autonomous computing devices) could be interconnected over TCP/IP to establish IoT.	4	1,4,7	4
16	Installation of Antivirus software	5	1,4,7	5
17	Demonstration and hands on browser settings	5	1,4,7	5
18	Demonstration and hands on privacy settings and password policy	5	1,4,7	5
19	Demonstration of common security threats (using videos) 6. Phishing 7. DoS attack 8. Man in the middle attack 9. Spamming 10. Virus	5	1,4,7	5

The suggested practical activities (TABLE-I) in this section are demonstrated for the attainment of the competency. These practical activities can also be used for the student assessment in portfolio mode for awarding CIE marks. **The lecturer can enhance the competency level of the students by sketching more practical exercises.**

NOTES:

1. It is compulsory to prepare log book/record of exercises. It is also required to get each exercise recorded in logbook, checked and duly dated signed by the teacher
2. Student activities are compulsory and are also required to be performed and noted in logbook.
3. Student activity is compulsory and part of skill assessment. The activity enable student to explore the course, help student to demonstrate creativity & critical thinking.
4. Student activity report is compulsory part to be submitted at the time of practical ESE
5. Term work report is compulsory part to be submitted at the time of practical ESE.

6. Student activity and student activity reports must be uploaded to Learning management system.
7. For CIE, students are to be assessed for Skills/competencies achieved.

11. MAPPING OF CO WITH PO

COURSE	CO'S	PROGRAMME OUTCOMES (PO'S)						
		1	2	3	4	5	6	7
IT SKILLS	CO1	3	0	0	3	0	0	3
	CO2	3	0	0	3	0	0	3
	CO3	3	0	0	3	0	0	0
	CO4	3	0	0	3	0	0	3
	CO5	3	0	0	3	0	0	0
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped								

12 SUGGESTED LEARNING RESOURCES

BOOKS	
1	The Art of Programming Through Flowcharts & Algorithms, A. B. Chaudhuri, Firewall Media publication
2	HTML5 Black Book, by Publishing company Limited. Kogent Learning Solutions Inc.
3	"World Wide Web design with HTML", Xavier, Tata McGraw-Hill
4	Internet of Things – A Hands on Approach, By ArshdeepBahga and Vijay Madiseti Universities Press, ISBN: 9788173719547
URL'S	
1	https://scratch.mit.edu
2	https://studio.code.org
3	http://ai2.appinventor.mit.edu
4	https://www.w3schools.com
5	https://www.tutorialspoint.com/javascript/index.htm
6	https://www.geeksforgeeks.org/html-tutorials/
7	Android https://developer.android.com
8	https://www.khanacademy.org
9	Tools for Web Development a. https://www.wix.com

	b. https://atom.io/ c. https://www.openelement.com/ d. https://www.layoutit.com
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13. SUGGESTED LIST OF PROPOSED STUDENTS ACTIVITY

Note: Refer activities mentioned in DETAILS OF COURSE CONTENT table

14. COURSE ASSESSMENT AND EVALUATION CHART

SL.N O	ASSESSMENT	DURATIO N (in minutes)	MAX MARKS	CONVERSION
1	CIE Assessment 1 (Written Test -1 TH) - At the end of 3 rd week	60	20	Average of two written tests 20
2	CIE Assessment 2 (Written Test -2 TH) - At the end of 13 th week	60	20	
3	CIE Assessment 3 (Skill Test) - At the end of 5 th week	3 hrs	20	Average of three skill test 20
4	CIE Assessment 4 (Skill Test) - At the end of 7 th week	3 hrs	20	
5	CIE Assessment 5 (Skill Test) - At the end of 9 th week	3 hrs	20	
6	CIE Assessment 6 (Student activity)- At the end of 11 th week	-	20	20
7	Total Continuous Internal Evaluation (CIE) Assessment			60
8	Semester End Examination(SEE) Assessment (Practical Test)	3 hrs	100	40
TOAL MARKS				100
Note: 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 from each section.				

15. RUBRICS FOR ACTIVITY

RUBRICS FOR ACTIVITY (Example Only)						
Appropriate rubrics shall be developed by the concerned faculty						
Dimension	Poor	Below Average	Average	Good	Exemplary	Student Score
	4	8	12	16	20	
Concept	Does not collect any information relating to the concept	Collects very limited information; some relate to the concept	Collect much information; but very limited relate to the concept	Collects some basic information; most refer to the concept	Collects a great deal of information; all refer to the concept	8
Design	Design is not acceptable/very poorly structured	Design is poor and not well structured.	Design Followed layout samples and well structured	Design & convey both content and context	Design considered all aspect of concept, concept and presentation (UI)	6
Creativity	Very little creativity in design/implementation	Creativity in concept or design or implementation	Creativity in concept /design/implementation	Creativity in concept /design/implementation which complements each other	Creative concept, content, presentation and implementation	8
Implementation	Poorly implemented	Partially implemented	Implemented on time with results (content)	Product convey both content and context	Product is creative with easy-to-use UI, structure	8
Average / Total Marks: (8+6+8+8)/4						7.5 = 8

16. RUBRICS for Skill Test Evaluation (Both for CIE & SEE)

Sl No	Parameter to be Observed	Marks Allotted
1	Design-Written Skill Test 1: Algorithm / Flowchart/Visual Design Skill Test 2: Web site visual design Skill Test 3: Work flow or Project plan or cyber security plan or Cloud service Concept	30
2	Implementation Skill Test 1: Android application Skill Test 2: Web site / Web pages Skill Test 3: Create or use cloud service account or Cyber safety and security- Antivirus Installation or browser settings	50
3	Appeal and Presentation	20
Total		100

17. SYSTEM REQUIREMENTS:

Sl. No.	Specification	Quantity
1.	Computers with HD Graphics Card	20
2.	Software: GIMP, KRETA, BLENDER, PHOTOSHOP or any other relevant open-source software.	-
3.	Internet Connectivity	-

Note: Above specification is for a batch of 20 students

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

Course Code	20EE01P	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

C01	Comply with the safety procedures
C02	Apply the fundamentals of electricity.
C03	Install and test electrical wiring system.
C04	Identify and Operate electrical machines, Batteries and UPS.

CO5	Identify and test the different electronic devices.
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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) <i>On successful completion of the class, the students will be able to</i>	Topics/Sub topics	Practical	Hours L-T-P
UNIT-1 Electrical Safety				
1	Comply with the Electrical safety	1. Electrical Symbols 2. Electrical safety <ul style="list-style-type: none"> 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 precautionary 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

		<ul style="list-style-type: none"> ➤ 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 <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Relationship between V, I and R. (Ohms law) • Behavior of V, I in Series and Parallel DC circuits. • Describe open circuit, close circuit and short circuit • http://nreeder.com/Flash/ohmsLaw.htm 	1. Measure current, voltage and analyze effective resistance in series circuit 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: Sinusoidal 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 <ul style="list-style-type: none"> • SI units • Mention the meters used to measure them ➤ http://nreeder.com/Flash/powerLaw.htm	• Measure the voltage, current, power using relevant measuring instruments in a Single-phase load.	1:0:2
7.		1. Electrical energy <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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, 1 ceiling 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> Need for AC to DC conversion Bridge rectifier with and without C filter, Rectifier IC. 	Construct and test bridge rectifiers using semiconductor 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) <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> • Concept • Types: Temperature, Pressure, Water, Light, Sound, Smoke, proximity Sensors, Flow, humidity, voltage, vibration, IR (Principle/working, ratings/ specifications, cost, and applications) 2.Actuators <ul style="list-style-type: none"> • Concept • Types and applications. • Relay as an actuator. 	2. Connect and test an IR proximity sensor to a Digital circuit. <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Microcontroller as a programmable device, and list of real-world applications. • PLC and Their applications. (Activity based learning) 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Identify Various types of safety signs and what they mean Demonstrate 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	<ul style="list-style-type: none"> • 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
C01	Comply with the safety procedures	PO1, PO4	1-2	A	6	
C02	Apply the fundamentals of electricity.	PO1, PO4	3-7	A	15	
C03	Install and test electrical wiring system and protective devices.	PO1, PO4	8-12	A	15	
C04	Identify and Operate electrical machines, Batteries and UPS.	PO1, PO4	13-17	A	15	
C05	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 by V. Mittle and Arvind Mittle, McGrawHill Companies, 2005 Edition.
5. The 8051 Microcontroller & Embedded systems by S. K. Bhattacharya, Pearson Education India, 2012 Edition – 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=mc9790hitAg&list=PLWv9VM947MKi_7yI0_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/~qi4/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 ACTIVITIES 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

(CONTINUOUS 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 – 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 $\frac{3}{4}$ "	06 Nos.
15	Dual 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	<ul style="list-style-type: none"> a) PVC conduit - $\frac{3}{4}$" - 10 lengths b) Cap and casing - $\frac{3}{4}$" - 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 mm², 2.5 mm², 4 mm² – 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		<p>Electronic Components</p> <ul style="list-style-type: none"> 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	20AT21P	Semester	II
Course Title	AUTOMOTIVE ENGINES	Course Group	Core
No. of Credits	4	Type of Course	Tutorial & Practice
Course Category	PC	Total Contact Hours	6 Hrs Per Week
			78 Hrs Per Semester
Prerequisites	Drawing/Creativity	Teaching Scheme	(L:T:P)-1:0:2
CIE Marks	60	SEE Marks	40

1. 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.

Perform Service & Repair Work of an IC engine in the Automobile Engineering Workshops/Service stations

2. INSTRUCTIONAL STRATEGY

1. The training methods to be used should be appropriate to the development of competencies. It should be individual centered to make each person a competent one.
2. Demonstrations using different models, audio visual aids and equipment be used intensively.
3. Instructor should expose to different tools used in Automobile service stations, Operational safety and Procedure to be followed for service & repair of different IC engines. Emphasis should be given on technical aspects as per manufacturer's standards & use of service manuals.
4. Focus should be on proper selection & use of measuring tools, service tools & equipment's and their proper use.

3. COURSE OUTCOMES

On successful completion of the course, the students will be able to demonstrate industry-oriented Cos associated with the above-mentioned competency:

CO1	Classify various types of automobile, its nomenclature & explain the constructional & working principle of IC engine components with their functions.
CO2	Select & use different types of conventional and special tools, equipment, data & information for servicing & overhauling of an IC engine.
CO3	Ascertain and select measuring instrument and measure dimension of components and compare them with standard values.
CO4	Perform machining operations such as re boring, honing, valve refacing & lapping applying safe working practices.

CO5	Perform engine disassembly / assembly, repair and maintenance of SI& CI engines as per workshop manual, identify and rectify errors and repair/replace components.
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4. COURSE CONTENT

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

SHOP	Topics/Sub topics	Unit skill set (In cognitive domain)	Hours L-T-P
UNIT-1: GENERAL STRUCTURE OF AUTOMOBILE	<ol style="list-style-type: none"> 1. Identify major systems of Automobile with their functions. 2. Identify major components of a 2-3 & 4-wheeler with their functions. 3. Measure the wheel base - wheel track - overall length - front overhung - rear overhung - height of CG point - ground clearance - gross weight and kerb weight of different vehicles. 4. Know the different manufacturing concerns of two-wheeler, three-wheeler, LMV and HTV – their products and plants location 	Automobile - Classification of Automobile, Major systems of an Automobile - their functions, Chassis – chassis layout of two, three & four-wheeler with major components - their functions, engine mounts, definition of: wheel base - wheel track - overall length - front overhung - rear overhung - height of CG point - ground clearance - gross weight and kerb weight. Automobile manufacturing concerns of two & three-wheeler, LMV and HTV – their products and plants location	04-00-08
UNIT-2: CYLINDER BLOCK	<ol style="list-style-type: none"> 1. Remove the cylinder head, gasket & crankcase using suitable tools. 2. Compare the cylinder block, cylinder head & gaskets of different materials with their advantages and disadvantages. 3. Explain & compare wet & dry liners with their merits & demerits. 4. Measure the ovality and taperness of cylinder bore using bore gauge. 5. Perform reboring & honing operations. 	Cylinder block – types - Constructional details - materials used, Cylinder head - constructional details - materials used – Gasket- purpose- types, crank case, oil pan, cylinder liners – types – construction –comparison- merits and demerits.	04-00-08
UNIT-3: PISTON & PISTON RINGS	<ol style="list-style-type: none"> 1. Remove piston-connecting rod assembly and piston rings using special tools. 2. Identify the different methods adopted to control piston expansion. 3. Describe the necessity of compression & oil ring with their constructional features 	Piston - functions - requirements - constructional details - materials, piston clearance – importance – piston slap-expansion controlling methods in piston- heat dam- slots in piston- cam grounded, Piston rings – functions - types - constructional details – materials, Piston pin -construction – materials	04-00-06

	4. Perform measurement of piston ring gap, piston ring to groove clearance, piston OD, cylinder to piston clearance & compare them with standard values in service manual.		
UNIT-4 : CONNECTING ROD, CRANKSHAFT & CAMSHAFT	<ol style="list-style-type: none"> 1. Remove crankshaft, camshaft & flywheel from the engine. 2. Know different methods of connecting piston with connecting rod and compare them. 3. Explain & compare the different camshaft drive mechanisms. 4. Checking of connecting rod, crankshaft, camshaft & flywheel as per service manual. 5. Measurement of crank pin diameter using vernier caliper & compare them with standard data. 	<p>Connecting rod and crank shaft– Constructional details, material - functions, List different methods of connecting piston with connecting rod – Explain fully floating type.</p> <p>Camshaft-functions– construction-materials, explain different types of camshaft drives. Flywheel-need-construction and materials.</p>	04-00-06
UNIT - 5: VALVES & VALVE MECHANISM	<ol style="list-style-type: none"> 1. Explain & compare the different types of valve mechanisms. 2. Dismantle the valve assembly and check them as per service manual. 3. Perform Re-conditioning of valve mechanism, measuring valve face angle, valve re-facing & honing. 4. Interpret the Valve timing diagram for four stroke petrol & diesel engines. 5. Set and adjust the valve clearance & know the importance of hydraulic valve lifter. 	<p>Poppet valve, valve materials, valve cooling - sodium cooled valve-overhead & side valve operating mechanism, overhead camshaft valve mechanism- valve seat- valve guide- valve spring, valve tappet, push rod, rocker arm & rocker shaft - hydraulic valve lifter, variable valve timing</p> <p>Valve timing diagram for four stroke petrol engines & diesel engines- valve clearance- its importance.</p>	05-00-10
UNIT-6: MANIFOLDS & MUFFLERS	<ol style="list-style-type: none"> 1. Explain the need of firing order, firing order in multi cylinder engines 2. Remove inlet & exhaust manifold, differentiate them & identify the materials used. 3. Identify different types of mufflers with their working principle. 4. Service the inlet & exhaust manifold of different types 5. Assemble all the engine parts using appropriate tools and equipment's. Tighten the bolts to the specified torques as per service manual. 	<p>Multi cylinder engine- arrangement of multi cylinder engine cylinders-Meaning and need of firing order, firing order of three, four six- & eight-cylinder engines.</p> <p>Inlet and exhaust manifold, mufflers-purpose - constructional details of absorber type, baffle plate type, wave cancellation type and resonance type mufflers.</p>	05-00-14

SL. No	Practical Outcomes/Practice Sessions	Unit No	PO	CO	L:T:P
1	Practice Health & Safety-%S technique (Sort, set in order, Shine/Sweep, Standardize &Sustain). Identifying and practice on use of conventional tools, special tools & equipment's, pneumatic tools, used for dismantling and assembling the engine.	1	1-6	2	0:0:2
2	Practice on use of measuring instruments such as vernier caliper, screw gauge, dial gauge, bore gauge, combination set square.	1	1-6	3-4	0:0:2
3	Identify the major systems & components of a 2-3 & 4-wheeler and do their comparative study	1	1-6	1	0:0:2
4	Measure the wheel base - wheel track - overall length - front overhung - rear overhung - height of CG point - ground clearance - gross weight and kerb weight of different vehicles and compare them with their manuals	1	1-6	1	0:0:2
5	Conduct compression test & vacuum test on SI & CI engine and check with the standard values	2	1-6	2-3	0:0:2
6	Remove any single cylinder engine from vehicle, drain engine oil and coolant, Water wash engine / degrease. Dismantle the engine parts, clean, inspect the parts. Check engine bore, cylinder, cylinder head, fins for warpage, cracks & rust.	2	1-6	3-5	0:0:2
7	Measure the ovality and taperness of cylinder bore & compare with standard values.	3	1-6	3	0:0:2
8	Practice on Re-boring of cylinder of single cylinder engine	3	1-6	3-4	0:0:4
9	Practice on Honing of cylinder of single cylinder engine	3	1-6	3-4	0:0:2
10	Practice on cleaning of piston & piston rings	3	1-6	5	0:0:2
11	Measure the piston ring end gap, piston ring to groove clearance, piston OD, cylinder to piston clearance, compare the measurements with service manual	3	1-6	3-4	0:0:2
12	Clean & check connecting rod, crankshaft, camshaft & flywheel	4	1-6	5	0:0:2
13	Study the camshaft drive mechanism – remove, clean, check & overhaul its components	4	1-6	5	0:0:2
14	Measure the crank pin/Journal diameters & compare them with service manual data	4	1-6	3-4	0:0:2
15	Remove, clean, check & overhaul the valve mechanism Remove valve seats and valve guides-	5	1-6	5	0:0:2
16	Check for valve stem bend, Check the condition of valve spring, Measure the valve face angle and compare with service manual data.	5	1-6	3-4	0:0:2
17	Practice on Valve refacing /lapping by using valve refacing machine.	5	1-6	3-4	0:0:4

18	Draw the Valve timing diagram for four stroke petrol engines & diesel engines.	5	1-6	3-5	0:0:2
19	Assemble the engine by using appropriate tools with specified torques.	2,3, 4,5	1-6	2-5	0:0:6
20	Set the valve tappet clearance for inlet and exhaust valves as specified in the manual	5	1-6	3-5	0:0:2
21	Service the inlet & exhaust manifold of different types	6	1-6	5	0:0:2
22	Observe and compare the arrangement of cylinders in a multi cylinder engine	6	1-6	5	0:0:2
Total Hours					0:0:52=52

MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	Experiment Linked	R/U/A	Tutorial & Practical Sessions in Hrs	
CO1	Classify various types of automobile, its nomenclature & explain the constructional & working principle of IC engine components with their functions.	PO1	1-6	A	12	
CO2	Select & use different types of conventional and special tools, equipment, data & information for servicing & overhauling of an IC engine.	PO1, PO4	1-6	A	12	
CO3	Ascertain and select measuring instrument and measure dimension of components and compare them with standard values.	PO1, PO4	1-6	A	10	
CO4	Perform machining operations such as reboring, honing, valve refacing & lapping applying safe working practices.	PO1, PO4	1-6	A	10	
CO5	Perform engine disassembly / assembly, repair and maintenance of SI& CI engines as per workshop manual, identify and rectify errors and repair/replace components.	PO1, PO2, PO4	1-6	A	15	

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Automotive Engines	CO1	3	0	0	0	0	0	0
	CO2	3	1	0	2	0	0	0
	CO3	3	0	0	2	0	0	0
	CO4	3	1	0	2	0	0	0
	CO5	3	2	0	2	0	0	0
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped								

7. SUGGESTED LEARNING RESOURCES

Sl.No.	Title of Book	Author	Publication
1	A course in Internal Combustion Engines	M. L. Mathur, R. P. Sharma	Dhanpat Rai and sons.
2	Automobile Engineering	G. B. S. Narang.	Khanna Publication
3	Automobile Engineering	R. B. Gupta.	S. Chand
4	Automobile Engineering (Vol II)	Dr. Kripal Singh.	Standard Publication
5	Automotive Engineering	G. B. S. Narang.	Tata McGraw Hill
6	Automobile Mechanics	S. Shrinivasan	Tata McGraw Hill
7	The Automobile	Harbans Singh Royat.	S. Chand Publication
8	Internal Combustion Engine	V. Ganeshan	Tata McGraw Hill
9	Automobile Engineering	Ramlingam K. K.	Saitech Publication
10	Automotive engines	James D. Halderman	Pearson

Websites:

1. How stuff works.com.
2. <http://en.wikipedia.org/wiki/Car>
3. http://en.wikipedia.org/wiki/History_of_the_automobile
4. <http://www.history.com/topics/automobiles>.
5. http://en.wikipedia.org/wiki/History_of_the_automobile.
6. <https://www.youtube.com/watch?v=fTAUq6G9apg>.
7. <https://www.youtube.com/watch?v=rWmR9UIz5iA>.
8. <https://www.youtube.com/watch?v=nAKTVBRNsmI>.
9. <https://www.youtube.com/watch?v=hV3LImCslpo>.
10. <https://www.youtube.com/watch?v=PYje-4D76kc>.

