



**Government of Karnataka**  
**Department of Collegiate and Technical Education**

**C-20 Second Year Diploma Curriculum**  
**Automobile Engineering**

Curriculum Development Cell, DTE  
2021-22



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					
<b>Integrated Courses</b>																	
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			
<b>Audit Course</b>																	
5	AU/KA	20KA31T	ಸಾಹಿತ್ಯಸಿಂಚನ-II/ಬಳಕೆಕನ್ನಡ-II	2	0	0	2	2	50	20	-	-	50	20			
<b>Total</b>				<b>14</b>	<b>4</b>	<b>16</b>	<b>34</b>	<b>26</b>	<b>290</b>	<b>116</b>	<b>160</b>	<b>64</b>	<b>450</b>	<b>180</b>			

\*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					
<b>Integrated Courses</b>																	
1	P/AT	20AT41P	Advanced Automotive Systems	3	1	4	8	6	60	24	40	16	100	40			<b>Both SGPA &amp; CGPA</b>
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			
<b>Audit Course</b>																	
5	AU/	20AT45T	Indian Constitution	2	0	0	2	2	50	20	-	-	50	20			
<b>Total</b>				<b>14</b>	<b>4</b>	<b>16</b>	<b>34</b>	<b>26</b>	<b>290</b>	<b>116</b>	<b>160</b>	<b>64</b>	<b>450</b>	<b>180</b>			

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

# **3<sup>RD</sup> SEMESTER**



**Government of Karnataka**  
**DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION**

<b>Programme</b>	Automobile Engineering	<b>Semester</b>	III
<b>Course Code</b>	20AT31P	<b>Type of Course</b>	Programme Core
<b>Course Name</b>	Automobile Chassis and Transmission	<b>Contact Hours</b>	8 hours/week 104 hours/semester
<b>Teaching Scheme</b>	L:T:P: 3:1:4	<b>Credits</b>	6
<b>CIE Marks</b>	60	<b>SEE Marks</b>	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. <b>Frames-</b> purpose- loads acting - types -construction-ladder type-x type-integral, sections used in frames- Channel-Box-Tubular.</p> <p>2. Materials used for frames &amp; sub frames-need. Checking the alignment of chassis frame.</p> <p>3.<b>Clutch-</b>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.<b>Gearbox</b>-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 &amp; 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 &amp; calculation of gear ratio w.r.t number of teeth. <b>(3HRS)</b></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 &amp; 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. <b>Steering system</b> -mechanisms-types –Ackerman mechanism, steering gear box-need-types.</p> <p>2. Construction and working- Rack &amp; Pinion</p> <p>3. Construction and working of recirculating ball type steering gearbox.</p>	Refer Table 1.	<p>1. Overhauling of a front axle &amp; hub greasing.</p> <p>2. Overhauling of rack &amp; 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 &amp; 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 &amp; collapsible).</p> <p>2. Wheel alignment and wheel balancing-need- procedure.</p> <p>3. <b>Propeller shaft</b> - function - construction, universal joints &amp; slip joints.</p>	Refer Table 1.	<p>1. Practice on checking of wheel alignment and adjustment (computerized/mechanical) &amp; prepare the detailed trouble shooting chart.</p> <p>2. Servicing of a propeller shaft &amp; universal joint.</p>
8	2	1,2,4	<p>1. Function- types construction &amp; working - cross or spider type - flexible ring type - Rzeppa joint - Tripod joint.</p> <p>2. <b>Final drive</b>- Purpose- types. Differential- necessity- principle</p> <p>3. Differential - construction &amp; working. backlash, differential lock, inter-axle differential, transaxle types.</p>	Refer Table 1.	<p>1. Checking of constant velocity joint for wear &amp; tear and replace it with new one.</p> <p>2. Overhauling of differential with backlash adjustment &amp; calculate the gear ratio.</p>
9	2	1,2,4	<p>1. <b>Rear axle</b>- 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. <b>Brakes</b> - Type. Internal expanding Drum Brake- Construction &amp; Working. Disc Brake (Calliper types) - Construction &amp; 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 &amp; trouble shooting of a drum brake &amp; 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. <b>Suspension System</b> - Construction &amp; Working of Leaf spring and Coil Spring Suspension system.</p> <p>3. Working of - Hydraulic Suspension &amp; 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 &amp; brake shoe adjustments.</p> <p>2. Overhauling leaf spring &amp; re-cambering.</p>
12	2,3,4	1,2,4,7	<p>1. Working of Independent Suspension- Front Wheel &amp; 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. <b>Wheels-</b> 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.<b>Tyres</b>-Types- Construction (Tube &amp; 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>
<b>Total in hours</b>			<b>39</b>	<b>13</b>	<b>52</b>

**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
<b>Total Marks</b>					<b>100</b>

#### 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
<b>Note:</b> 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
<b>Total Marks</b>			<b>100</b>

### 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

	<b>Total Marks</b>	<b>100</b>
--	--------------------	------------

### 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							<b>5</b>

**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 b) Skill based question - 15 marks.</p> <p><b>Or</b></p> <p>One question on “wheels / tyres” for the given case</p> <p>a) Skill test question on wheels/ tyres/ alloy wheels – 10 marks. 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 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
<b>Total Marks</b>			<b>100</b>

## 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,

Table with 4 columns: Programme, Course Code, Course Name, Teaching Scheme, CIE Marks, Semester, Type of Course, Contact Hours, Credits, SEE Marks.

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:

Table with 2 columns: CO (CO-01 to CO-04) and Description of outcomes.

3. Course Content

Table with 6 columns: Week, CO, PO, Lecture (Knowledge Criteria), Tutorial (Activity Criteria), Practice (Performance Criteria).

2	1	1,2,4	<p>1. <b>Battery</b> -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><b>1.Estimation &amp; Costing:</b> 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. <b>Charging system</b>-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. <b>Starting system</b> -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. <b>Ignition System:</b> Fundamentals- Ignition timing (with respect to load &amp; speed). Types of ignition systems, components.</p> <p>2. Construction &amp; Working of battery Ignition system. Construction &amp; 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. <b>Spark plug</b> -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	<ol style="list-style-type: none"> <li>1. Speedometer, odometer, etc. (Dash board instruments).</li> <li>2. Wiring diagram of 2-wheeler - Circuit &amp; construction.</li> <li>3. Wiring diagram of 4-wheeler- Circuit &amp; construction.</li> </ol>	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"> <li>1. Practice on Circuit building of electrical Components, test and repair to ensure the circuit provides the necessary output/result as required.</li> <li>2. Practice on testing of dashboard instruments.</li> </ol>
<b>Total in hours</b>			<b>39</b>	<b>13</b>	<b>52</b>

**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
<b>Total Marks</b>					<b>100</b>

#### 5. a) Format for CIE written Test

Course Name	<b>Automotive Electrical System</b>	Test	I/II/III	Sem	III/IV
Course Code	<b>20AT32P</b>	Duration	80 Min	Marks	30
<b>Note:</b> 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
<b>Total Marks</b>			<b>100</b>

### 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
<b>Total Marks</b>			<b>100</b>

### 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							<b>5</b>

**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><b>or</b></p> <p>One question on “cables/ bulbs/ fuses/colour codes, circuit construction and faults arising in automotive wiring and lighting system also to repair &amp; 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
<b>Total Marks</b>			<b>100</b>

### 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

<b>Programme</b>	Automobile Engineering	<b>Semester</b>	III
<b>Course Code</b>	20AT33P	<b>Type of Course</b>	Programme Core
<b>Course Name</b>	Thermal Engineering and Engine Testing	<b>Contact Hours</b>	8 hours/week 104 hours/semester
<b>Teaching Scheme</b>	L:T:P :: 3:1:4	<b>Credits</b>	6
<b>CIE Marks</b>	60	<b>SEE Marks</b>	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	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	1,2,3	<p>1. <b>Fundamentals of thermodynamic</b> - 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 &amp; 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 <math>\gamma</math>.</p> <p>2. Definition of enthalpy and entropy.</p> <p>3. <b>Introduction to thermodynamic processes</b> - 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 &amp; 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><b>or</b></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 <b>or</b></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><b>or</b></p>