8. SUGGESTED LIST OF STUDENT ACTIVITIES

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

Each student should conduct different activity and no repeating should occur

1	Visit to an Automobile service station; observe the safety practices followed and service procedures followed. Make hand written report
2	Collect the vehicle specifications of different vehicles & prepare a comparison study report.
3	Collect different parts of automobile engine parts and write material, function of those parts
4	Prepare trouble shooting chart for SI and CI engines (symptoms, causes and remedies).
5	Visit to an Automobile service station; observe the different machining operations (cylinder reboring, honing, valve refacing) ,safety practices and service procedures followed. Make hand written report

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 Tests - Theory	20	Blue Book	1,2,3,4,5
				Three Skill tests	20	Log of Records	1,2,3,4,5
				Student Activity	20		1,2,3,4,5
				TOTAL CIE	60	-	-
	SEE (Semester End Examination)	End Exam		End of the course-SEE	40	BTE Answer Scripts	1,2,3,4,5
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3,4,5 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5 Effectiveness of Demonstrations & Assessment Methods

Assessment Methodology

Sl.No	Assessment	Mode of Assessment	Schedule of Assessment	Duration	Max marks	Conversion after taking Average
1	CIE Assessment 1	Written Test-1 (At the end of 3 rd week)	End of 3 rd week	1 Hr	20	Average of two written tests 20
2	CIE Assessment 2	Written Test-2 (At the end of 13 th week)	End of 13 th week	1 Hr	20	
3	CIE Assessment 3	Skill Test-1 (At the end of 7 th week)	End of 5 th week	3 Hrs	20	Average of three skill tests 20
4	CIE Assessment 4	Skill Test-2 (At the end of 9 th week)	End of 7 th week	3 Hrs	20	
5	CIE Assessment 5	Skill Test-3 (At the end of 11 th week)	End of 9 th week	3 Hrs	20	
6	CIE Assessment 6	Student Activity	End of 11 th week	-	20	20
Total Continuous Internal Assessment (CIE) Marks						60
7	SEE- Semester End Examination	Skill Test	As per BTE	3 Hrs	100	40
Total Marks						100

Note:

1. Assessment of student activity is evaluated through appropriate rubrics by the respective course coordinator.
2. CIE Skill tests to be conducted as per SEE scheme of evaluation.

10. RUBRICS for Skill Test Evaluation

Sl No	Parameter to be Observed	Marks Allotted
1	Knowledge on Measuring Instruments	20
2	Tools Identification	20
3	Application Knowledge	20
4	Application of skill	20
5	Viva-voce	20
Total		100

RUBRICS FOR ACTIVITY (10marks)

Dimension	Unsatisfactory	Developing	Satisfactory	Good	Exemplary	Student Score
	2	4	6	8	10	
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
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	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

**ದ್ವಿತೀಯ ಸೆಮಿಸ್ಟರ್ ಕನ್ನಡ ಬಾರದ / ಕನ್ನಡೇತರ ಡಿಪ್ಲೋಮಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ
ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ
ಬಳಕೆ ಕನ್ನಡ - 1**

Course Code	20KA21T	Semester : II	Course Group – AU/KA
Course Title	ಬಳಕೆ ಕನ್ನಡ – I	Category : AU	Lecture Course
No. of Credits	2	Type of Course	CIE Marks : 50
Total Contact Hours	2 Hrs Per Week 26Hrs Per Semester	Teaching Scheme (L:T:P)= 2:0:0	SEE Marks : Nil

Table of Contents (ಪರಿವಿಡಿ)

Part – 1	Teaching Hour
Introduction to the Book, Necessity of learning a local language, Tips to learn the language with easy methods. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation. Instructions to Teachers for Listening and Speaking Activities.	02
Part – II	
Key to Transcription for Correct Pronunciation of Kannada Language, Instructions to Teachers to teach Kannada Language	02
Part – III Lessons to teach Kannada Language - Listening and Speaking Activities	
Lesson – 1 Personal Pronouns, Possessive Forms, Interrogative words	02
Lesson – 2 Possessive forms of nouns, dubitive question and Relative nouns	02
Lesson – 3 Qualitative, Quantitative and Colour Adjectives, Numerals	02
Lesson – 4 Predictive Forms, Locative Case	02
Lesson – 5 Dative Cases, and Numerals	02
Lesson – 6 Ordinal numerals and Plural markers	02
Lesson – 7 Defective / Negative Verbs and Colour Adjectives	02
Lesson – 8 Permission, Commands, encouraging and Urging words (Imperative words and sentences)	02
Lesson – 9 Accusative Cases and Potential Forms used in General Communication	02
Lesson – 10 Helping Verbs “iru and iralla”, Corresponding Future and Negation Verbs	02
Lesson – 11 Do's and Don'ts in Learning of Kannada Language (Any Language in General)	01
Lesson – 12 Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು -	01
Kannada Words in Conversation	Total Teaching
Hours	26 Hours

**ದ್ವಿತೀಯ ಸೆಮಿಸ್ಟರ್ ಕನ್ನಡ ಬಲ್ಲ ಡಿಪ್ಲೋಮಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ
ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ
(ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ಪರಂಪರೆ ಕುರಿತು)**

Course Code	20KA21T	Semester : II	Course Group – AU/KA
Course Title	ಸಾಹಿತ್ಯ ಸಿಂಚನ – ೧	Category : AU	Lecture Course
No. of Credits	2	Type of Course	CIE Marks : 50
Total Contact Hours	2 Hrs per Week 26 Hrs per Semester	Teaching Scheme (L:T:P)= 2:0:0	SEE Marks : Nil

ಸಾಹಿತ್ಯ ಸಿಂಚನ – ೧ (ಕಾರ್ಯಪುಸ್ತಕ) (20KA21T)

ಪಠ್ಯಪುಸ್ತಕದ ಪರಿವಿಡಿ	ಬೋಧನಾ ಅವಧಿ
1. ಕರ್ನಾಟಕದ ಸಂಕ್ಷಿಪ್ತ ಇತಿಹಾಸ ಮತ್ತು ಸಾಹಿತ್ಯದ ಬೆಳವಣಿಗೆ	01 ಗಂಟೆ
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಸಂಕ್ಷಿಪ್ತ ಚರಿತ್ರೆ	01 ಗಂಟೆ
3. ಹಳಗನ್ನಡ ಸಾಹಿತ್ಯ - ಪಂಪ ಪೂರ್ವ ಯುಗ	
ಕನ್ನಡ ಸಾಹಿತ್ಯದ ರಚನೆಗೆ ಪ್ರಮುಖ ಪ್ರೇರಣೆಗಳು ಮತ್ತು ಪ್ರಭಾವಗಳು ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಂಪರೆ ಮತ್ತು ರಾಜಾಶ್ರಯ ಕವಿರಾಜಮಾರ್ಗ ಮತ್ತು ವಡ್ಡಾರಾಧನೆ	03 ಗಂಟೆ
4. ಪಂಪ / ಚಂಪೂ ಯುಗದ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಮತ್ತು ಪರಂಪರೆ	
ಆದಿಕವಿ ಪಂಪ, ರನ್ನ, ಪೊನ್ನ, ಜನ್ನ, ಒಂದನೇ ನಾಗವರ್ಮ ಮತ್ತು ನಾಗಚಂದ್ರ 10 ಮತ್ತು 11ನೇ ಶತಮಾನದ ಸಮಕಾಲೀನ ಪ್ರಮುಖ ಕವಿಗಳು	04 ಗಂಟೆ
5. ನಡುಗನ್ನಡ ಸಾಹಿತ್ಯ - ವಚನ ಸಾಹಿತ್ಯ / ಬಸವ ಯುಗ	
ವಚನ ಸಾಹಿತ್ಯದ ಬೆಳವಣಿಗೆಗೆ ಕಾರಣಗಳು ಮತ್ತು ಅದರ ಮಹತ್ವ ಪ್ರಮುಖ ವಚನಕಾರರು, ವಚನ ಸಾಹಿತ್ಯದಲ್ಲಿ ವೈಚಾರಿಕತೆ ಮತ್ತು ಕಾಯಕ ತತ್ವ	04 ಗಂಟೆ
6. ಕುಮಾರವ್ಯಾಸ ಯುಗ ಮತ್ತು ಸಾಹಿತ್ಯದ ಇತರೆ ರೂಪಗಳು	
ರಗಳೆ - ಹರಿಹರ, ಷಟ್ಪದಿ - ಕುಮಾರವ್ಯಾಸ, ಲಕ್ಷ್ಮೀಶ ಮತ್ತು ರಾಘವಾಂಕ ಸಾಂಗತ್ಯ - ರತ್ನಾಕರವರ್ಣಿ,	04 ಗಂಟೆ
7. ದಾಸ ಸಾಹಿತ್ಯ / ಕೀರ್ತನೆಗಳು	02 ಗಂಟೆ
ಪುರಂದರದಾಸರು, ಕನಕದಾಸರು ಮತ್ತು ಇತರೆ ಕೀರ್ತನೆಕಾರರು	
8. ಇತರೆ ಸಾಹಿತ್ಯದ ಪ್ರಕಾರಗಳು	04 ಗಂಟೆ
ತ್ರಿಪದಿ - ಸರ್ವಜ್ಞ, ಜಾನಪದ ಸಾಹಿತ್ಯ, ತತ್ತ್ವಪದಗಳು - ಶಿಶುನಾಳ ಶರೀಫರು	
9. ಮಹಿಳಾ ಸಾಹಿತ್ಯ : ಹೆಳವನಕಟ್ಟೆ ಗಿರಿಯಮ್ಮ ಮತ್ತು ಸಂಚಿಹೊನ್ನಮ್ಮ, ಆಧುನಿಕ ಪೂರ್ವ ಕನ್ನಡ ಸಾಹಿತ್ಯ : ಕೆಂಪುನಾರಾಯಣ ಮತ್ತು ಮುದ್ದಣ	02 ಗಂಟೆ
10. ಹಳಗನ್ನಡ ಮತ್ತು ನಡುಗನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಒಂದು ಅವಲೋಕನ	01 ಗಂಟೆ
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ 26 ಗಂಟೆಗಳು	26 ಗಂಟೆ

ಬಳಕೆ ಕನ್ನಡ -I ಮತ್ತು ಸಾಹಿತ್ಯ ಸಿಂಚನ -೦೧ ಪಠ್ಯಕ್ರಮಗಳಿಗೆ ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ

ಮಾರ್ಗಸೂಚಿಗಳು

(COURSE ASSESSMENTS AND EVALUATION CHART- CIE ONLY)

Sl.No	Assessment	Type	Time frame in semester	Duration	Max marks	Conversion
1.	CIE Assessment 1	Written test-1	- At the end of 3 rd week	80 minutes	30	Average of three written tests-1,2,3 for 30 marks
2	CIE Assessment 2	Written test-2	- At the end of 7 th week	80 minutes	30	
3	CIE Assessment 3	Written test-3	- At the end of 13 th week	80 minutes	30	
4	CIE Assessment 4	MCQ/Quiz	- At the end of 5 th week	60 minutes	20	Average of three Assessment 4,5,6 for 20 marks
5	CIE Assessment 5	Open book test	- At the end of 9 th week	60 minutes	20	
6	CIE Assessment 6	Student activity & presentation	- At the end of 11 th week	60 minutes	20	
	Total Continuous Internal Evaluation (CIE) Assessment					50
				Total Marks		50



Government of Karnataka
Department of Collegiate and Technical Education

C-20 Second Year Diploma Curriculum

Automobile Engineering



Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Curriculum Structure

III Semester Scheme of Studies- Diploma in Automobile Engineering

Sl. No.	Course Category / Teaching Department	Course Code	Course Name	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					
Integrated Courses																	
1	P/AT	20AT31P	Automobile Chassis and Transmission System	3	1	4	8	6	60	24	40	16	100	40			Both SGPA & CGPA
2	P/AT	20AT32P	Automotive Electrical System	3	1	4	8	6	60	24	40	16	100	40			
3	P/AT	20AT33P	Thermal Engineering and Engine Testing	3	1	4	8	6	60	24	40	16	100	40			
4	P/AT	20AT34P	Automotive Manufacturing Processes	3	1	4	8	6	60	24	40	16	100	40			
Audit Course																	
5	AU/KA	20KA31T	ಸಾಹಿತ್ಯ ಸಿಂಚನ-II/ಬಳಕೆ ಕನ್ನಡ-II	2	0	0	2	2	50	20	-	-	50	20			
Total				14	4	16	34	26	290	116	160	64	450	180			

***PC: Programme Core:: AU-Audit Course:: KA: Kannada:: L: Lecture:: T: Tutorial:: P: Practice**



Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Curriculum Structure
IV Semester Scheme of Studies- Diploma in Automobile Engineering

Sl. No.	Course Category / Teaching Department	Course Code	Course Name	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					
Integrated Courses																	
1	P/AT	20AT41P	Advanced Automotive Systems	3	1	4	8	6	60	24	40	16	100	40			Both SGPA & CGPA
2	P/AT	20AT42P	Design and Drafting	3	1	4	8	6	60	24	40	16	100	40			
3	P/AT	20AT43P	Vehicle Body Engineering and Dynamics	3	1	4	8	6	60	24	40	16	100	40			
4	P/AT	20AT44P	Fuels and Pollution Control	3	1	4	8	6	60	24	40	16	100	40			
Audit Course																	
5	AU/	20AT45T	Indian Constitution	2	0	0	2	2	50	20	-	-	50	20			
Total				14	4	16	34	26	290	116	160	64	450	180			

***PC: Programme Core:: AU-Audit Course:: L: Lecture:: T: Tutorial:: P: Practice**

3RD SEMESTER



Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Automobile Engineering	Semester	III
Course Code	20AT31P	Type of Course	Programme Core
Course Name	Automobile Chassis and Transmission	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1. Rationale:

Automobile chassis and transmission forms the core of Automobile Engineering. The course is designed to impart knowledge and skills regarding chassis and transmission that make a complete automobile. The major systems include clutch system, transmission system, drive system, steering mechanism, suspension system, braking system and wheels and tyres without which propulsion of vehicle is not possible.

2. Course Outcomes/Skill Sets: At the end of the course the student will be able to:

CO-01	Examine a given chassis frame, document all frame measurements, compare and align the frame to predefined standards.
CO-02	Repair and/or service a given transmission system, steering system, braking system, suspension system and braking system.
CO-03	Check wheel alignment for a given vehicle and perform the alignment to pre-defined standards.
CO-04	Design or identify alloy wheels after studying the chassis frame and demonstrate repair and replacement of tyres for a given vehicle.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1,2	1,2,4	<p>1. Frames- purpose- loads acting -types –construction-ladder type-x type-integral, sections used in frames- Channel-Box-Tubular.</p> <p>2. Materials used for frames & sub frames-need. Checking the alignment of chassis frame.</p> <p>3.Clutch-Requirements- Classifications. Principle of friction clutch, Clutch Lining materials.</p>	Refer Table 1.	<p>1.a) Instruction on Personal Protection Equipment, Workshop Safety, First Aid, Safety Charts of dos and Don'ts in work area.</p> <p>b) Identification of different sections of chassis frame.</p> <p>2.a) Analyse different loads acting on the frame.</p> <p>b) Checking the alignment of chassis frame and align it to the predefined standards.</p>
2	2	1,2,4	1. Construction and working -single plate (Coil Spring type & Diaphragm type)	Refer Table 1.	1. Service & troubleshoot a single plate clutch (coil spring type) with faults,

			<p>2.Construction and Working of Centrifugal clutch and Multiplate clutch.</p> <p>3.Clutch adjustment, clutch troubles and their causes.</p>		<p>causes and remedies.</p> <p>2. a) Service and troubleshoot a centrifugal clutch by removing it from the vehicle with faults, causes and remedies.</p> <p>b) Clutch adjustment - free play adjustment - adjustment of lever. Replacement of clutch cable.</p>
3	2	1,2,4	<p>1.Gearbox-Necessity-classification.</p> <p>2. Construction and working of synchromesh gear box. Comparison of synchromesh gear box with other type.</p> <p>3.Synchroniser-need-construction and working.</p>	0	<p>1. Service & troubleshoot of a multiplate clutch by removing it from the vehicle with faults causes and remedies.</p> <p>2. Overhauling of a 2-wheeler gearbox & calculation of gear ratio w.r.t number of teeth. (3HRS)</p>
4	2	1,2,4	<p>1. Gear box troubles shooting and their causes.</p> <p>2. Planetary gear train-construction and working.</p> <p>3. Front Axle – Types – Construction – Materials - Live (drive shaft) - Dead axle (conventional), Stub axles - Types - construction.</p>	Refer Table 1.	<p>1. Overhauling of a synchromesh gearbox & calculation of gear ratio w.r.t number of teeth. Gearbox troubles shooting and their causes.</p> <p>2. Demonstration of servicing of planetary gear train/video.</p>
5	2	1,2,4	<p>1. Steering system -mechanisms-types –Ackerman mechanism, steering gear box-need-types.</p> <p>2. Construction and working- Rack & Pinion</p> <p>3. Construction and working of recirculating ball type steering gearbox.</p>	Refer Table 1.	<p>1. Overhauling of a front axle & hub greasing.</p> <p>2. Overhauling of rack & pinion type of steering system.</p>