					Drawing of PV diagrams of cycles (Diesel) using any software and find various parameters.
5	2	1,2,4	<p><b>1.Lubrication System:</b> Need-Types-Layout of pump feed system.</p> <p>2. Oil Pump-Types- Gear pump- Rotor type- Vane type.</p> <p>3. Oil filter- need- Types-Construction and working of cartridge type oil filter.</p>	Refer Table 1	<p>1. Find the Oil level and replace the engine oil and oil filter and Quality checking</p> <p>2. Servicing of oil pumps and filters</p> <p><b>Note:</b> Prepare the trouble shooting chart.</p>
6	2	1,2,4	<p><b>1.Cooling System:</b> Need- types- Comparison- Layout of pump circulation system.</p> <p>2. Construction and working of Water pump- radiator</p> <p>3. Thermostat - Need-Types-Construction &amp; Working of Wax type</p>	Refer Table 1	<p>1. Servicing of cooling system.</p> <p>2. Servicing of water pump and radiator.</p> <p><b>Note:</b> Prepare the trouble shooting chart.</p>
7	3,4	1,2,4	<p>1. <b>Combustion in engines</b> - Stages of combustion in SI engines and Diesel engines.</p> <p>2. SI engine detonation &amp; pre-ignition- process- effects</p> <p>3. Controlling methods of SI engine detonation &amp; pre-ignition.</p>	Refer Table 1	<p>1. Case study on detonation and preignition for SI engine and write a report on the study conducted.</p> <p>2. Using engine scanner, identify the knocking in SI engine.</p>
8	3,4	1,2,4	<p>1. CI engine detonation</p> <p>2. Knocking- process- effects.</p> <p>3. Controlling methods of CI engine detonation.</p>	Refer Table 1	<p>1. Case study on detonation and preignition for CI engine and write a report on the study conducted.</p> <p>2. Using engine scanner, identify the knocking in CI engine.</p>
9	3,5	1,2,4	<b>1.Engine performance-</b> 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>	<p>Study the latest technological changes in this course in this course and present the impact of these changes on industry.</p>	<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>	<p>Study the latest technological changes in this course in this course and present the impact of these changes on industry.</p>	<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>	<p>Study the latest technological changes in this</p>	<p>1. Conduct experiment to determine the</p>

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

\* 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
<b>Total CIE Marks</b>					60
Semester End Examination (Practice)			180	100	40
<b>Total Marks</b>					<b>100</b>

### 5. a) Format for CIE written Test

Course Name	<b>Thermal Engineering and Engine Testing</b>	Test	I/II/III	Sem	III/IV
Course Code	<b>20AT33P</b>	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
<b>Total Marks</b>			<b>100</b>

### 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
<b>Total Marks</b>			<b>100</b>

### 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							<b>5</b>

**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 Niranjana 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
---------	----	-----------------------	-------

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 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 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 h) Formulas adopted -05 m i) Conduction of experiment -20 m j) Calculation &amp; 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
<b>Total Marks</b>			<b>100</b>

**NOTE: Use same format of evaluation for CIE skill test. Portfolio evaluation of practical session should be considered from “Week 1-6” for 1<sup>st</sup> CIE and “Week 7-12” for 2<sup>nd</sup> 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**

<b>Programme</b>	Automobile Engineering	<b>Semester</b>	III
<b>Course Code</b>	20AT34P	<b>Type of Course</b>	Programme Core
<b>Course Name</b>	Automotive Manufacturing Processes	<b>Contact Hours</b>	8 hours/week 104 hours/semester
<b>Teaching Scheme</b>	L:T:P :: 3:1:4	<b>Credits</b>	6
<b>CIE Marks</b>	60	<b>SEE Marks</b>	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. <b>Arc Welding:</b> 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 &amp; Application.</p> <p>2. GTAW- Operation- Equipment &amp; Materials- Joint Design- Application.</p> <p>3. GMAW- Operation- Equipment &amp; Materials- Joint Design- Application.</p>	Refer Table 1	<p>1. Practice on Simple job work on Lap joint using metallic arc welding, GTAW &amp; GMAW and Video demonstration &amp; documentation of the same.</p> <p>2. Practice on Simple job work on butt joint using metallic arc welding, GTAW &amp; GMAW and Video demonstration &amp; documentation of the same.</p> <p>Note: Use Personal Protective equipment &amp; follow the safety practices against fumes and welding gases (Record all the safety tips followed).</p>
3	1	3,4	<p>1. <b>Resistance Welding</b>- Principle- Construction &amp; 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. <b>Gas welding</b>- Working process of Gas Welding and Gas cutting. Types of Gas Welding &amp; Types of flames in Gas welding- Application.</p> <p>2. Welding Defects and remedies.</p> <p>3. <b>NON-DESTRUCTIVE TESTS (NDT)</b>: 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 &amp; 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. <b>Brazing</b>: 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 &amp; documentation of the same.</p> <p>2. Practice on Brazing of different automobile components and Video demonstration &amp; documentation of the same.</p> <p>Note: Follow the safety rules (Record all the safety tips followed).</p>

6	2	3,4	<p><b>1. Sheet Metal Technology-</b> Introduction, Fundamentals of sheet metal work, Different hand tools used in automobile body shop.</p> <p><b>2. Sheet Metal operations: -</b> <b>Cutting operation</b>-producing blanks, cutting holes, progressive, miscellaneous operation.</p> <p><b>3. Forming operation</b>-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><b>Note:</b> 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><b>2. Drawing operation</b>- 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 &amp; documentation of the same.</p> <p><b>Note:</b> Follow the Sheet Metal fabrication safety tips.</p>
8	2	3,4	<p>1. Operations performed on press. Work &amp; tool holding devices.</p> <p><b>2. Casting:</b> 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 &amp; 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. <b>Forging:</b> 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 &amp; note down their functions.</p>
12	4	3,4,7	<p>1. <b>ISO 9000 series Quality management system:</b> 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. <b>Lathe:</b> Types-Construction &amp; working of engine lathe- Turning, step turning, taper turning &amp; knurling.</p> <p>2. <b>Drilling:</b> 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 &amp; knurling operations.</p> <p>2. Practice on drilling and counter boring of the given Sample.</p> <p>Note: Follow the safety practices.</p>
<b>Total in hours</b>			<b>39</b>	<b>13</b>	<b>52</b>

\* 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
--------	------------	-----------	---------------------	-----------	------------

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
<b>Total Marks</b>					<b>100</b>

### 5. a) Format for CIE written Test

Course Name	<b>Automotive Processes</b>	<b>Manufacturing</b>	Test	I/II/III	Sem	III/IV
Course Code	<b>20AT34P</b>		Duration	80 Min	Marks	30
<b>Note:</b> 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
<b>Total Marks</b>			<b>100</b>

### 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
<b>Total Marks</b>			<b>100</b>

### 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							<b>5</b>

**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
<b>Total Marks</b>			<b>100</b>

### 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"> <li>• ನವೋದಯ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು.</li> <li>• ನವ್ಯ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು.</li> <li>• ಬಂಡಾಯ ಮತ್ತು ಪ್ರಗತಿಪರ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು.</li> <li>• ದಲಿತ ಸಾಹಿತ್ಯ, ಮಹಿಳಾ ಸಾಹಿತ್ಯ, ವಿಜ್ಞಾನ ಸಾಹಿತ್ಯ ಮತ್ತು ಇತ್ತೀಚಿನ ಪ್ರಚಲಿತ ಕನ್ನಡ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು.</li> </ul>	03 ಗಂಟೆ 03 ಗಂಟೆ 03 ಗಂಟೆ 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 - "ಷೇರು 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
<b>ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ 26 ಗಂಟೆಗಳು</b>	<b>26 ಗಂಟೆ</b>

**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**

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

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 <sup>rd</sup> week	80	30	<b>Average of three written tests : 1, 2 &amp; 3 for 30 Marks</b>
2.	CIE- Assessment - 2	Written Test - 2	At the end of 7 <sup>th</sup> week	80	30	
3.	CIE- Assessment - 3	Written Test - 3	At the end of 13 <sup>th</sup> week	80	30	
4.	CIE- Assessment - 4	MCQ/Quiz	At the end of 5 <sup>th</sup> week	60	20	<b>Average of three Assessment tests : 4, 5 &amp; 6 for 20 Marks</b>
5.	CIE- Assessment - 5	Open Book Test	At the end of 9 <sup>th</sup> week	60	20	
6.	CIE- Assessment - 6	Work book Consolidation & Activities	At the end of 11 <sup>th</sup> week	60 (Work book Submission)	20	
<b>Total CIE – Continuous Internal Evaluation Assessment Marks</b>						50
<b>Total Marks</b>						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.