6	2	1,2,4	<p>1. Steering geometry-definition, define and explain-camber-caster-king pin inclination</p> <p>2. Define and explain-combined angle toe in and toe out, correct steering angle, under steer and over steer</p> <p>3. Define and explain-Wheel base, wheel track, Toe-in, Toe-out, over length, over all height, front over-hang, rear over-hang, ground clearance.</p>	Refer Table 1.	<p>1. Overhauling of a Worm & nut/ Recirculating steering system with different steering gear box with backlash, end-play Adjustment.</p> <p>2.a) Practice on wheel balancing.</p> <p>b) Measurement of Wheel base, wheel track, Toe-in, Toe-out, overall length, over all height, front over-hang, rear over-hang, ground clearance.</p>
7	2	1,2,4	<p>1. Define and explain-Cornering force, self-righting torque, steering linkages, special steering columns (tilt, length & collapsible).</p> <p>2. Wheel alignment and wheel balancing-need- procedure.</p> <p>3. Propeller shaft – function - construction, universal joints & slip joints.</p>	Refer Table 1.	<p>1. Practice on checking of wheel alignment and adjustment (computerized/mechanical) & prepare the detailed trouble shooting chart.</p> <p>2. Servicing of a propeller shaft & universal joint.</p>
8	2	1,2,4	<p>1. Function- types construction & working - cross or spider type - flexible ring type - Rzeppa joint - Tripod joint.</p> <p>2. Final drive- Purpose- types. Differential- necessity- principle</p> <p>3. Differential - construction & working. backlash, differential lock, inter-axle differential, transaxle types.</p>	Refer Table 1.	<p>1. Checking of constant velocity joint for wear & tear and replace it with new one.</p> <p>2. Overhauling of differential with backlash adjustment & calculate the gear ratio.</p>
9	2	1,2,4	<p>1. Rear axle- loads acting- types - construction and operation - hotch</p>	Refer Table 1.	<p>1. Servicing and troubleshooting of Rear axle of fully floating axle housing.</p>

			<p>kiss - torque tube drive, rear axle drive.</p> <p>2. Construction of rear axle shaft supporting- fully floating and semi floating arrangements, axle housings, trouble shooting.</p> <p>3. Brakes - Type. Internal expanding Drum Brake- Construction & Working. Disc Brake (Calliper types) - Construction & Working (slider calliper type). Parking Brake- Types-Operating Mechanism.</p>		<p>2. Servicing and troubleshooting of Rear axle of semi -floating axle housing.</p>
10	2	1,2,4	<p>1. Hydraulic Brakes- principle. Master Cylinder- Working.</p> <p>2. Tandem Master Cylinder- working.</p> <p>3. wheel cylinder- Types- Working.</p>	Refer Table 1.	<p>1. Servicing & trouble shooting of a drum brake & Disc brake.</p> <p>2. Servicing of a Tandem master cylinder.</p>
11	2	1,2,4,7	<p>1. Bleeding of brakes- Brake lining materials- Brake adjustment.</p> <p>2. Suspension System - Construction & Working of Leaf spring and Coil Spring Suspension system.</p> <p>3. Working of - Hydraulic Suspension & Telescopic suspension.</p>	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	<p>1. Bleeding of hydraulic brake system, free-play & brake shoe adjustments.</p> <p>2. Overhauling leaf spring & re-cambering.</p>
12	2,3,4	1,2,4,7	<p>1. Working of Independent Suspension- Front Wheel & rear Wheel.</p>	Refer Table 1, Study the latest technological changes in	<p>1. Overhauling of an independent suspension system.</p> <p>2. a) Practice on using different jacks to remove</p>

			<p>2. Wheels- Types of wheels, construction, structure and function, wheel dimensions.</p> <p>3. Constructional details-wire-disc. Alloy wheel- Construction, choosing right alloy wheel for the vehicle, changing of the steel wheel to alloy wheel.</p>	<p>this course in this course and present the impact of these changes on industry.</p>	<p>wheels from (different) vehicle(s).</p>
13	3,4	1,2,4,7	<p>1.Tyres-Types- Construction (Tube & Tubeless). Cross ply tire construction, Radial ply tire construction.</p> <p>2. Tyre thread pattern, Tyre selection. Tyre pressure and Wear, Tyre maintenance</p> <p>3. Changing of the tyre, Precaution to be taken while removing tyre. Rotation of the tyre - Need-procedure.</p>	<p>Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.</p>	<p>1.Practice on Changing the steel wheel to alloy wheel. 2. a) Practice on removal of tyre from disc and mending the punctured tubes using hot patch and cold patch. b) Repair of tubeless tyre.</p>
Total in hours			39	13	52

Note: At the end of each practical student has to prepare trouble shooting chart and prepare repair estimation.

*** PO= = Program Outcome as listed and defined in year 1 curriculum and PO – CO mapping with strength (Low/Medium/High) has to be mapped by the course Co-Ordinator. (Above only suggestive)**

Table 1: = Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution).

Sl.no	Week	Suggested Activities
1	1	Sketch/draw the layout of chassis frames of cars, bus (front engine & rear engine), truck and articulated vehicles
2	2	Study and present at least one of the latest technologies in clutch, transmission, suspension and brakes.
3	3	Integrated with practical.
4	4	List the factors that helps you decide type of axle or CVT transmission for a given vehicle and submit it as an assignment.
5	5	Create 10 groups in class so that each group will present at least one type of steering gearbox used in a vehicle.

6	6	Select a race track and an appropriate car model to calculate the turning circle radius of that car and demonstrate the suitability for that race track.
7	7	Study the effects of worn steering linkages from available incident reports and present remedial solutions to identify the wearing along with appropriate materials and suggest right lubricant.
8	8	Study and propose alternative materials for differential and justify the benefits of using such material.
9	9	Study any two research papers about different loads acting on the rear axle and present the impact of those loads for any given vehicle.
10	10	Study and present at least one of the latest technologies on braking systems.
11	11	Study and present the suspension system used in modern heavy commercial vehicles.
12	12	Visit the nearest alloy wheel replacement center, identify the different type of alloy wheels used and understand how alloy wheels were replaced for given vehicle types.
13	13	Study the different treading patterns used in different vehicle models and justify why certain patterns are used for specific purposes like sports, adventure, off road, farming, earthmoving, etc.

4.CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3.	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5.	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					100

5. a) Format for CIE written Test

Course Name	Automobile Chassis and Transmission	Test	I/II/III	Sem	III/IV
Course Code	20AT31P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks	
I	1				
	2				
II	3				
	4				
III	5				
	6				

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

5. b) CIE Skill Test-I Scheme of Evaluation

Duration: 180 min.

SL. No.	CO	Particulars/Dimension	Marks
1	1	One question on “chassis frames used in Automobile and alignment of the frame”. a) Identification of the chassis frame – 5 marks b) Skill based question - 5 marks.	10
2	2	One questions on “Troubleshoot, Repair and service transmission system”. a) Identification of the defect. – 10 m b) Troubleshooting. –35 m	45
3	2	One questions on “Troubleshoot, Repair and service steering system”. a) Identification of the defect. – 05 m b) Service/Troubleshooting. –20 m	25
4	1,2	Viva-voce	10
5	1,2	Portfolio evaluation of practical session (1-6 weeks)	10
		Total Marks	100

5. c) CIE Skill Test-II Scheme of Evaluation

Duration: 180 min.

SL. No.	CO	Particulars/Dimension	Marks
1	2	One questions on “Troubleshoot, Repair and service propeller shaft/ final drive rear axle”. a) Identification of the defect. – 05m b) Service/Troubleshooting. –20 m	25
2	2	One questions on “Troubleshoot, Repair and service Brakes/Suspension system”. a) Identification of the defect. – 10 m b) Troubleshooting. –20 m	30
3	2,3,4	One question on “wheels / tyres” for the given case a) Skill test question on wheels/ tyres/ alloy wheels – 20 m b) Setting the alignments - 05 m	25
4	2,3,4	Viva-voce	10
5	2,3,4	Portfolio evaluation of practical session (6-12 weeks)	10

	Total Marks	100
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6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
Average Marks=(8+6+2+2)/4=4.5							5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7.Reference:

Sl. No.	Description
1	Automobile Engineering by R B Gupta (Satya Publication)
2	Automobile Engineering Vol I By Kirpal Singh (Standard publication).
3	The Automobile Engineering Vol-2 By K.M Guptha (Umesh publications)
4	Automobile Engineering by Er S K Gupta (S Chand)
5	Automotive Technology by Jack Erjavec (CENGAGE Learning)

8. SEE Scheme of Evaluation

Duration: 180 min.

SL. No.	CO	Particulars/Dimension	Marks
1	1,3,4	<p>One question on “chassis frames used in Automobile and alignment of the frame”.</p> <p>a) Identification of the chassis frame – 05 marks</p> <p>b) Skill based question - 15 marks.</p> <p>Or</p> <p>One question on “wheels / tyres” for the given case</p> <p>a) Skill test question on wheels/ tyres/ alloy wheels – 10 marks.</p> <p>b) Alignment - 10 marks.</p>	20
2	2	<p>One questions on “Troubleshoot, Repair and service transmission system/ Steering system/ Suspension system / Braking system”.</p> <p>a) Identification of defects - 10 m</p> <p>b) Servicing/ Troubleshooting. - 40 m</p>	50
3	1,2,3,4	Portfolio evaluation of practical session (1-13)	10
4	1,2,3,4	Viva-voce	20
Total Marks			100

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Chassis frames of different types (ladder type, x type, integral type).		2 each
2	Different types of clutches (single plate, multiplate and centrifugal clutches).		5 each
3	Gear boxes (motor cycle & synchromesh mesh).		5 each
4	Front axle assembly with wheels.		5
5	Steering gearbox assemblies (Worm and nut, rack and pinion, recirculating ball type)		5 each
6	Computerized wheel balancing machine.		1
7	Computerized wheel alignment machine.		1
8	Propeller shaft assembly.		5
7	Rear axle housings (fully floating and semi-floating)		3 each
8	Mechanical brake assemblies		3
9	Hydraulic brake system.		3
10	Master Cylinder-Single piston and Tandem master cylinder.		5 each
11	Wheel cylinders-single piston and double piston.		5 each
12	Drum brake assemblies.		5
13	Disc brake assemblies.		5
14	Hydraulic brake bleeding kit.		5
15	Independent & leaf spring suspension system.		3
16	Telescopic shock absorber (cut-section model).		2
17	Conventional and Radial tyres with tubes & wheels.		5 Each
18	Tubed and tubeless tyre puncture kit.		5
19	Major tool kit		3
20	Alloy Wheels		2
21	Automatic tyre changing machine		5
22	Vulcanizing machine		5
23	Two post lift		1

24	Tyre pressure gauge		5
25	Vehicle: Four-wheeler (Scrap with all parts)		1



Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

1.Rationale: The course aims to impart basic skills and understanding of automotive electrical systems,

Programme	Automobile Engineering	Semester	III
Course Code	20AT32P	Type of Course	Programme Core
Course Name	Automotive Electrical System	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L: T: P:: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

equipment and their working details. Automobile electrical system has gradually evolved over the years. The automobiles electrical system comprises of wiring technologies that are used for distributing power to other parts of a vehicle and various electrical components for production, storage and distribution of electrical power.

2. Course Outcomes/Skill Sets: At the end of the course the student will be able to:

CO-01	Test a battery, identify the problem, service and charge it using the right method suitable for that battery type.
CO-02	Test charging, cranking, ignition systems and dashboard instruments and service or troubleshoot it for any problems identified.
CO-03	Diagnose the electrical system, estimate the cost of repairing or replacement and make recommendation of either repair or replace based on cost benefit analysis.
CO-04	Study a given wiring diagram, list all the components, build the wiring circuits, test and repair to ensure the circuit provides the necessary output/result as required.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1,4	1,2,4	1. Earth Return System: Introduction-Earth return and insulated systems, 6 volts and 12 volts system. 2. Fusing of circuits, low and high voltage automobile cables, cable specifications and sizes, Colour cables, Circuit tracing 3. Diagram of typical wiring system, Wiring Harness. Tracing fault in wiring, Fault location test. Symbols used in automobile electrical systems.	Refer Table 1	1. a) Demonstrate the wiring flow pattern in the Vehicle. b) Demonstrate the wiring color code used for different circuits. 2. a) Study a given wiring diagram and list all the components b) Practice on troubleshooting of wiring defects.

2	1	1,2,4	<p>1. Battery -purpose-types, construction and working-Lead acid.</p> <p>2. Methods of charging the Battery and how to choose which type of Charging method.</p> <p>3. Battery capacity-Battery efficiency, ratings.</p>	Refer Table 1	<p>1.a) Test the battery charge condition using hydrometer, Voltmeter, Test the battery condition using battery tester.</p> <p>b) Practice on preparation of electrolyte.</p> <p>2. a) Charging of Lead acid battery by constant voltage method.</p> <p>b) Practice on Charging multiple batteries</p>
3	1	1,2,4	<p>1. Battery maintenance and troubleshooting.</p> <p>2. Construction and working of Lithium-ion battery.</p> <p>3. Maintenance-free batteries.</p>	Refer Table 1	<p>1. a) Practice on Charging multiple batteries by trickle charging</p> <p>b) Practice on finding the defects and troubleshooting of batteries.</p> <p>2. Practice on Servicing of lithium-ion battery.</p>
4	3	1,2,4	<p>1.Estimation & Costing: Introduction, Procedure of Estimation.</p> <p>2. Introduction to Costing, Elements of cost, Components of cost.</p> <p>3. Procedure of Costing.</p>	Refer Table 1	<p>1. Estimate the cost of repairing or replacement the battery/Wiring system, make recommendation of either repair or replace based on cost benefit analysis.</p> <p>2. Case study on estimation of servicing/repair of any one electrical component in vehicle.</p>
5	2	1,2,4	<p>1. Charging system-purpose-circuit diagram. DC generator- principle, construction and working.</p>	Refer Table 1	<p>1. Practice on servicing of the Alternator.</p> <p>2. Test the stator, rotor and rectifier for</p>

			<p>2. Alternator charging circuit with alternator principle, construction and working.</p> <p>3. Regulator for A.C. Generators- Construction and working.</p>		<p>continuity, short and open circuit using Multifunction Tester/ Test lamp.</p>
6	2,3	1,2,4	<p>1. Electronic voltage regulators- Construction and working.</p> <p>2. Defects and troubleshooting Alternators.</p> <p>3. Starting system -requirements- circuit diagram-working principle.</p>	Refer Table 1	<p>1. Practice on testing of voltage regulators.</p> <p>2. Practice on finding the Defects and troubleshooting of alternators and estimate the same.</p>
7	2	1,2,4	<p>1. Construction and working: series, shunt wound motor.</p> <p>2. Construction and working of Bendix drive.</p> <p>3. Construction and working of positive engaging drive with shift lever.</p>	Refer Table 1	<p>1. Practice on servicing of the starter motor.</p> <p>2. Servicing of Bendix drive.</p>
8	2,3	1,2,4	<p>1. Construction and working of overrunning clutch drive</p> <p>2. Construction and Working of Axial Sliding armature drive.</p> <p>3. Solenoid switch with two winding- construction and working.</p>	Refer Table 1	<p>1. Test field windings, brush holder's armature and solenoid switch for continuity, short and open circuit using growler/ Multifunction Tester.</p> <p>2. Repair and Service Estimation of the stator motor.</p>
9	2,3	1,2,4	<p>1. Ignition System: Fundamentals- Ignition timing (with respect to load & speed). Types of ignition systems, components.</p> <p>2. Construction & Working of battery Ignition system. Construction & working of magneto ignition systems.</p>	Refer Table 1	<p>1. a) Diagnose Ignition problems and demonstrate the trouble shooting of the same</p> <p>b) Repair/Service estimation the same.</p> <p>2. Checking and setting ignition timing and starting the engine.</p>

			3. Construction & Working of Electronic Ignition system. Distributor less ignition system (DIS).		
10	2,3	1,2,4	1. Spark plug -classification 2. construction-Types-specification. 3. Spark plug gap, heat range and reach- definition and importance.	Refer Table 1	1. Servicing of the DIS and repair/Service estimation the same. 2. a) Servicing of the sparkplug cleaning, testing and adjusting gap. b) Service estimation of the same.
11	3,4	1,2,4,7	1. Principle of automobile illumination. 2. Different bulbs used in automobile, fuses and relay. 3. Head lamp mounting and construction -Types.	Refer Table 1, Study the latest technological changes in this course and present the impact of these changes on industry.	1.Practice on replacement of bulbs, fuses and relays and estimate the cost of replacement of the same. 2. Practice on aiming of head lights.
12	2,3	1,2,4,7	1. Working and Construction of windscreen-wipers. Working of Horn. 2. Working of electrical fuel pump, fuel gauge. 3. Working of oil and temperature gauge.	Refer Table 1, Study the latest technological changes in this course and present the impact of these changes on industry.	1. Practice on servicing of the Wiper and horn & service estimation of the same. 2. Practice on testing of fuel gauge, oil gauge & Temperature gauge.

13	2,3	1,2,4,7	1. Speedometer, odometer, etc. (Dash board instruments). 2. Wiring diagram of 2-wheeler - Circuit & construction. 3. Wiring diagram of 4-wheeler- Circuit & construction.	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	1. Practice on Circuit building of electrical Components, test and repair to ensure the circuit provides the necessary output/result as required. 2. Practice on testing of dashboard instruments.
Total in hours			39	13	52

Note: At the end of each practical, student has to prepare trouble shooting chart and prepare repair estimation.

*** PO= Program Outcome as listed and defined in year 1 curriculum and PO – CO mapping with strength (Low/Medium/High) has to be mapped by the course Co-Ordinator. (Above only suggestive)**

Table 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution).

Sl. No.	Week	Suggested Tutorial
1	1	Study and present different ampere ratings of fuses used in different Vehicle.
2	2	Study any one research papers about “Environmental impact on battery recycling of automobile batteries” and present the environmental effects of battery recycling.
3	3	Study on different types of batteries used for electric vehicles compare their durability and present the materials used in positive and negative plates and electrolyte and how long each battery lasts.
4	4	Visit the nearby service center and note down the estimation procedure followed for the servicing or repairing of electrical parts and component of the vehicle.
5	5	Study whether alternators are used in electric vehicle, justify your answer. With proper documentation submit the report as an assignment.
6	6	Document what are the symptoms of faulty working of the regulators and how it can be troubleshooted.
7	7	Study starting system used in any one of the heavy vehicles and present how they differ from the starting system used in cars.
8	8	Build a starter solenoid relay circuit in given vehicle and test for its working.
9	9	Study the ignition system of the given vehicle, note down the causes of ignition coil failure and demonstrate the remedial solution for the diagnosed fault.
10	10	Study and present at least one of the latest technologies in ignition innovation.
11	11	Study and present the innovation on “Night Vision Technology.”
12	12	Study any one journal on windscreen wiper and present the advancements in the wiper.
13	13	Study and present on automobile lighting technology for modern automobile.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio evaluation of Activity through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					100

5. a) Format for CIE written Test

Course Name	Automotive Electrical System	Test	I/II/III	Sem	III/IV
Course Code	20AT32P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.					

5. b) CIE Skill Test-I Scheme of Evaluation

Duration:180min.

SL. No.	CO	Particulars/Dimension	Marks
1	1,4	One Skill oriented question on Earth return system/wiring system based on the given Condition. a) Identification of the color code - 05m b) Identification of the defect - 05 m c) Troubleshooting - 10m	20
2	1	One Skill oriented question on Battery based on the given Condition. a) Analyzing/finding the faults and recording it - 10 m b) Servicing/ troubleshooting - 10 m	20
3	3	Question on the given case (case study) a) Identification of the key facts in the case - 05m b) Identification of the key issues - 05m	20

		c) Evaluate and recommend the course of action -10m	
4	2,3	One question on "Troubleshoot and Service the Charging systems used in automotive vehicles and its service estimation". a) Identification of the fault and recording it - 05 m b) Troubleshooting/ Servicing - 20 m c) Service Estimation - 05 m	30
5	1,2,3,4	Portfolio evaluation of practical session (1-6) week	10
Total Marks			100

5. c) CIE Skill Test-II Scheme of Evaluation

Duration:180min.

SL. No.	CO	Particulars/Dimension	Marks
1	2,3	One question on "Troubleshoot and Service the Cranking systems used in automotive vehicles and its service estimation". d) Identification of the fault and recording it - 05 m e) Troubleshooting/ Servicing - 20 m f) Service Estimation - 05 m	30
2	2,3	One question on "Troubleshoot and Service the Ignition systems used in automotive vehicles and its service estimation". c) Identification of the fault and recording it - 05 m d) Troubleshooting/ Servicing - 30 m e) Service Estimation - 05 m	40
3	2,3	One question on "Troubleshoot and Service dashboard instruments used in automotive vehicles and its service estimation". d) Identification of the fault and recording it - 05 m e) Troubleshooting/ Servicing - 10 m f) Service Estimation - 05 m	20
4	2,3	Portfolio evaluation of practical session (7-12) week	10
Total Marks			100

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
Average Marks= (8+6+2+2)/4=4.5							5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Automobile Engineering Vol-2 by Kirpal Singh (Standard Publications).
2	Automobile Electrical Equipment by P.M. Kohli (Tata McGraw-Hill).
3	The Automobile Engineering by Harban Singh Reyath (S Chand & Co).
4	The Automobile Engineering Vol-2 by K.M Guptha (Umesh publications).
5	Automobile Electrical and Electronic systems by Tom Denton (SAE publication).
6	Vehicle Maintenance & Garage Practice by Jigar A. Doshi (PHI Learning, Delhi).
7	Mechanical Estimating and Costing by S.C. Sharma & T.R.Banga (KHANNA PUBLISHERS).

8. SEE Scheme of Evaluation

Duration:180min

SL. No.	CO	Particulars/Dimension	Marks
1	1,3,4	<p>One Skill oriented question on Battery based on the given Condition.</p> <p>a) Analyzing/finding the faults and recording it - 10 m</p> <p>b) Servicing/ troubleshooting - 10 m</p> <p>or</p> <p>One question on “cables/ bulbs/ fuses/colour codes, circuit construction and faults arising in automotive wiring and lighting system also to repair & estimate”</p> <p>a) Identification of the different cables/ bulbs/ fuses - 05 m</p> <p>b) Fault finding - 05m</p> <p>c) Replace/ repair - 10 m</p>	20
2	2,3	<p>One question on “Troubleshoot and Service the Charging/ Cranking/ Ignition systems used in automotive vehicles and its service estimation”.</p> <p>g) Identification of the fault and recording it - 10</p> <p>h) Troubleshooting/ Servicing - 30</p> <p>i) Service Estimation - 10</p>	50
4	1,2,3,4	Portfolio evaluation of practical session (1-13)	10
5	1,2,3,4	Viva-voce	20
Total Marks			100

9. Equipment/software list with Specification for a batch of 20 students:

Sl. No.	Particulars	Specification	Quantity
1	Lead acid batteries.		3

2	lithium-ion batteries.		3
3	Battery chargers.		2
4	Cut-section model of DC generators.		1
5	Alternators.		5
6	Electronic voltage regulators for alternators.		3
7	Starting motors of different starting drives (Bendix, axially sliding armature, overrunning clutch type).		2 each
8	Spark plug testing machine.		2
9	Digital timing light.		3
10	Distributor assemblies.		4
11	Ignition coils.		5
12	Magneto assembly.		3
13	Fuel, Oil, Temperature gauges.		2 each
14	Wiper motors.		3
15	All types of bulbs, fuses, relays.		5 each
16	Petrol engine with coil ignition system.		2
17	Recent make 4-wheeler.		1
18	Electrical test bench.		2
19	Growlers		5
20	Battery tester		5
21	Bench vice		5
22	Hydraulic Press (10 ton)		3
23	Demo model of 2 & 4-wheeler Vehicle Electrical system		1 Each
24	Modern engine with electronic ignition/ DIS		1 Each



Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

1.Rationale: The course will enable the students to learn the principles, concepts and application of

Programme	Automobile Engineering	Semester	III
Course Code	20AT33P	Type of Course	Programme Core
Course Name	Thermal Engineering and Engine Testing	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

thermodynamic laws and air standard cycles which is needed to look after an IC engine. The operating behavior of an IC engine on test bed is the common purpose to learn various parameters like fuel consumption, various powers and efficiency. This course enables us to run internal combustion engines under realistic conditions and examine new combustion processes under part and full load conditions and various rotation speeds.

2. Course Outcomes/Skill Sets: At the end of the course the student will be able to:

CO-01	Explain the concept of thermodynamics and demonstrate its application through simple experiments.
CO-02	Test lubrication and cooling systems and service or troubleshoot it for any problems identified.
CO-03	Draw, label and compare SI and CI engines in terms of their operations, efficiency, fuel, speed, pressure and knocking.
CO-04	Explain abnormal combustion process and demonstrate with experiments both how it occurs and its prevention for a given engine.
CO-05	Conduct an engine performance test, draw its performance characteristics and measure friction power, air / fuel ratio and efficiencies.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week		4 hours/week (2 hours/batch twice in a week)
1	1	1,2,3	<p>1. Fundamentals of thermodynamic - System, surroundings, intensive and extensive property.</p> <p>2. Laws of thermodynamics- Zeroth, First and Second law.</p> <p>3. Gas Laws - Boyle's law - Charles's Law - Avogadro's law - Joule's law.</p>	Refer Table 1	<p>1.Illustration of system and surrounding using simple experiments/ Virtual simulations, Video demonstration & documentation.</p> <p>2. Illustrate the principles of the laws of thermodynamics using simple experiments/ Virtual simulations, Video</p>

					demonstration & documentation.
2	1	1,2,3	<p>1. Relationship between the two specific heats- characteristic gas constant R. Adiabatic index γ.</p> <p>2. Definition of enthalpy and entropy.</p> <p>3. Introduction to thermodynamic processes - PVT relations -work done, heat transfer, change in internal energy, change in enthalpy and entropy for constant volume and constant pressure process.</p>	Problems on thermodynamic processes.	<p>1. Case study on enthalpy and entropy.</p> <p>2. Simple experiments on work and heat, Video demonstration & documentation.</p>
3	1	1,2,3	<p>1. PVT relations -work done, heat transfer, change in internal energy, change in enthalpy and entropy for isothermal process.</p> <p>2. PVT relations -work done, heat transfer, change in internal energy, change in enthalpy and entropy for isentropic process.</p> <p>3. Air standard cycles. Types, assumptions made in air standard cycles.</p> <p>Note: No derivations are needed.</p>	Refer Table 1	<p>1. Virtual exposure on thermodynamic processes.</p> <p>or</p> <p>Drawing of PV diagrams of process and cycles using software and find various parameters.</p> <p>2. Virtual exposure on thermodynamic processes/ Drawing of PV diagrams of process using software and find various parameters.</p>
4	1	1,2,3	<p>1. Explanation of PV and T-S diagrams of Carnot cycle.</p> <p>2. Explanation of PV and T-S diagrams of Otto cycle.</p> <p>3. Explanation of PV and T-S diagrams of Diesel cycle.</p> <p>Note: No derivations are needed.</p>	Problems on Air standard cycles.	<p>1. Virtual exposure on the otto Cycle or</p> <p>Drawing of PV diagrams of cycles(otto) using any software and find various parameters.</p> <p>2. Virtual exposure on the Diesel Cycle</p> <p>or</p>

					Drawing of PV diagrams of cycles (Diesel) using any software and find various parameters.
5	2	1,2,4	1.Lubrication System: Need-Types-Layout of pump feed system. 2. Oil Pump-Types- Gear pump- Rotor type- Vane type. 3. Oil filter- need- Types-Construction and working of cartridge type oil filter.	Refer Table 1	1. Find the Oil level and replace the engine oil and oil filter and Quality checking 2. Servicing of oil pumps and filters Note: Prepare the trouble shooting chart.
6	2	1,2,4	1.Cooling System: Need- types- Comparison- Layout of pump circulation system. 2. Construction and working of Water pump- radiator 3. Thermostat - Need-Types-Construction & Working of Wax type	Refer Table 1	1. Servicing of cooling system. 2. Servicing of water pump and radiator. Note: Prepare the trouble shooting chart.
7	3,4	1,2,4	1. Combustion in engines – Stages of combustion in SI engines and Diesel engines. 2. SI engine detonation & pre-ignition- process- effects 3. Controlling methods of SI engine detonation & pre-ignition.	Refer Table 1	1. Case study on detonation and preignition for SI engine and write a report on the study conducted. 2. Using engine scanner, identify the knocking in SI engine.
8	3,4	1,2,4	1. CI engine detonation 2. Knocking- process- effects. 3. Controlling methods of CI engine detonation.	Refer Table 1	1. Case study on detonation and preignition for CI engine and write a report on the study conducted. 2. Using engine scanner, identify the knocking in CI engine.
9	3,5	1,2,4	1.Engine performance- determination of IP- BP - MEP-	Refer Table 1	1. Determine the Compression pressure

			<p>IMEP-BMEP- Engine Torque - piston speed.</p> <p>2. Friction power- types of measuring friction power.</p> <p>3. A/F ratio- Requirement of A/F ratio for different operating conditions of engine.</p>		<p>and vacuum pressure of multi cylinder engine</p> <p>2. To determine A/F Ratio on the four-stroke diesel engine.</p>
10	3,5	1,2,4	<p>1. Volumetric efficiency. Methods for increasing volumetric efficiency.</p> <p>2. Simple problems on IP, BP, IMEP, BEMP.</p> <p>3. Simple problems on FP, A/F ratio and Volumetric efficiency.</p>	Refer Table 1	<p>1. To determine volumetric Efficiency on the four-stroke diesel engine.</p> <p>2. To determine volumetric Efficiency on the four-stroke diesel engine.</p>
11	5	1,2,4,7	<p>1. Determination of IP of a multicylinder engine using Morse test.</p> <p>2. TFC-SFC- BSFC- ISFC- Importance.</p> <p>3. Simple problems.</p>	Study the latest technological changes in this course in this course and present the impact of these changes on industry.	<p>1. Conduct the experiment to determine indicated power of multicylinder engine using Morse test.</p> <p>2. Conduct the experiment to determine indicated power of multicylinder engine using Morse test.</p>
12	3,5	1,2,4,7	<p>1. Efficiency-Mechanical efficiency -Thermal efficiency- indicated thermal efficiency- brake thermal efficiency.</p> <p>2. Methods to improve thermal efficiency of engine.</p> <p>3. Simple problems.</p>	Study the latest technological changes in this course in this course and present the impact of these changes on industry.	<p>1. Conduct experiment to determine the different efficiencies of two stroke SI engine at Constant load and constant speed condition</p> <p>2. Conduct experiment to determine the different efficiencies of four stroke SI engine at Constant load and constant speed condition.</p>
13	3,5	1,2,4,7	<p>1. Performance characteristics V/s Engine speed.</p>	Study the latest technological changes in this	<p>1. Conduct experiment to determine the</p>

			2. SI engine-Heat balance sheet. Performance Curves. Study of engine behavior using performance curves. 3. CI engine-Heat balance sheet and performance curves. Study of engine behavior using performance curves.	course in this course and present the impact of these changes on industry.	performance of four stroke SI engine at constant load and constant speed condition. Compute heat balance sheet for SI engine 2. Conduct experiment to determine the performance of four stroke CI engine at constant load and constant speed condition. Compute heat balance sheet for CI engine.
Total in hours			39	13	52

* PO= Program Outcome as listed and defined in year 1 curriculum and PO – CO mapping with strength (Low/Medium/High) has to be mapped by the course Co-Ordinator. (Above only suggestive).

TABLE 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution).

Sl. No.	Suggested Activity
1	Prepare and submit a report on applications of Laws of Thermodynamics in automobile engines as an assignment.
2	Collect information regarding maximizing volumetric efficiency of an IC engine by referring to one of the journal papers and present the details collected.
3	Collect/download information from the internet regarding how different efficiencies affect the engine performance and prepare a report as an assignment.
4	Collect/download information and present the techniques used to reduce frictional power to improve engine performance.
5	Visit nearby KSRTC workshop/depot and collect information regarding abnormal combustion/detonation or knock and prepare a report and submit as an assignment.
6	Visit nearby car service centre/showroom and make a note of fault codes detected using engine onboard diagnostic tools and submit a report on procedure used for diagnosing the fault codes.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3.	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	

5	CIE-5 Skill Test-Practice	12	180	100	Average of two skill tests 20
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					100

5. a) Format for CIE written Test

Course Name	Thermal Engineering and Engine Testing	Test	I/II/III	Sem	III/IV
Course Code	20AT33P	Duration	80 Min	Marks	30

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

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

5. b) CIE Skill Test-I Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1	Question on Concepts of Thermodynamics /Processes a) PV diagram or cycle b) Illustration of the stated law or any one cycle	30
2	2	One skill-oriented question on “lubrication system” for the given case. a) Fault detection - 10 m b) Troubleshooting/ Servicing - 20 m	30
3	2	One skill-oriented question on “cooling system” for the given case. a) Fault detection - 10 m b) Troubleshooting/ Servicing - 20 m	30
4	1,2	Portfolio evaluation on practical sessions (1-6 week)	10
Total Marks			100

5. C) CIE Skill Test-II Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	3,4	One skill-oriented question on “combustion process, measure and prevent abnormal combustion” for the given case. c) Analyse the situation based on given case. - 10 m d) Measure the parameters - 30 m	40
2	3,5	One skill-oriented question on “performance characteristics of an internal combustion engines, efficiency etc.” for the given case. c) Tabular Column to note down the parameters - 05 m d) Formulas adopted -05 m e) Conduction of experiment -20 m f) Calculation & Result -20 m	50
3	3,4,5	Portfolio evaluation on practical sessions (7-12 week)	10
Total Marks			100

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
Average Marks= (8+6+2+2)/4=4.5							5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Thermal Engineering by R.S. Khurmi (S Chand & Co)
2	I C Engines by Mathur & Sharma (Danapat Rai & sons)
3	Thermal Engineering by R K Hegde and Niranjan Murthy (Sapna Publications)
4	Internal Combustion Engines by N Ganeshan (Tata McGraw-Hill)
5	Thermal Engineering by Kodanda Ramanna
6	Automobile Engineering by Kirpal Singh (Vol 1 and II)
7	Basic and Applied thermodynamics by P.K. Nag (Tata McGraw-Hill)

8. SEE Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
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1	1,2,3,4	<p>One skill-oriented question on “lubrication/cooling system” for the given case.</p> <p>a) Fault detection - 10 m</p> <p>b) Troubleshooting/ Servicing - 20 m</p> <p>OR</p> <p>One skill-oriented question on “combustion process, measure and prevent abnormal combustion” for the given case.</p> <p>a) Analyse the situation based on given case. - 10 m</p> <p>b) Measure the parameters - 20 m</p>	30
2	3,5	<p>One skill-oriented question on “performance characteristics of an internal combustion engines, efficiency etc.” for the given case.</p> <p>g) Tabular Column to note down the parameters - 05 m</p> <p>h) Formulas adopted -05 m</p> <p>i) Conduction of experiment -20 m</p> <p>j) Calculation & Result -10 m</p>	40
3	1,2,3,4,5	Portfolio evaluation on practical sessions (1-13 week)	10
4	1,2,3,4,5	Viva-voce	20
Total Marks			100

NOTE: Use same format of evaluation for CIE skill test. Portfolio evaluation of practical session should be considered from “Week 1-6” for 1st CIE and “Week 7-12” for 2nd CIE each 10 marks.

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Electronically controlled multi cylinder 4 stroke petrol engine in working condition		1
2	Multi-cylinder petrol engine with electric dynamometer test rig, suitable to determine the performance parameters, morse test and heat balance sheet.		1
3	4-stroke multicylinder Diesel engine with hydraulic dynamometer test rig suitable to determine the performance parameters, morse test and heat balance sheet.		1
4	Single cylinder Diesel engine with Dynamometer test rig.		1
5	Single cylinder 4 stroke Petrol engine with Dynamometer test rig		1
6	Computerized Diesel / petrol engine test rig		1
7	Engine scanner		1
8	Onboard diagnostic tools like OBD2 scanner.		1



Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Automobile Engineering	Semester	III
Course Code	20AT34P	Type of Course	Programme Core
Course Name	Automotive Manufacturing Processes	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1.Rationale: Manufacturing process is a branch of professional engineering that shares many common concepts and ideas with other fields of engineering such as mechanical, chemical, electrical, and industrial engineering. The manufacturing or production engineer's primary focus is to turn raw material into an updated or new product in the most effective, efficient & economic way possible. The objective of the course is to develop skill in the most important manufacturing processes in to a context of a production environment.

2. Course Outcomes/Skill Sets: At the end of the course the student will be able to:

CO-01	Review a given drawing to identify the metal to be used, select the appropriate welding method and the right electrodes to be used.
CO-02	Build a sheet metal model using metal fabrication, brazing, lathe and drilling processes while adhering to all prescribed workshop safety protocols.
CO-03	Inspect the model to identify defects in welding processes using prescribed inspection procedure and also explain press work operation needed for any identified repair.
CO-04	Explain and implement the requirements of ISO standards 9000 series.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	3,4	1.Introduction to Welding Technology in Automobile Industry 2. Classification of welding and types of Welding Processes. 3. Arc Welding: Principle of Arc Welding- Types and preparation of materials in welding – Consumable Electrode method & Non-Consumable Electrode method. Steps involved in Arc Welding	Refer Table 1	1. a) Show various safety sign charts and Safety tips to be followed in the machine shop. Note down the Safety tips in the record book. b) Identify and record different Welding Joints in the Vehicle. 2. a) Practice on Material preparation for welding. b) Review the given drawing, Demonstrate and practice on selection of

					electrodes and setting the current, Arc initiation.
2	1	3,4	<p>1. TIG Welding – Construction- Working Principle- Material preparation- Process & Application.</p> <p>2. GTAW- Operation- Equipment & Materials- Joint Design- Application.</p> <p>3. GMAW- Operation- Equipment & Materials- Joint Design- Application.</p>	Refer Table 1	<p>1. Practice on Simple job work on Lap joint using metallic arc welding, GTAW & GMAW and Video demonstration & documentation of the same.</p> <p>2. Practice on Simple job work on butt joint using metallic arc welding, GTAW & GMAW and Video demonstration & documentation of the same.</p> <p>Note: Use Personal Protective equipment & follow the safety practices against fumes and welding gases (Record all the safety tips followed).</p>
3	1	3,4	<p>1. Resistance Welding- Principle- Construction & Working. Types of Resistance Welding.</p> <p>2. Working principle- Spot Welding, Butt Welding</p> <p>3. Seam Welding- Working Principle.</p>	Refer Table 1	<p>1. a) Demonstrate the safety precautions to be Practiced during spot welding and identify the welding method used to join the component in the given drawing.</p> <p>b) Case Study/ Industrial visit to metro, Aircraft outer bodies, Rail coaches etc. on spot welding and write a report on the same.</p> <p>2. a) Demonstrate the safety precautions to be</p>

					<p>Practiced during seam welding.</p> <p>b) Case study/ Industrial visit on Seam welding and write a report on the same.</p>
4	1,3	3,4	<p>1. Gas welding- Working process of Gas Welding and Gas cutting. Types of Gas Welding & Types of flames in Gas welding- Application.</p> <p>2. Welding Defects and remedies.</p> <p>3. NON-DESTRUCTIVE TESTS (NDT): Define NDT, Classify NDT methods, Visual inspection and its remedy.</p>	Refer Table 1	<p>1.a) Practice on Simple job work on Lap joint using gas welding.</p> <p>b) Identify the method of welding used to join the components in the given drawing and note down the electrode/binding material used.</p> <p>2. a) Practice on Gas cutting.</p> <p>b) Practice on Visual inspection of the cracks by Microscope.</p> <p>Note: Use Personal Protective equipment & follow the safety rules (Record all the safety tips followed).</p>
5	2,3	3,4	<p>1. Liquid Penetrant Testing – Basic steps in LPT, types of LPT and its remedy.</p> <p>2. Brazing: Introduction-Types, Joint design, Cleaning the joint</p> <p>3. Selecting the flux, Selection of a Brazing process, Post cleaning and inspections. Difference between brazing and welding.</p>	Refer Table 1	<p>1. Practice on Visual Inspection of the cracks by LPT and Video demonstration & documentation of the same.</p> <p>2. Practice on Brazing of different automobile components and Video demonstration & documentation of the same.</p> <p>Note: Follow the safety rules (Record all the safety tips followed).</p>

6	2	3,4	<p>1. Sheet Metal Technology- Introduction, Fundamentals of sheet metal work, Different hand tools used in automobile body shop.</p> <p>2. Sheet Metal operations: - Cutting operation-producing blanks, cutting holes, progressive, miscellaneous operation.</p> <p>3. Forming operation-bending, Embossing, flanging, hemming, seaming, curling, wiring.</p>	Refer Table 1	<p>1. Demonstrate and record different types of tools used in automobile body shop.</p> <p>2. Practice on Preparation of number plate using Embossing and rivet operation in sheet metal operation.</p> <p>Note: Follow the safety rules (Record all the safety tips followed).</p>
7	2,3	3,4	<p>1. Ribbing, staking, crimping, bulging, beading, enclosing, tube forming.</p> <p>2. Drawing operation- cupping, box drawing, panel drawing, Shallow, deep panel drawing.</p> <p>3. Introduction to Press working. Power press- Types- Working.</p>	Refer Table 1	<p>1. Demonstrate and prepare various sheet metals joint for any one application.</p> <p>2. Practice on any one drawing operation in sheet metal for any one application and Video demonstration & documentation of the same.</p> <p>Note: Follow the Sheet Metal fabrication safety tips.</p>
8	2	3,4	<p>1. Operations performed on press. Work & tool holding devices.</p> <p>2. Casting: Introduction to metal castings and moulding in foundry.</p> <p>3. Use of patterns, pattern materials.</p>	Refer Table 1	<p>1. Demonstrate the press work operation using hydraulic press.</p> <p>2. a) Demonstrate the Selection of right type of foundry tools and equipment. b) Practice on Sand mixing.</p>
9	2	3,4	<p>1. Types of patterns-single, split, loose</p> <p>2. Sweep pattern, skeleton pattern, Gated Patterns – allowances.</p>	Refer Table 1	<p>1. Practice on preparing the Square Mould.</p> <p>2. Practice on preparing the Hexagonal Mould.</p>

			3. Types of moulding sand and properties.		
10	2	3,4	<p>1. Concept of Cope, Drag. Concept of Runner, riser & core.</p> <p>2. Permanent mould casting –Die casting, Slush Casting.</p> <p>3. Centrifugal casting, investment casting. Brief explanation of defects in castings.</p>	Refer Table 1	<p>1. Practice on preparing the pattern cavity and provide runner and riser. (To show the concept of cope and drag)</p> <p>2. Melt Wax cast the same in the prepared pattern of the mould.</p>
11	2	3,4,7	<p>1. Forging: Introduction - Types- Working Processes of different types.</p> <p>2. Working of Open and Closed Die- Forging. Effects of forging on microstructure.</p> <p>3. Forging defects and their effects. Steel Forging in Automobile Industries- Need.</p>	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	<p>1. Melt the Aluminium/ tin/ Cool drink Tin and cast the same in the prepared pattern of the mould using electric furnace.</p> <p>Note: Follow all the safety precautions.</p> <p>2. Demonstration of tools and equipment used in Forging operation. List & note down their functions.</p>
12	4	3,4,7	<p>1. ISO 9000 series Quality management system: History of International Organisation for standardization. ISO members. ISO standards and rules.</p> <p>2. History of ISO 9001. BS 5750. QM principle.</p> <p>3. The main requirements of ISO 9001.</p>	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	<p>1. Practice on smith Forging of the given Material.</p> <p>2. Case study on ISO standards related to automotive industry.</p> <p>Note: Follow the safety precautions in the forging lab.</p>

13	2	3,4,7	<p>1. Lathe: Types-Construction & working of engine lathe- Turning, step turning, taper turning & knurling.</p> <p>2. Drilling: Working principle of Conventional drilling operation and its parts.</p> <p>3. Nomenclature of drill tool. Hole drilling operation- Reaming, Boring, Counter boring.</p>	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	<p>1. Demonstrate different parts of lathe and practice turning, step turning, taper turning & knurling operations.</p> <p>2. Practice on drilling and counter boring of the given Sample.</p> <p>Note: Follow the safety practices.</p>
Total in hours			39	13	52

*** PO= Program Outcome as listed and defined in year 1 curriculum and PO – CO mapping with strength (Low/Medium/High) has to be mapped by the course Co-Ordinator. (Above only suggestive)**

TABLE 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution).

Sl. No.	Week	Suggested Activity
1	1	Study and write a report on different welding methods used in automobile industry and submit as an assignment.
2	2	Study and present the use of Robot arc Welding or advanced arc welding operation in present automotive industries.
3	3	Create 6 groups in a class allow each group to study different arc and resistance welding joints in a given vehicle component. Note down and submit a report on components where the particular type of weld is used and justify with valid answer why that particular welding is done on that joint.
4	4	Study and prepare a report on Automotive NDT applications.
5	5	Study and submit a report on laser welding.
6	6	Study and present how high velocity forming is useful in automobile industry.
7	7	Study and Present on working of Sheet metal stamping and its application in automobile industry.
8	8	Study and write a report on Zinc die casting.
9	9	Study and submit the report on Evaporative pattern casting.
10	10	Study and Compare die casting Vs permanent mold casting or sand casting and submit the report on how each casting is different and their application in industry.
11	11	Study and present on Master bond epoxies used for automobile assembly application.
12	12	Visit nearby industry and know about different Forged components made in automobile and what methods/type of forging are adapted for these parts, submit the report.
13	13	Study and present on Drilling holes in automotive glass and Drilling hole in windshield glass for wiper evolution.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
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1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
k	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					100

5. a) Format for CIE written Test

Course Name	Automotive Manufacturing Processes	Test	I/II/III	Sem	III/IV
Course Code	20AT34P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.					

5. b) CIE Skill Test-I Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1	Identify the safety tools used for performing different metal fabrication processes/sheet metal operation/drilling operation. - 10m Identify the appropriate metal to be used, appropriate welding method and the right electrodes to be used for a given component/draft. -5m	15
2	2	One skill-based question on “any one type of Welding operation”. a) Safety methods followed -10m b) Performance of the Operation - 30 m c) Accuracy - 05 m	45
3	3	One question on “NDT/ Brazing” a) Identification of defects/ Brazing -10 m b) Remedy/ Procedure followed before brazing -10 m	20
4	1,2,3	Portfolio evaluation of practical session (1-6) week	10

5	1,2,3	Viva-voce	10
Total Marks			100

5. c) CIE Skill Test-II Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	2	One skill-based question on "Sheet Metal operation operation". a) Safety methods followed -05m b) Performance of the Operation - 25 m	30
2	2	One skill-based question on "Casting/ Forging operation". a) Safety methods followed - 05m b) Performance of the Operation - 25 m	30
3	4	Question based on the given case in ISO standards in Organization management system. a) Identification of the key facts in the case - 05m c) Identification of the key issues - 05m d) Evaluate and recommend the course of action -10m	20
4	2,4	Portfolio evaluation of practical session (7-12) week	10
5	2,4	Viva-voce	10
Total Marks			100

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
Average Marks= (8+6+2+2)/4=4.5							5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Manufacturing Technology-1By P.C Sharma of S. CHAND Publications.
2	Elements of Workshop Technology Vol-I Manufacturing Process edition-ByHajraChoudry
3	Elements of Workshop TechnologyVol-II Manufacturing Process edition-ByHajraChoudry
4	Work shop technology By R. S KHURMI &J. K GUPTA of S. CHAND&Co.Ltd
5	Welding processes and technology – O.P Khanna
6	Manufacturing Technology: Foundry Forming and Welding, P.N.Rao 2nd Edition TMH
7	Welding and Welding technology, Richard L little, Mc. Graw Hill Education

8. SEE Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1,3	<p>Identify the safety tools used for performing different metal fabrication processes/sheet metal operation/drilling operation. – 10m</p> <p>Identify the appropriate metal to be used, appropriate welding method and the right electrodes to be used for a given component/draft. -10m</p> <p>Or</p> <p>One question on “Defects in Welding/ press work operation/brazing”</p> <p>a) Identification of defects/ press work operation/brazing -10 m</p> <p>b) Remedy/ procedure followed before brazing 10 m</p>	20
2	2	<p>One skill-based question on “Welding/ Lathe/ Sheet Metal operation/ Casting/ Forging/ Drilling operation”.</p> <p>a) Safety methods followed -10m</p> <p>b) Performance of the Operation - 30 m</p> <p>c) Accuracy - 10 m</p>	50
4	1,2,3,4	Portfolio evaluation of practical session (1-13)	10
5	1,2,3,4	Viva-voce	20
Total Marks			100

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Arc welding transformer upto 300Amps with attachments and welding shields.		2
2	Gas welding machine with attachments and oxygen and acetylene cylinders.		2
3	Gas welding and gas cutting torches.		2
4	Electric furnace.		2
5	Spot welding machine with attachments.		1
6	Riveting machine		2
7	Sheet metal embossing machine.		2

8	Molding boxes.		2
9	Rammers.		2
10	Flatteners.		2
11	Trowels.		2
12	Strike off bar.		2
13	Shovels.		2
14	Open hearth furnace.		2
15	Anvil.		2
16	Swage block.		2
17	Flat and round tongs.		2
18	Bench vice.		2
19	Portable vertical drilling machine.		2
20	Lathe machine with attachments		5

ಮೂರನೇ ಸೆಮಿಸ್ಟರ್

ಕನ್ನಡ ಬಲ್ಲ ಡಿಪ್ಲೋಮಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ

(ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ಪರಂಪರೆ ಕುರಿತು)

Course Code	20KA31T	Semester : III	Course Group - AU
Course Title	ಸಾಹಿತ್ಯ ಸಿಂಚನ - 2	Category : Audit	Lecture Course
No. of Credits	2	Type of Course	CIE Marks : 50
Total Contact Hours	02 Hrs Per Week 26 Hrs Per Semester	Prerequisites Teaching Scheme (L:T:P)= 2:0:0	SEE Marks : Nil

ಸಾಹಿತ್ಯ ಸಿಂಚನ - 2 ಪಠ್ಯಕ್ರಮ - 20KA31T

26 ಗಂಟೆಗಳು

ಪಠ್ಯಕ್ರಮದ ಪರಿವಿಡಿ	ಬೋಧನಾ ಅವಧಿ
1. ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಪ್ರಭಾವಗಳು ಮತ್ತು ಪ್ರೇರಣೆಗಳು	01 ಗಂಟೆ
2. ಹೊಸಗನ್ನಡ ಕಾವ್ಯದ ಪ್ರಕಾರಗಳು -	02 ಗಂಟೆ
<ul style="list-style-type: none"> ನವೋದಯ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು. 	03 ಗಂಟೆ
<ul style="list-style-type: none"> ನವ್ಯ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು. 	03 ಗಂಟೆ
<ul style="list-style-type: none"> ಬಂಡಾಯ ಮತ್ತು ಪ್ರಗತಿಪರ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು. 	03 ಗಂಟೆ
<ul style="list-style-type: none"> ದಲಿತ ಸಾಹಿತ್ಯ, ಮಹಿಳಾ ಸಾಹಿತ್ಯ, ವಿಜ್ಞಾನ ಸಾಹಿತ್ಯ ಮತ್ತು ಇತ್ತೀಚಿನ ಪ್ರಚಲಿತ ಕನ್ನಡ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು. 	03 ಗಂಟೆ
3. ವೈಚಾರಿಕತೆ ಕುರಿತಾದ ಲೇಖನ - ಜಿ ಎಸ್. ಶಿವರುದ್ರಪ್ಪ	01 ಗಂಟೆ
4. ಕಥೆ - ನೇಮಿಚಂದ್ರ	01 ಗಂಟೆ
5. ಪ್ರವಾಸ ಕಥನ - ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯರವರ (ಕುಪ್ಪಳಿ ಡೈರಿ ಪುಸ್ತಕದಿಂದ)	01 ಗಂಟೆ
6. ಪರಿಸರ, ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ಕುರಿತಾದ ಲೇಖನಗಳು	01 ಗಂಟೆ
7. ಪ್ರಬಂಧ - ಗೊರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ	01 ಗಂಟೆ
8. ಪ್ರಚಲಿತ ವಿದ್ಯಮಾನಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಲೇಖನ - "ಪೇರು ಮಾರುಕಟ್ಟೆ ಮತ್ತು ಹಣಕಾಸು ನಿರ್ವಹಣೆ" ಕುರಿತಂತೆ	01 ಗಂಟೆ
9. ಕರ್ನಾಟಕ ಏಕೀಕರಣ ಚಳುವಳಿ - ಪ್ರೊ. ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ	01 ಗಂಟೆ
10. ಕನ್ನಡ ಸಿನಿಮಾರಂಗ ಬೆಳೆದು ಬಂದ ದಾರಿ ಮತ್ತು ನಾಡು-ನುಡಿ ಹಾಗೂ ನಾಡಿನ ಸಂಸ್ಕೃತಿಯ ಮೇಲೆ ಬೀರಿದ ಪ್ರಭಾವಗಳು	01 ಗಂಟೆ
11. ಕನ್ನಡದ ಸಾಮಾಜಿಕ ಉಪಭಾಷೆಗಳು (ಭಾಷಾ ಪ್ರಭೇದಗಳು)	01 ಗಂಟೆ
12. ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಒಂದು ಅವಲೋಕನ	02 ಗಂಟೆ
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ 26 ಗಂಟೆಗಳು	26 ಗಂಟೆ

**ಕನ್ನಡ ಬಾರದ / ಕನ್ನಡೇತರ ಡಿಪ್ಲೋಮಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಕನ್ನಡ ಕಲಿಸಲು
ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ**

Course Code	20KA31T	Semester : III	Course Group - AU
Course Title	ಬಳಕೆ ಕನ್ನಡ - 2	Category : Audit	Lecture Course
No. of Credits	2	Type of Course	CIE Marks : 50
Total Contact Hours	2 Hrs Per Week 26Hrs Per Semester	Prerequisites Teaching Scheme (L:T:P)= 2:0:0	SEE Marks : Nil

ಬಳಕೆ ಕನ್ನಡ - 2 ಪಠ್ಯಕ್ರಮ - 20KA31T

Table of Contents (ಪರಿವಿಡಿ)

26 ಗಂಟೆಗಳು

Part – 1	Teaching Hour
Necessity of learning a local language (Continuation). Tips to learn the language with easy methods (Continuation). Easy learning of a Kannada Language: A few tips (Continuation). Hints for correct and polite conversation (Continuation). Instructions to Teachers for Listening and Speaking Activities (Continuation). Instructions to Teachers for Reading and Writing Activities (Continuation).	01 Hour
Part – II	
Key to Transcription for Correct Pronunciation of Kannada Language (Continuation). Instructions to Teachers to teach Kannada Language (Continuation).	02 Hour
Part – III Lessons to teach Kannada Language (Speaking, Listening, Reading and Writing Activities with Explanation)	
Lesson – 1 Personal Pronouns, Possessive Forms, Interrogative words – Part II	02 Hour
Lesson – 2 Permission, Commands, encouraging and Urging words (Imperative words and sentences) – Part II	02 Hour
Lesson – 3 Comparative, Relationship, Identification and Negation Words – Part II	02 Hour
Lesson – 4 Different types of forms of Tense (Use and Usage of Tense in Kannada) – Part II	02 Hour
Lesson – 5 Kannada Helping Verbs in Conversation (Use and Usage of Verbs) – Part II	02 Hour
Lesson – 6 Formation of Past, Future and Present Tense Sentences with Changing Verb Forms	02 Hour
Lesson – 7 Karnataka State and General Information about the State	02 Hour
Lesson – 8 Kannada Language and Literature	02 Hour
Lesson – 9 Do's and Don'ts in Learning a Language	02 Hour
PART - IV Reading and writing Practice of Kannada Language	
Lesson – 10 Kannada Language Script Part – I	02 Hour
Lesson – 11 Kannada Language Script Part – II (Continuation)	02 Hour
Lesson – 12 Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - Kannada Words in Conversation (Continuation).	01 Hour
Total Teaching Hours	26 Hour

**ಸಾಹಿತ್ಯ ಸಿಂಚನ ಭಾಗ - II ಮತ್ತು ಬಳಕೆ ಕನ್ನಡ ಭಾಗ - II ಈ ಎರಡು ಪಠ್ಯಕ್ರಮಗಳಿಗೆ
CIE - ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಮಾರ್ಗಸೂಚಿಗಳು :**

(Course Assessment and Evaluation Chart - CIE only)

Sl. No	Assessment	Type	Time frame in semester	Duration In minutes	Max marks	Conversion
1.	CIE- Assessment - 1	Written Test - 1	At the end of 3 rd week	80	30	Average of three written tests : 1, 2 & 3 for 30 Marks
2.	CIE- Assessment - 2	Written Test - 2	At the end of 7 th week	80	30	
3	CIE- Assessment - 3	Written Test - 3	At the end of 13 th week	80	30	
4.	CIE- Assessment - 4	MCQ/Quiz	At the end of 5 th week	60	20	Average of three Assessment tests : 4, 5 & 6 for 20 Marks
5	CIE- Assessment - 5	Open Book Test	At the end of 9 th week	60	20	
6	CIE- Assessment - 6	Work book Consolidation & Activities	At the end of 11 th week	60 (Work book Submission)	20	
Total CIE – Continuous Internal Evaluation Assessment Marks						50
Total Marks						50

- ಸೂಚನೆ :**
- 1.CIE - ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ 1, 2 ಮತ್ತು 3 ರ ಕಿರು ಪರೀಕ್ಷೆಗಳನ್ನು ಮತ್ತು ಮೌಲ್ಯಮಾಪನದ 4, 5 ಮತ್ತು 6 ರ ಪರೀಕ್ಷೆಗಳನ್ನು ಪ್ರತ್ಯೇಕ ಬ್ಲಾಬುಕ್ ಪುಸ್ತಕದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು ಬರೆಯಬೇಕು.
 - 2.ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು, ತರಗತಿ ಕನ್ನಡ ಭಾಷಾ ಶಿಕ್ಷಕರಿಂದ ಮತ್ತು ವಿಭಾಗಾಧಿಕಾರಿಗಳಿಂದ ದೃಢೀಕರಣಗೊಂಡ ಕಾರ್ಯಪಠ್ಯಪುಸ್ತಕವನ್ನು (Work Book) ಮೌಲ್ಯಮಾಪನ ಭಾಗ- CIE- Assessment – 6 ರ ಪರೀಕ್ಷೆಯ ನಂತರ ಆಯಾ ವಿಭಾಗಕ್ಕೆ ಸಲ್ಲಿಸಬೇಕು.

4TH SEMESTER



Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Automobile Engineering	Semester	IV
Course Code	20AT41P	Type of Course	Programme Core
Course Name	Advanced Automotive Systems	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1. Rationale: The automotive industry has observed a drastic evolution since 2010 with many advancements in technology. The traditional 4-wheeled cars, which were earlier equipped with basic features have transformed into connected cars with advanced features such as cloud computing, big data, and the Internet of Things (IoT), among others. There is increasing number of electronic embedded systems in 2-wheelers as well as passenger and commercial vehicles such as Antilock Braking System (ABS), Electronic Control Units (ECUs) for engine management, park assist, Electronic Stability Programme (ESP), glow plug timers, Capacitive Discharge Ignition (CDI), etc., that are nowadays being installed not only in luxury cars but also in mid-segment cars by manufacturers. This course focusses on developing skill on these advanced automotive systems.

2. Course Outcomes/Skill Sets: At the end of the course the student will be able to:

CO-01	Test, Service and troubleshoot advanced automotive and electronic components of the given vehicle.
CO-02	Select an appropriate sensor and/or actuator for a given automated application, demonstrate collection of measurement data and explain process variables using sensors and transducers.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	2	2,3,4	1. Computer operation (ECU) - Block diagram of computer (ECU) with its microprocessor-functions working principle. 2. Microprocessors-design-program-information storage-information retrieval. 3. Typical multipoint fuel injection system input/output pin configuration	Refer Table 1	1. Identification of pin configuration of ECU of different engines. 2. a) Identification of pin configuration of ECU of other systems of vehicle. b) Study different error codes of different makes of ECU.
2	2	2,3,4	1. Open loop and closed loop control systems 2. Multiplexing-concept. Computer networking-concept need-Controlled Area Network (CAN)-concept-merits-types. 3. Sensors- Definition, construction and working- throttle position sensor-crankshaft position sensor-types-	Refer Table 1	1. Demonstration of computer area network and Identify TPS and crankshaft position sensor and their locations used in vehicle. 2. Diagnose and troubleshoot TPS and crank position sensor with

					engine scanner (and multi-meter).
3	2	2,3,4	<p>1. Construction and working of magnetic pickup coil type, Hall effect.</p> <p>2. Construction and working- Piezoelectric combustion, Knock sensor, temperature sensor.</p> <p>3. Strain gauge type manifold absolute sensor-exhaust gas oxygen sensor.</p>	Refer Table 1	<p>1 Identify piezoelectric knock sensor and temperature sensor and their locations used in vehicle.</p> <p>2. Diagnose and troubleshoot piezoelectric knock sensor and temperature sensor with engine scanner (and multi-meter).</p>
4	2	2,3,4	<p>1. Mass air flow Sensor-types</p> <p>2. construction and working of hot film and hot wire type sensors.</p> <p>3. Potentiometer type -need-working. principle.</p>	Refer Table 1	<p>1. Diagnose and troubleshoot Potentiometer with engine scanner (and multi-meter).</p> <p>2. Build circuit to demonstrate the testing and working of Potentiometer, LVDT type ride height sensors, rain sensor.</p>
5	1,2	2,3,4	<p>1. LVDT type ride height sensors, rain sensor-need-working. principle.</p> <p>2. Actuator-Definition, pulse width modulation of input voltage-duty cycle-need.</p> <p>3. On/off solenoid proportionate solenoid-stepper motor-servo motor-relays-construction and working - applications.</p>	Refer Table 1	<p>1. Diagnose and troubleshoot LVDT type ride height sensors, rain sensor with engine scanner (and multi-meter).</p> <p>2. Build circuit of On/off and proportionate solenoid stepper motor.</p>
6	1	2,3,4	<p>1. Power steering - types, construction and working- HPS.</p> <p>2. Construction & working -linkage power steering, Integral power steering.</p> <p>3. electronic rack and pinion power steering-electronic power steering.</p>	Refer Table 1	<p>1. Servicing and troubleshooting of hydraulic power steering.</p> <p>2. Service and troubleshoot electronic rack and pinion power steering.</p>
7	1	2,3,4	<p>1. Continuously variable transmission-construction and working.</p> <p>2. Hydraulic automatic transmission-gear shifting process.</p> <p>3. Automated manual transmissions-modes-working principle.</p>		<p>1. Service and troubleshoot of CVT.</p> <p>2. Service and troubleshoot of Hydraulic automatic transmission.</p>
8	1	2,3,4	<p>1. Torque converter- construction and working, torque converter.</p> <p>2. Limited slip differential-need-types.</p> <p>3. Working principle of clutch type LSD.</p>	Refer Table 1	<p>1. Servicing of torque converter</p> <p>2. Service and troubleshoot clutch type LSD.</p>

9	1	2,3,4	1. Anti-lock brakes-Need and types, construction and working. 2. Anti-lock brake modulator. 3. Servo brakes -types, vacuum servo brakes-layout- working,	Refer Table 1	1. Test and troubleshoot wheel speed sensor of anti-lock braking system. 2. Servicing of servo brakes.
10	1,2	2,3,4	1. Electronic stability control-working principle. 2. Hill assistance and traction control system – working principle. 3. Air bag system-need-types-layout of accelerometer-based air bag system.	Refer Table 1	1. Virtual Demonstration of Electronic stability control. 2. Virtual demonstration of air bag systems.
11	1,2	2,3,4,7	1. Collision avoidance warning system-tyre pressure warning system- need-working. 2. Computer based instrumentation-working principle. 3. Trip information computer working principle, working principle-vehicle speed measurement.	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	1. Test and troubleshoot of tyre pressure warning system. 2. Demonstration of computer-based instrumentation.
12	1,2	2,3,4,7	1. Navigation- types- GPS navigation system. 2. Four-wheel drive system & all-wheel drive -types. 3. construction and working of permanent 4-wheel drive with viscous coupling.	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	1. Demonstration of GPS navigation system. 2. Service and troubleshoot 4-wheel drive system.
13	1	2,3,4,7	1. Air spring-types. construction and working- Bellows' air spring, piston air spring. 2. Hydro-elastic spring construction and working.	Refer Table 1, Study the latest technological changes in	1. Servicing and troubleshooting of air springs 2. Servicing and troubleshooting of hydro-elastic spring.

			3. Working principle-electronically controlled shock absorber.	this course in this course and present the impact of these changes on industry.	
Total in hours			39	13	52

*** PO= Program Outcome as listed and defined in year 1 curriculum and PO – CO mapping with strength (Low/Medium/High) has to be mapped by the course coordinator. (Above only suggestive)**

Table 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution)

Sl. No.	Week	Suggested Activity
1	1	Open an ECU from a vehicle and reconnect as per the pin configuration.
2	2	Study and give a Presentation on diagnosis of CAN.
3	3	Make a list of various sensors used in a vehicle with their position and submit it as an assignment.
4	4	Make a list of various actuators used in a vehicle with their position and submit it as an assignment.
5	5	Study and present on the topic evolution of fuel injection and benefits of electronic fuel injection.
6	6	Check modern vehicles which comes with CRDI and Inline systems and present the comparison of their efficiency, speed and other performance of the vehicle.
7	7	Submit as an assignment with proper justification on air bags for 2-wheeler vehicle system.
8	8	Study and Present on reverse parking collision-avoidance assist system.
9	9	Submit a report on various navigation systems used in India.
10	10	Make a group of 5 and visit nearest showroom discuss on the topic battery life, cost of replacement, recycling of batteries in EV and write a report on the observed data.
11	11	List and present the merits and demerits of modern vehicles using clutch-less manual transmission and automatic transmission.
12	12	Study and present on electronically controlled air springs.
13	13	Study and Present on construction and working of electrical power steering.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3.	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5.	CIE-5 Skill Test-Practice	12	180	100	
6.	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40

Total Marks	100
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5. a) Format for CIE written Test

Course Name	Advanced Automotive Systems	Test	I/II/III	Sem	III/IV
Course Code	20AT41P	Duration	80 Min	Marks	30

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

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

5. b) CIE Skill Test-I Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1	One question on "Service and troubleshoot different power steering". a) Analysis of defects. -05 m b) Service/ Troubleshooting. -25 m	30
2	2	One question on "Sensors and sensor monitoring mechanisms aligned to automotive systems/different signal conditioning techniques/ interfacing techniques/ actuator mechanisms." From week (1-3) a) Identification or Circuit building - 10 m b) Dragonize or troubleshooting - 20m	30
3	2	One question on "Sensors and sensor monitoring mechanisms aligned to automotive systems/different signal conditioning techniques/ interfacing techniques/ actuator mechanisms." From week (5&6) a) Identification or Circuit building -10 m b) Dragonize or troubleshooting - 20m	30
4	1,2	Portfolio evaluation of practical sessions (1-6 week)	10
Total Marks			100

5. c) CIE Skill Test-II Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1,2	One question on "Service and troubleshoot different advanced automotive components".	45

		a) Identification of defects -15 m b) Question on Troubleshooting. -30 m	
2	1,2	One question on "Service and troubleshoot advanced electronic systems" a) Identification of defects -10 m b) Question on Servicing/ Troubleshooting. -35m	45
3	1,2	Portfolio evaluation of practical sessions (7-12) week	10
Total Marks			100

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
Average Marks= (8+6+2+2)/4=4.5							5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Understanding Automotive electronics, William Ribben, Butterworth-Heinemann Publications.
2	Automotive Computer Controlled Systems (Diagnostic tools and techniques), Allan. W. M Bonnick, Butterworth-Heinemann Publications.
3	Automobile electrical and electronic systems, Tom Denton, Butterworth-Heinemann Publications.
4	Electronic Engine Controls, Steve. V. Hatch, Cengage Learning.
5	Truck engines Fuel & computerized management systems, Sean Bennett, Cengage Learning.
6	Automobile engineering Vol I by Anil Chikara (Satya Prakashan)
7	Advanced vehicle technology by Heinz Heisler (Butterworth-Heinemann)
8	A Systems Approach to Automotive technology by Jack Erjavec (Cengage Learning)
9	Mechatronics by Prof C R Venkataramana
10	Mechatronics by W Bolten (Longman Pearson publications)

8. SEE Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1	One question on "Service and troubleshoot different advanced automotive components/ advanced electronic systems". a) Identification of defects. -20 m b) Servicing/Troubleshooting. -30 m	50

2	2	One question on “Sensors and sensor monitoring mechanisms aligned to automotive systems/different signal conditioning techniques/ interfacing techniques/ actuator mechanisms.” c) Identification or Circuit building - 10 m d) Dragonize or troubleshooting - 10 m	20
3	1,2	Portfolio evaluation of practical sessions (1-13) week	10
4	1,2	Viva-voce	20
Total Marks			100

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Multi-cylinder Engine with Electronic control unit and different engine sensors.		2 sets
2	ECU's of other vehicle systems (ABS, Transmission)		2 sets
3	Throttle position sensors / kit, crank shaft position sensor (Magnetic pickup coil type, Hall type)/kit, exhaust gas sensor/kit, mass flow sensor, LVDT height sensors, rain sensor, knock sensor and temperature sensor, Potentiometer.		4 each
4	Solenoid stepper motor demo kit.		5
5	Automatic hydraulic transmission with Torque converter.		2
6	Automated manual transmission.		2
7	Continuously variable transmission		2
8	Air spring suspension system demo model.		1
9	Hydro-elastic spring suspension system demo model.		1
10	Engine scanner		1
11	Hydraulic power steering trainer unit.		2
12	Electrical power steering trainer unit.		2
13	ABS trainer unit.		2
14	Air bag trainer unit.		2
15	Limited Slip differential		2



Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Automobile Engineering	Semester	IV
Course Code	20AT42P	Type of Course	Programme Core
Course Name	Design and Drafting	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L: T:P: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1.Rationale: Machine design is the most important activity in the mechanical industries. Success or failure of any industry is product design. Designers are individuals who use their talents to solve user-product problems on an on-going basis. Since design is the first step toward manufacturing, it is important that potential designers have some experience in manufacturing and industrial engineering. Design drawing will develop in detail from block drawings and sketches to very detailed technical drawings describing every component in a way that will enable them to be constructed and operated. This course enables the students to design and draw simple machine components using 3D modelling software.

2. Course Outcomes/Skill Sets: At the end of the course the student will be able to:

CO-01	Analysis the behaviour of simple load carrying members which are subjected to an axial and shear loading and record the resulting impact of both loads.
CO-02	List the standards and codes used in the design process.
CO-03	Design automobile components and draft machine components used in a given automobile by computer-based techniques.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1,3	1,2,3	1. Introduction to design. Simple stress and strains – tensile compressive, shear and Hooke's law. Factor of safety. 2. Young's modulus, modulus or rigidity, bulk modulus. Centre of gravity & moment of Inertia – importance. 3. Moment of Inertia about C.G for L-section and Channel section.	Refer Table 1	1. Drawing stress-strain diagram using UTM machine and record the resulting impact of both loads. 2. Finding Centre of gravity and moment of inertia of different shapes using analytical method and software like AutoCAD/Solid edge etc.

2	1,2	1,2,3	<p>1. Moment of Inertia about C.G for I Section, tubular section.</p> <p>2. Limits-Need for limit system. Fit-Types of Fit – Clearance fit, interference fit, transition fit and their designation.</p> <p>3. Allowance, Tolerance – System of tolerance dimensions (system of writing tolerance). Unilateral system and bilateral system.</p>	Refer Table 1	<p>1. a) Represent and interpret tolerances given in drawings.</p> <p>b) List the standards and codes used in the design process.</p> <p>2. Practice to insert different fit, tolerance, precision and limit symbols using any CAD software.</p>
3	2	1,2,3	<p>1. Specifying tolerances in assembly. Geometrical tolerance, positional tolerance.</p> <p>2. Terminologies used in limits and fits – shaft, hole, basic size, actual size, zero-line, upper deviation, lower deviation.</p> <p>3. System of Fits - Hole Basis System-Shaft Basis system.</p>	Refer Table 1	<p>1. Practice to insert appropriate ISO system of Limits, Fits and tolerances.</p> <p>2. Practice calculating limits for a given tolerance case.</p>
4	1,3	1,2,3,4	<p>1. Fasteners-types-screw terminology-types of screw profiles.</p> <p>2. Locking of bolts-need-types.</p> <p>3. Stresses acting in a bolt. Stresses in screw fastening due to external loading- Tensile-compressive-combined tensile & shear stress. Simple problems</p>	Find the max stress in the bolt using any CAD software.	<p>1. Using part modelling work bench tools and assembly workbench tools create a square nut and bolt.</p> <p>2. Using part modelling work bench tools and assembly workbench tools create a hexagonal nut and bolt using any CAD software like-solid edge, UG-NX etc.</p>
5	3	1,2,3,4	<p>1. Types of shafts, shaft materials, standard sizes.</p>	Refer Table 1	<p>1. Create a model of shaft and key using any</p>

			<p>2. Design of Shafts subjected to twisting & bending moment (Hollow and Solid) using strength and rigidity criteria. Simple problems</p> <p>3. Keys-need, types. Design of keys under different load conditions-shear and crush. Simple problems.</p>		<p>CAD software like-solid edge, UG-NX etc.</p> <p>2. Create an 3D-assembly model of shaft and key then create a 2D drawing using any CAD software like-solid edge, UG-NX etc.</p>
6	3	1,2,3,4	<p>1. Couplings-purpose-requirements-types- applications.</p> <p>2. Design of Muff coupling. Simple problems.</p> <p>3. Design of Flange coupling-Unprotected. Simple problems.</p>	Refer Table 1	<p>1. Create an 3D-assembly model of Muff coupling and then create a 2D drawing using any CAD software like-solid edge, UG-NX etc.</p> <p>2. Create an 3D-assembly model of flange coupling and then create a 2D drawing using any CAD software like-solid edge, UG-NX, etc.</p>
7	3	1,2,3	<p>1. Coil spring-terms used in helical compression spring. Simple problems</p> <p>2. Stresses & deflection of helical spring. Simple problems</p> <p>3. Leaf springs- Effective & ineffective length, camber, stresses & deflection of semi elliptic leaf. Simple problems.</p>	Refer Table 1	<p>1. Using part modelling work bench tools create a helical spring CAD software like-solid edge, UG-NX etc.</p> <p>2. Using part modelling work bench tools and assembly workbench tools create a leaf spring assembly.</p>
8	3	1,2,3,4	<p>1. Design concepts of piston.</p> <p>2. Design of piston, piston pin & piston rings based on strength and heat transfer.</p> <p>3. Simple problems.</p>	Refer Table 1	<p>1. Create an 3D-assembly model of piston, piston rings and piston pin and then create a 2D drawing using any CAD software</p>

					<p>like-solid edge, UG-NX, etc.</p> <p>2 Create an assembly model of piston, piston rings and piston pin and then create a 2D drawing using any CAD software like-solid edge, UG-NX, etc.</p>
9	3	1,2,3,4	<p>1. Forces acting on connecting rod.</p> <p>2. Design parameters of connecting rod.</p> <p>3. Design of connecting rod. Simple problems.</p>	Refer Table 1	<p>1. Create an 3D-assembly model of connecting rod and then create a 2D drawing using any CAD software like-solid edge, UG-NX, etc.</p> <p>2. Create an assembly model of connecting rod and then create a 2D drawing using any CAD software like-solid edge, UG-NX, etc.</p>
10	3	1,2,3,4	<p>1. Design of flywheel. Simple Problems.</p> <p>2. Cam and followers-types, Cam profile-types.</p> <p>3. Construct a cam profile using uniform velocity method. Simple Problems.</p>	Refer Table 1	<p>1. Create an assembly 3D-model of flywheel and ring gear and then create a 2D drawing using any CAD software like-solid edge, UG-NX, etc.</p> <p>2. Create an 3D-assembly model of camshaft and then create a 2D drawing using any CAD software like-solid edge, UG-NX, etc..</p>
11	3	1,2,3,4,7	<p>1. Torque transmitted through single and multi-plate clutches.</p>	Refer Table 1,	<p>1. Create an 3D-assembly model of single plate-clutch assembly and then</p>

			<p>2. Uniform intensity of pressure-uniform rate of wear conditions.</p> <p>3. Design of single plate clutch and multi-plate clutch. Simple problems.</p>	<p>Study the latest technological changes in this course in this course and present the impact of these changes on industry.</p>	<p>create a 2D drawing using any CAD software like-solid edge, UG-NX, etc.</p> <p>2. Create an assembly 3D-assembly model of single plate clutch assembly and then create a 2D drawing using any CAD software like-solid edge, UG-NX, etc.</p>
12	3	1,2,3,4,7	<p>1. Gear-terminology of gear-gear teeth profiles.</p> <p>2. Design of spur gear. Simple problems.</p> <p>3. Find gear ratio, number of teeth and distance between lay shaft and main shaft.</p>	<p>Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.</p>	<p>1. Create an 3D-assembly model of spur gear and then create a 2D drawing using any CAD software like-solid edge/UG-NX.</p> <p>2. Create an 3D-assembly model of a helical gear and then create a 2Ddrawing using any CAD software like-solid edge/UG-NX.</p>
13	2,3	1,2,3,4,7	<p>1. Find different vehicle speed at different engine speed and gear ratios.</p> <p>2. Brakes: Stopping distance, braking efficiency, Braking torque. Leading and trailing shoe,</p> <p>3. Equation for Braking Torque on Leading and Trailing Shoe. Simple Problems.</p>	<p>Study the latest technological changes in this course in this course and present the impact of these changes on industry.</p>	<p>1. Create an 3D-assembly model of pinion and gear and then create a 2D drawing using any CAD software like-solid edge/ UG-NX.</p> <p>2. Create an 3D-assembly model of Leading and trailing shoe(drum brake) and then create all 2D views using any CAD software like-solid edge/UG-NX.</p>
Total in hours			39	13	52

*** PO= Program Outcome as listed and defined in year 1 curriculum and PO – CO mapping with strength (Low/Medium/High) has to be mapped by the course coordinator. (Above only suggestive)**

Table 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution)

Sl. No.	Week	Suggested Activity
1	1	Study on “influence of center of gravity on vehicle performance.” Present on the suitable location of CG.
2	2	Study and give a presentation of GD&T drawings & symbols. Read and document an industrial drawing using GD&T.
3	3	Study and present on classification of tolerance with examples.
4	4	Using part modelling work bench tools create a different type of helical spring (assume suitable dimensions)
5	5	Using part modelling work bench tools create a lock nut with split pin (assume suitable dimensions)
6	6	Study and present with suitable video/diagrams on different stresses in shafts and keys.
7	7	Study and document on failures of universal joint and its advancements to overcome the problem.
8	8	Discuss on different methods of designing of piston. Design a suitable piston to increase volumetric efficiency.
9	9	Study on analysis of forces on connecting rod and use simulation software to show forces acting on connecting rod.
10	10	Study dual mass flywheel. Refer a journal paper and present on the advantages of using dual mass flywheel.
11	11	Study and present on the topic “design consideration of heavy-duty clutches”
12	12	Study gear nomenclature and submit a report as an assignment.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3.	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5.	CIE-5 Skill Test-Practice	12	180	100	
6.	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					100

5. Format for CIE written Test

Course Name	Design and Drafting	Test	I/II/III	Sem	III/IV
Course Code	20AT42P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.				

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
Average Marks= (8+6+2+2)/4=4.5							5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	A Text book of Machine Design by R.S. Khurmi&J.K.Gupta (S. Chand publication).
2	Design Of Machine Elements Vol I, Vol II by J.B.K. Das, P.L. Srinivas Murthy (Sapna Publication).
3	Auto Design by R B Gupta (Satya Prakashan).
4	Automobile Engineering Drawing by R B Gupta (Satya Prakashan).
5	CADD software for Engineers and Designers by Prof. Sham Tickoo (Dream tech press).
6	Automotive Mechanics by Dr.N.K. Giri (Khanna Publishers))
7	Automobile design Problem by R.S. Agarwal
8	Machine Drawing by K R Gopalakrishna (Subhas Stores)

8. CIE Skill Test and SEE Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1,2	One question on simple load carrying members/The codes and standards used in design process. Practical question/Interpret the given chart - 20m	20
2	3	One question on "Use computer-based techniques in drafting of machine components used in automobile" a) 3D- drafting of all components - 30 m b) Assembly model -10 m c) Front view, side view, top view - 10 m	50

3	1,2,3	Portfolio evaluation of practical sessions (1-13 week)	10
4	1,2,3	Viva-voce	20
Total Marks			100

NOTE: Use same format of evaluation for CIE skill test. Portfolio evaluation of practical session should be considered from “Week 1-6” for 1st CIE and “Week 7-12” for 2nd CIE each 10 marks.

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Universal testing machine.	30 ton	1
2	Any Genuine CAD software or free and open-source CAD software (solid edge, solid works, AutoCAD etc.).		30
3	Any Genuine or free and opensource Simulation Software.		30
4	Computer with minimum 16inch color monitor, Intel/AMD latest generation i5 processor, 4 GB graphics card, 8 GB RAM, 512 GB SSD, 1 TB HDD, DVD read write drive.		30
5	UPS with 5 KW sine wave.		2
6	LED/LCD Projector with 500 lumens (20000 hrs)		4



Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Automobile Engineering	Semester	IV
Course Code	20AT43P	Type of Course	Programme Core
Course Name	Vehicle Body Engineering and Dynamics	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1.Rationale: In automobile, the body work is the main structure which protects the occupants and any other payload. Thus, the body engineering plays an important role in construction of body and providing comfort and safety to the passengers. The automobile when rolling on the road is subjected to various types of forces. The main goals are reducing drag and wind noise, minimizing noise emission, and preventing undesired lift forces and other causes of aerodynamic in stability at high speeds. The main goal of this course is to impart skill of vehicle body construction, repair and dynamics of the vehicle which also improves the performance of vehicle.

2. Course Outcomes/Skill Sets: At the end of the course the student will be able to:

CO-01	Identify the body and glass material for a given vehicle type and demonstrate replacement of windshield and vehicle body repair while complying with all necessary safety protocols.
CO-02	Select accessories for a given vehicle and list the right adhesives used to affix them.
CO-03	Check for metal corrosion on structural panel for a given vehicle, prepare corrosion spots and perform spray painting process.
CO-04	Test and troubleshoot or service the air conditioning system of a given vehicle.
CO-05	Design an aerodynamic vehicle body ensuring appropriate load distribution along with ergonomical interiors.
CO-06	Design the steering system, braking system and bus body ensuring appropriate design parameters.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1,2	1,4	1. Vehicle body -Need- body styles- Materials. 2. Composite materials- Advantage - types- Application. GRP, FRP, carbon reinforced plastics, insulating materials- need-types- properties. 3. Automotive Adhesives & Sealant - Need-Types, Structural adhesive. Application of Adhesive in Automobile	Refer Table 1	1. Identify and compare different materials in a vehicle body. 2. Practice on using of different adhesives and sealant in vehicle body. Note: Use Personal Protective gears & follow the safety rules.

2	1	1,4	<p>1. Automotive Glass – types- toughened glass, laminated glass, Bullet resistance glass. Difference between Toughened glass, sheet glass & Laminated glass.</p> <p>2. Defrosting of windshield glass. Window winding mechanisms-types- mechanical & electrical.</p> <p>3. Automatic window regulating mechanism and center locking mechanism</p>	Refer Table 1	<p>1. Identify the glass material for a given vehicle. Practice on removing and refitting wind shield glasses.</p> <p>2. Servicing of window regulating mechanisms.</p> <p>Note: Use Personal Protective gear & follow the safety rules.</p>
3	1		<p>1. Vehicle body repair - Identification of location of parts and panels. Techniques/ procedure required to Repair of body panel, minor and major structural damage.</p> <p>2. Damages on chassis and body- diamond type, banana damage, twist damage, mash damage, dents and scratches, weld burrs.</p> <p>3. Body & chassis alignment- Reasons & effects.</p>	Refer Table 1	<p>1. a) Remove and refit body panels, doors, floors and fenders.</p> <p>b) Demonstrate different processes for removing dents.</p> <p>2. Checking and correcting the body and chassis alignment</p> <p>Note: Use Personal Protective gears & follow the safety rules.</p>
4	3	1,4	<p>1. Body painting- objectives – Paint types. Elements of paint-pigment- resins- solvents.</p> <p>2. Paint drying process-Types-drying principle of each type.</p> <p>3. Composition & functions- primer paint- putty paint.</p>	Refer Table 1	<p>1. Practice on removing paint from the damaged area, practice on mixing and applying body filler.</p> <p>2. Practice on applying primer, practice on feather edge sanding and masking.</p> <p>Note: Use Personal Protective gears & follow the safety rules.</p>

5	3,5	1,4,7	<p>1. Spray painting - Types, air spray painting-procedure.</p> <p>2. Corrosion: Causes and effects of corrosion on automobile bodies. Methods of corrosion protection.</p> <p>3. Interior aesthetics: -Introduction, Seat ergonomics, seat belt -need-types. seat adjustment mechanisms.</p>	Refer Table 1	<p>1. Practice on cutting, scuffing, rubbing and polishing in painting.</p> <p>2. Demonstrate and practice on anti - corrosion and rust prevention procedure on vehicle body.</p> <p>Note: Use Personal Protective gears & follow the safety rules.</p>
6	4	1,4	<p>1. HVAC system - Functions- Working of vehicle air condition system and its layout</p> <p>2. Construction and working of expansion valve and Accumulator/ drier.</p> <p>3. Working of heating and ventilation system in automobile.</p>	Refer Table 1	<p>1. Air conditioner maintenance and service using automatic AC refilling machine.</p> <p>2.HVAC system troubleshooting.</p>
7	5	1,4	<p>1.Body Dynamics: Different types of engines and drive location with their merits and demerits.</p> <p>2. Different resistance to body motion. Wind resistance, rolling resistance and gradient resistance.</p> <p>3. Power required for propulsion. Traction and tractive effort. Surplus power, acceleration, gradability, draw bar pull, Equivalent weight.</p>	Refer Table 1	<p>1. Case study on load distribution of a vehicle under different conditions (on level road and while ascending the hill). or Using the simulation software examine on load distribution of a vehicle under different conditions</p> <p>2. Case study on resistance to vehicle motion and surplus power of different wheel drive.</p>

8	5	2,4	<p>1.Maximum acceleration, max tractive effort, reactions for front wheel, 4 wheel and rear wheel drive.</p> <p>2.Simple Problems.</p> <p>3. Simple Problems.</p>	Refer Table 1	<p>1.Find different performance parameters of a given vehicle by analytical method using its specification and compare it with actual parameters.</p> <p>2. Using the simulation software examine the different performance parameters of a given vehicle.</p>
9	5		<p>1. Vehicle Aerodynamics: Objectives, aerodynamic forces and moments.</p> <p>2. Various body optimization techniques for minimum drag.</p> <p>3. Various body design features to improve safety. Sources of noise and vibration- various noise and vibration reduction techniques.</p>	Refer Table 1	<p>1.Case Study on determining different type of flow on vehicle body and effects of aerodynamic forces and moments on vehicle body.</p> <p>Or</p> <p>Observe the aerodynamic drag forces using simulation software /set up.</p> <p>2. Practice on Sources of body noises testing and methods of elimination. Water leakage test.</p>
10	6	2,4	<p>Braking System:</p> <p>1.Different forces acting on the vehicle moving on a level road and gradient - when-front wheel brakes applied,</p> <p>2. Different forces acting on the vehicle moving on a level and gradient- when rear wheel brakes applied and all wheel brakes applied.</p>	Refer Table 1	<p>1.Case study on load distribution of a vehicle under different conditions while braking.</p> <p>Or</p> <p>Using the simulation software examine load distribution of a vehicle</p>

			3. Weight transferred during braking, stopping distance, stopping time and efficiency of brakes.		under different conditions while braking. 2. Case study on weight transfer, stopping distance and time improvement under various conditions. Or Using the simulation software examine the weight transfer, stopping distance and time improvement under various conditions.
11	6	2,4,7	Steering System: 1. True steering, over steering, under steering, minimum turning circle radius of vehicle. 2. Collapsible steering column- types, - Construction and working. 3. tilt-telescopic steering columns- construction and working.	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	1. Finding minimum turning radius- analytical/ practical method. 2. Demonstration of different types of collapsible steering. Or Using the simulation software analyse the working of collapsible steering column.
12	6	2,4,7	1. Bus Body Details: Types, Bus Body Lay Out: Floor height, engine location, entrance and exit location. 2. seating dimensions, Dimensions of driver's seat in relation to controls, driver's cabin design.	Refer Table 1 Study the latest technological changes in this course	1. Practice on checking of frame alignment and its correction. 2. Practice on Bus body dent removal and painting.

			3. Constructional details: Frame construction, Double skin construction-Types of metal section used-Regulations-Conventional and Integral type construction.	in this course and present the impact of these changes on industry.	Note: Use Personal Protective gears & follow the safety rules.
13	5	2,4,7	1. Wind tunnels for automotive aerodynamics: Introduction – Principles of wind tunnel technology. 2. Flow visualization techniques. Testing with wind tunnel balance (scale models). 3. Road Testing -Need-Equipment used in road testing. Crash test- need- types- Equipment needed- government regulation- rating.	Study the latest technological changes in this course and present the impact of these changes on industry.	1. Case study on Analysis of flow visual technique. Case study on wind tunnel technology. Or Using the simulation software analyse the flow visual technique. 2. Case study to improve safety rating of a given vehicle.
Total in hours			39	13	52

*** PO= Program Outcome as listed and defined in year 1 curriculum and PO – CO mapping with strength (Low/Medium/High) has to be mapped by the course coordinator. (Above only suggestive)**

Table 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution)

Sl. No.	Week	Suggested Activity
1	1	Study advantages of plastics and Aluminum over other body materials. List and present all the Aluminum body materials used in a given car.
2	2	Study and demonstrate various tools used in body repair.
3	3	Present on “Modern techniques of painting a car”.
4	4	Visit a nearby car paint shop to witness corrosion coating and painting process and record the details and present it as an assignment.
5	5	Refer any one journal paper and present on corrosion prevention techniques on vehicle bodies.
6	6	Study and present on different types of air conditioner refrigerants and the effects on atmosphere.
7	7	Study car dashboard and car interior decoration, suggest innovative dashboard with neat sketch.
8	8	Study on weight distribution of a vehicle during braking and prepare a report on how the weight is transferred during braking.
9	9	“Does a car really need spoiler?” justify your answer. Install a spoiler to given car in a suitable place considering aerodynamics.

10	10	Study air resistance & rolling resistance losses. Suggest and present remedies to prevent these losses.
11	11	Study and present importance of shape optimization in racing cars.
12	12	Visit a manufacturing industry and witness the working of a wind tunnel and present the report based on the study and submit as an assignment.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					100

5. a) Format for CIE written Test

Course Name	Vehicle Body Engineering and Dynamics	Test	I/II/III	Sem	III/IV
Course Code	20AT42P	Duration	80 Min	Marks	30

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

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

5. b) CIE Skill Test-I Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1	One question on "Vehicle body materials & Vehicle body repair." a) Identification of the material type - 10 m b) Removing & Refitting/ repair -20 m	20
2	1,2	One question on "glass materials, refitting and adhesives".	20

		a) Identification of the material type - 10 m b) Removing & Refitting/ repair -20 m	
3	3	One skill- oriented question on “metal corrosion and painting” a) Safety precautions followed - 5 b) Identification of problem -10 c) Servicing/ Coating/ Painting -10	25
4	4	One question on “air-conditioning cooling system”. a) Identification of defects - b) Troubleshooting/ Servicing `	25
5	1,2,3,4	Portfolio evaluation of practical sessions (1-6 week)	10

5. c) CIE Skill Test-II Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	5	Question on body dynamics a) Demonstration of the given case based on case study/Simulation technique - 15 m b) Identification of the key points - 05 m	20
2	5	One question on “aerodynamics and wind tunnel”. c) Demonstration of the given case based on case study/Simulation technique - 15 m d) Identification of the key points - 05 m	20
3	6	One skill-oriented question on braking system/bus body/ steering system. a) Analyzing the problem - 10m b) Troubleshooting/ simulation technique - 30m	40
4	5,6	Viva-voce	10
5	5,6	Portfolio evaluation of practical sessions (7-12 week)	10
Total Marks			100

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
Average Marks= (8+6+2+2)/4=4.5							5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Vehicle body engineering by Giles J Pawlowsky (Business books limited)
2	Vehicle body layout and analysis by John Fenton (Mechanical Engg.Publication ltd, London.)
3	Aerodynamics of Road Vehicles by W.H. (Butter worth's 1987)
4	Automobile Engineering (Paint Technology) Vol V by Anil Chhikara, Satya Prakashana New Delhi
5	Automotive Engineering (Heating & Air conditioning) class room manual, Mark Schnubel, Cengage Learning
6	A. Pope - "Wind Tunnel Testing" - John Wiley & Sons - 2nd Edition, New York - 1974.
7	Vehicle maintenance and Garage practice by jigar A. Doshi, Dhruv U. Panchal, Jayesh P. Maniar.
8	Siemens NX 2019 for Designers, 12 Edition by Prof. Sham Tickoo, Purdue University Northwest, USA. (Tickoo-CADCIM Series)
9	Beginning MATLAB and Simulink: From Novice to Professional by Sulaymon Eshkabilov.
10	MATLAB and SIMULINK for Engineers by Agam Kumar Tyagi
11	Siemens NX 2021 for Designers, 14th Edition by Prof. Sham Tickoo, Purdue University Northwest

8. SEE Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1,6	<p>One question on "Vehicle body materials& type and repair/glass materials and refitting."</p> <p>a) Identification of the material type - 10 m</p> <p>b) Removing & Refitting/ repair -20 m</p> <p>Or</p> <p>One skill-oriented question on braking system/bus body/ steering system.</p> <p>a) Analyzing the problem - 05m</p> <p>b) Troubleshooting/ simulation technique - 25m</p>	30
2	2,3,4	<p>One skill- oriented question on "adhesive/metal corrosion / painting"</p> <p>a) Safety precautions followed - 5</p> <p>b) Identification of problem -10</p> <p>c) Servicing/ Coating/ Painting -25</p> <p>Or</p> <p>One skill- oriented question on "air condition system"</p> <p>a) Safety precautions followed - 5</p> <p>b) Identification of problem -10</p> <p>c) Servicing - 25</p>	40

3	1,2,3,4,5,6	Viva-voce	20
5	1,2,3,4,5,6	Portfolio evaluation of practical sessions (1-13 week)	10
Total Marks			100

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Four-wheeler with all body fittings and accessories.		1
2	Mini-Bus with all body fittings and accessories.		1
3	Body repair Equipment.		2
4	Body repair tool kit		2
5	Arc welding transformer up to 300 Amps with attachments and welding shields.		1
6	Gas welding machine with attachments and oxygen and acetylene cylinders.		1
7	Single action sander		1
8	Dual action sander		1
9	Dent repair kit		1
10	Magnetic Dent puller kit		1
11	Aluminum suction cup		1
12	Glue tab dent pullers		1
13	Polishing and buffing machine		1
14	Fully Automatic car AC servicing equipment		1
15	Paint booth		1
16	Spray painting equipment.		2
17	Vehicle AC demo kit.		2
18	Simulation software (Siemen's NX), any simulation software		10



Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Automobile Engineering	Semester	IV
Course Code	20AT44P	Type of Course	Programme Core
Course Name	Fuels and Pollution Control	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1.Rationale: Automobiles burn different kinds of fuels to generate mechanical power. Fuel burning also generates exhaust emissions, which pollutes the atmosphere. Increase in number of automobiles has resulted in atmospheric pollution beyond permissible limits in cities. Thus, automobile emissions have become a social concern and engineers are supposed to reduce it. Emission standards are therefore set in every country to control this problem. These standards specify maximum amount of pollutants that can be released into the environment by different types of vehicles. The students should therefore have knowledge about the pollutants produced by automobiles and ways to reduce the pollution by the use of the various emission control devices maintain level of pollutants in emissions of various kinds of automobiles.

2. Course Outcomes/Skill Sets: At the end of the course the student will be able to:

CO-01	Differentiate between petroleum and alternative fuels and analyse emission performance of an engine using alternative fuels.
CO-02	Test and troubleshoot or service a fuel feed system, supercharger, turbocharger and Micro-Hybrid Vehicle.
CO-03	Explain the formation of pollutants, its measurement techniques and list the appropriate methods to be used to control pollutions from vehicles.
CO-04	List emission standards & the regulations applicable to vehicles manufactured in India and carry out emission tests to record emission levels as per each standard.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	5	1. Petroleum fuels. Refining process. 2. Properties of liquid and gaseous fuels. Types – merits – demerits. 3. Alternative fuels –Methanol – properties merits- demerits -storage emissions.	Refer Table 1	1. Determination of flash point, fire point and viscosity of petrol fuel. 2. Determination of flash point, fire point and viscosity of Diesel fuel.
2	1	5	1. Ethanol – properties merits- demerits -storage emissions. 2. Biodiesel - properties merits- demerits -storage emissions- Biodiesel production processes.	Refer Table 1	1. Determination of Calorific value of methanol and Ethanol using Bomb's calorimeter.

			3. Hydrogen - properties merits- demerits -storage emissions. CNG - properties merits- demerits -storage emissions- CNG fuel feed system layout.		2.a) Installation CNG kit to the car, setting and maintenance. b) Determination of Calorific value of CNG using Junker's calorimeter.
3	2	1,5	1. Fuel feed system in SI engine- Requirements-types- Layout - Working of 2-wheeler carburetor. 2. Fuel feed system in CI engine- requirements-types- Layout- Inline and distributor system. 3. Governor- need- types- working of mechanical governor. single cylinder fuel injector pump. Multi hole fuel injector.	Refer Table 1	1. Servicing of 2-wheeler fuel feed system. 2.a) Servicing of typical CI engine fuel feed system. b) Trouble shooting of fuel feed systems
4	2	1,5	1. Stratified engine -Need- types. 2. Supercharging- need. Supercharger-types. 3. Turbocharging- need- types construction - working of turbocharger.	Refer Table 1	1. Servicing of super charger. 2. Servicing of a turbocharger.
5	3	4,5	1. Pollutants from an automobile – Sources of pollutants in SI engine & Diesel engine 2. Formation of Particulate emission in Diesel engine. 3. Mechanism of nitrogen oxide, carbon monoxide and unburnt hydro carbon in SI engine.	Refer Table 1	1. Measurement of HC, CO, CO ₂ , O ₂ using exhaust gas analyzer. 2. Measurement of smoke of Diesel engine using Smoke meter.
6	3	5	1. Methods of controlling pollution: Crankcase ventilation system- need- layout. Exhaust gas recirculation-need- layout.	Refer Table 1	1. Servicing of PCV and EGR system 2. Servicing of catalytic converter.

			<p>2. Catalytic converters -need-types - construction and working of 3-way catalytic converter.</p> <p>3. SCR and Particulate filters to control particulate emission of diesel engine.</p>		
7	3	4,5	<p>1. Electronic fuel injection- Advantage. Construction and working -single point-multipoint fuel injectors. Variable valve timing-need-types.</p> <p>2. Multipoint direct injection system- operating modes of direct injection. construction and working-petrol injectors. Variable length intake system-need.</p> <p>3. CI Engine Electronic Fuel injection- types-construction and working- Electronic Diesel Control.</p>	Refer Table 1	<p>1. Service and troubleshoot single point injection system.</p> <p>2. Service and troubleshoot multipoint injection systems.</p>
8	3	4,5	<p>1. In line- Distributor pumps, construction and working.</p> <p>2. Unit Injector-Common rail injection System</p> <p>3. Electrohydraulic injector of CRDI system.</p>	Refer Table 1	<p>1. Servicing, calibrating and troubleshooting of Inline fuel pump system.</p> <p>2. Servicing and troubleshooting of CRDI system.</p>
9	3	4,5	<p>1. Battery operated vehicle-working principle -regenerative braking-working principle.</p> <p>2. Fuel cells-types- construction and working of polymer electrolyte membrane type.</p> <p>3. Hybrid vehicles-types- layouts of series and parallel.</p>	Refer Table 1	<p>1.Servicing and maintenance of battery-operated two-wheeler.</p> <p>2. Servicing and maintenance of micro hybrid vehicles</p>

10	4	5	<ol style="list-style-type: none"> 1. Emission norms-need- different emission standards for different engines in India. Driving cycles-need-types. 2. Bharath stage emission standards and norms. 3. Comparison of Bharath stage with European standards. 	Refer Table 1	<ol style="list-style-type: none"> 1. Case study on implantation of BS VI norms. 2. Test fuel consumption of a vehicle under different driving cycles.
11	4	4,5,7	<ol style="list-style-type: none"> 1. ARAI- Formation- functions. 2. Formulation of standards. Central Motor vehicle rules. Automotive pollution – air pollution & human health 3. Exhaust manifold- function, Exhaust manifold components, Muffler, Electronic muffler, Exhaust manifold reactor. 	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	<ol style="list-style-type: none"> 1. Case study on standardization/ Formulation/ Certification. 2. Case study on effects of exhaust gas and advancement in exhaust manifold to control exhaust emission level.
12	4	4,5,7	<ol style="list-style-type: none"> 1. Performance of SI engine using different blends of ethanol- modifications to engine and fuel feed system. 2. Performance of SI engine using different blends of methanol. modifications to engine and fuel feed system. 3. Comparison of above emissions (1 & 2). 	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these changes on industry.	<ol style="list-style-type: none"> 1. Measure ethanol & methanol emission on a SI engine. 2. Conduct an experiment to measure various performance parameters of a SI engine using ethanol blend.
13	4	4,5,7	<ol style="list-style-type: none"> 1. Performance of Diesel engine using CNG- Modifications to engine and fuel feed system. 2. Performance of Diesel engine using biofuel- Modifications to engine and fuel feed system. 3. Comparison of above emissions (1 & 2). 	Refer Table 1, Study the latest technological changes in this course in this course and present the impact of these	<ol style="list-style-type: none"> 1. Measure CNG emission on CI engine. 2. Conduct an experiment to measure various performance parameters of a CI engine using biofuel blend.

				changes on industry.	
Total in hours			39	13	52

*** PO= Program Outcome as listed and defined in year 1 curriculum and PO – CO mapping with strength (Low/Medium/High) has to be mapped by the course coordinator. (Above only suggestive)**

Table 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution)

Sl. No.	Week	Suggested Activity
1	1	Study the benefits of different alternative fuels and submit the report on the best alternative fuel for transit buses with proper justification.
2	2	Study the characteristics of alcohol fuels and justify why methanol is used as a racing fuel and submit a report as an assignment.
3	3	List the properties of hydrogen and prepare a presentation on hydrogen fuel cell vehicles.
4	4	Discuss and present why a turbocharger/supercharger is an essential requirement for an aircraft engine.
5	5	Take a survey on the effects of vehicular pollution on human health and present the effects of pollution on human health.
6	6	Refer any one journal paper and present on mechanism of pollutant formation in an IC engine.
7	7	Study and present on motor cycle crankcase ventilation.
8	8	Study and present on passive SCR.
9	9	Study and document the effect of Diesel particulate trap on efficiency of the engine and submit as an assignment.
10	10	Document the impact of BS VI norms on vehicle pollution as an assignment.
11	11	Study and present the central motor vehicle rules 1989 and its amendment.
12	12	Make a group of students, ask them to collect the information on methanol and ethanol blends. Run the engine with any one blend measure the emission.
13	13	Refer any one journal on future of CNG in India and present the collected information.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3.	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests 20
5.	CIE-5 Skill Test-Practice	12	180	100	
6.	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					100

5. a) Format for CIE written Test

Course Name	Fuels and Pollution Control	Test	I/II/III	Sem	III/IV
Course Code	20AT44P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks	
I	1				
	2				
II	3				
	4				
III	5				
	6				
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.					

5. b) CIE Skill Test-I Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1	One Question on “fuels”. a) Determining the fire point/flash point/ calorific value/ Servicing -15m b) Calculation -10m	25
2	2	One skill- oriented question on fuel feed system/supercharger/ turbocharger /stratified engine. a) Identification of the problem - 5m b) Servicing -20m	25
3	3	One question on measurement of the pollutants from automobile a) Measurements - 15 m b) Tabulation - 05 m	20
4	3	One question on “pollution control”. a) Servicing -20m	20
5	1,2,3	Portfolio evaluation of practical sessions (1-6 week)	10
Total Marks			100

5. c) CIE Skill Test-II Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	3	One question on “methods of Pollution control” a) Servicing - 25 m	25
2	4	One question on “Emission standards” based on given case (case study). a) Identification of the key facts in the case - 05m b) Identification of the key issues - 05m	25

		c) Evaluate and recommend the course of action -15m	
3	4	One question on "performance of engine". a) Finding the performance parameter/fuel consumption - 25 m b) Tabulation -05 m	30
4	3,4	Portfolio evaluation of practical sessions (7-12 week)	10
5	3,4	Viva-voce	10
Total Marks			100

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
Average Marks= (8+6+2+2)/4=4.5							5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Alternative fuels, Thipse, Jaico publications.
2	Alternative Fuels & the Environment, Frances S. Sterrett, Hardback Publications.
3	Alternative fuels, V.Ganeshan, McGraw Hill Education (India) Private Limited, New Delhi
4	Internal combustion Engine, M.L. Mathur and R.P. Sharma, Dhanpat Rai Publications.
5	SAE Transactions, "Vehicle Emission", 3 volumes, 1982
6	Automobiles and Pollution SAE Transaction, 1995.
7	Engine Emissions: pollution Formation and advances in control technology by B.P. Pundir.

8. SEE Scheme of Evaluation

SL. No.	CO	Particulars/Dimension	Marks
1	1,2	One Question on "fuels". a) Tabular column -5 m b) Determining the fire point/flash point/ calorific value/ Servicing -15m c) Calculation - 10 m Or One skill- oriented question on fuel feed system/supercharger/ turbocharger /stratified engine. a) Identification of problem - 05m b) Measurements - 25 m c) Accuracy -05 m	35

2	3,4	One question on “pollutants and control method” a) Identification of problem - 10 m b) Servicing- 25m Or One question on “Emission standards and testing procedures”. a) Finding the performance parameter/fuel consumption - 25 m b) Tabulation -10m	35
4	1,2,3,4	Viva-voce	20
5	1,2,3,4	Portfolio evaluation of practical sessions (1-13 week)	10
Total Marks			100

NOTE: Use same format of evaluation for CIE skill test. Portfolio evaluation of practical session should be considered from “Week 1-6” for 1st CIE and “Week 7-12” for 2nd CIE each 10 marks.

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Pensky Martin Flash and Fire point Equipment		2
2	Redwood and Saybolt Viscometer		1
3	Bomb Calorimeter		1
4	Junker’s gas Calorimeter		1
5	CNG kit		1
6	2-wheeler fuel feed system		4
7	Diesel engine with all accessories.		2
8	Single cylinder FIP		4
9	Multi hole diesel injector		6
10	MPFI petrol engine with all accessories (PCV, EGR, Catalytic convertor)		2
11	CRDI diesel engine with all accessories (PCV, EGR, Catalytic convertor, SCR/Particulate filter)		2
12	Turbochargers and Superchargers		2 each
13	MPFI engine injector tester		1
14	Diesel engine injector tester		2

15	FIP Calibrating machine		1
16	Four gas latest make exhaust gas analyser		2
17	Smoke meter		2
18	Catalytic Converter		2
19	Battery operated 2-wheeler		1
20	Vehicle with micro hybrid system		1



Government of Karnataka
Department of Collegiate and Technical Education

Programme	Audit Course	Semester	IV
Course Code	20AT45T	Type of Course	Audit
Course Name	Indian Constitution	Contact Hours	2 hours/week 26 hours/semester
Teaching Scheme	L:T:P :: 2:0:0	Credits	2
CIE Marks	50	SEE Marks	Nil

1. Course Outcomes: At the end of the Course, the student will be able to:

CO-01	CO1	Understand Preamble, salient features and importance of Indian Constitution.
CO-02	CO2	Understand Fundamental rights, duties and Directive principles of state policy.
CO-03	CO3	Understand Parliamentary system of governance, Structure, Functions, Power of Central, state governments (Legislative, Executive) and Judiciary.
CO-04	CO4	Understand Panchayat Raj Institutions and Local self-governments, UPSC, KPSC, NHRC, Status of women, RTE etc.

2. Course Content

Week	CO	Detailed Course Content	Contact Hours
1	1	Introduction to constitution of India-Formation and Composition of the Constituent Assembly-Salient features of the Constitution-Preamble to the Indian Constitution	2
2	1,2	Fundamental Rights- Definition, The right to equality, The right to freedom, The right against exploitation, The right to freedom of religion.	2
3	1,2	Cultural and educational rights and The right to constitutional remedies. Fundamental Duties, Directive principles of state policy.	2
4	1,3	Parliamentary system of governance- Structure of Parliament- Lok Sabha and Rajya Sabha. Functions of parliament- Legislative, Executive, Financial Function Powers of Lok Sabha and Rajya Sabha.	2
5	1,3	Procedure followed in parliament in making law, Annual financial statement (Budget) – procedure in parliament with respect to estimates, Appropriation bill, Supplementary, additional grants, Vote on account, votes on credit and exception grant, special provisions, rules of procedure.	2
6	1,3	Structure of union executive, Power and position of President. Vice President, Prime minister and council of ministers.	2
7	1,3	Structure of the judiciary: Jurisdiction and functions of Supreme Court, high court, and subordinate courts.	2
8	1,3	Federalism in the Indian constitution- Division of Powers: Union list, State list and concurrent list. Structure of state legislation, Legislative assembly and Legislative council.	2
9	1,3	Functions of state legislature, Structure of state executive-Powers and positions of Governor, Speaker, Deputy Speaker, Chief Minister and council of minister.	2

10	4	Local self-government- meaning-Three tier system, Village Panchayat-Taluk panchayat Zilla panchayat, Local bodies-Municipalities and Corporations, Bruhath Mahanagara Palike, Functions of Election commission, UPSC, KPSC.	2
11	4	Amendment of the constitution, Human Rights-Definition-constitutional provisions-right to life and liberty-Human Rights of Women-Discrimination against women steps that are to be taken to eliminate discrimination against women in Education, employment, health care, Economic and social life,	2
12	4	Status of Women in India - Women in rural areas, Constitutional Safeguards - Dowry Prohibition act 1961- Domestic violence act 2005- Sexual harassment at work place bill 2006. Human Rights of Children- Who is a child- list the Rights of the Child- Right to education, Protection of Children from Sexual Offences Act (POCSO)-2012-	2
13	1,4	National Human Rights Commission Constitution- Powers and function of the Commission-Employee rights- Provisions made, Contractual-Non contractual employee rights-Whistle blowing-definition-Aspects-Intellectual Property Rights (IPR)-Meaning-Need for protection- Briefly description of concept of patents, Copy right, Trademark	2
Total in Hours			26 Hrs

REFERENCES

1. Introduction to the Constitution of India- Dr. Durga Das Basu
2. Empowerment of rural women in India-Hemalatha H.M and Rameshwari Varma, Hema Prakashana.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 MCQ	6	60	20	Average of two CIE = 20
5	CIE-5 Open Book Test	12	60	20	
Total CIE Marks					50
Semester End Examination (Practice)			-	-	-
Total Marks					50