# **4<sup>TH</sup> SEMESTER**



**Government of Karnataka  
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION**

<b>Programme</b>	Automobile Engineering	<b>Semester</b>	IV
<b>Course Code</b>	20AT41P	<b>Type of Course</b>	Programme Core
<b>Course Name</b>	Advanced Automotive Systems	<b>Contact Hours</b>	8 hours/week 104 hours/semester
<b>Teaching Scheme</b>	L:T:P :: 3:1:4	<b>Credits</b>	6
<b>CIE Marks</b>	60	<b>SEE Marks</b>	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	<ol style="list-style-type: none"> <li>1. Construction and working of magnetic pickup coil type, Hall effect.</li> <li>2. Construction and working- Piezoelectric combustion, Knock sensor, temperature sensor.</li> <li>3. Strain gauge type manifold absolute sensor-exhaust gas oxygen sensor.</li> </ol>	Refer Table 1	<ol style="list-style-type: none"> <li>1 Identify piezoelectric knock sensor and temperature sensor and their locations used in vehicle.</li> <li>2. Diagnose and troubleshoot piezoelectric knock sensor and temperature sensor with engine scanner (and multi-meter).</li> </ol>
4	2	2,3,4	<ol style="list-style-type: none"> <li>1. Mass air flow Sensor-types</li> <li>2. construction and working of hot film and hot wire type sensors.</li> <li>3. Potentiometer type -need-working. principle.</li> </ol>	Refer Table 1	<ol style="list-style-type: none"> <li>1. Diagnose and troubleshoot Potentiometer with engine scanner (and multi-meter).</li> <li>2. Build circuit to demonstrate the testing and working of Potentiometer, LVDT type ride height sensors, rain sensor.</li> </ol>
5	1,2	2,3,4	<ol style="list-style-type: none"> <li>1. LVDT type ride height sensors, rain sensor-need-working. principle.</li> <li>2. Actuator-Definition, pulse width modulation of input voltage-duty cycle-need.</li> <li>3. On/off solenoid proportionate solenoid-stepper motor-servo motor-relays-construction and working - applications.</li> </ol>	Refer Table 1	<ol style="list-style-type: none"> <li>1. Diagnose and troubleshoot LVDT type ride height sensors, rain sensor with engine scanner (and multi-meter).</li> <li>2. Build circuit of On/off and proportionate solenoid stepper motor.</li> </ol>
6	1	2,3,4	<ol style="list-style-type: none"> <li>1. <b>Power steering</b> - types, construction and working- HPS.</li> <li>2. Construction &amp; working -linkage power steering, Integral power steering.</li> <li>3. electronic rack and pinion power steering-electronic power steering.</li> </ol>	Refer Table 1	<ol style="list-style-type: none"> <li>1. Servicing and troubleshooting of hydraulic power steering.</li> <li>2. Service and troubleshoot electronic rack and pinion power steering.</li> </ol>
7	1	2,3,4	<ol style="list-style-type: none"> <li>1. Continuously variable transmission-construction and working.</li> <li>2. Hydraulic automatic transmission-gear shifting process.</li> <li>3. Automated manual transmissions-modes-working principle.</li> </ol>		<ol style="list-style-type: none"> <li>1. Service and troubleshoot of CVT.</li> <li>2. Service and troubleshoot of Hydraulic automatic transmission.</li> </ol>
8	1	2,3,4	<ol style="list-style-type: none"> <li>1. Torque converter- construction and working, torque converter.</li> <li>2. Limited slip differential-need-types.</li> <li>3. Working principle of clutch type LSD.</li> </ol>	Refer Table 1	<ol style="list-style-type: none"> <li>1. Servicing of torque converter</li> <li>2. Service and troubleshoot clutch type LSD.</li> </ol>



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

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

**\* 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

<b>Total Marks</b>	<b>100</b>
--------------------	------------

### 5. a) Format for CIE written Test

Course Name	<b>Advanced Automotive Systems</b>	Test	I/II/III	Sem	III/IV
Course Code	<b>20AT41P</b>	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." <b>From week (1-3)</b> 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." <b>From week (5&amp;6)</b> 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
<b>Total Marks</b>			<b>100</b>

### 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
<b>Total Marks</b>			<b>100</b>

### 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							<b>5</b>

**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 Bonnicks, 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
<b>Total Marks</b>			<b>100</b>

### 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**

<b>Programme</b>	Automobile Engineering	<b>Semester</b>	IV
<b>Course Code</b>	20AT42P	<b>Type of Course</b>	Programme Core
<b>Course Name</b>	Design and Drafting	<b>Contact Hours</b>	8 hours/week 104 hours/semester
<b>Teaching Scheme</b>	L: T:P: 3:1:4	<b>Credits</b>	6
<b>CIE Marks</b>	60	<b>SEE Marks</b>	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 &amp; 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 &amp; 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 &amp; deflection of helical spring. Simple problems</p> <p>3. Leaf springs- Effective &amp; ineffective length, camber, stresses &amp; 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 &amp; 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>
<b>Total in hours</b>			<b>39</b>	<b>13</b>	<b>52</b>

**\* 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
<b>Total Marks</b>					<b>100</b>

#### 5. Format for CIE written Test

Course Name	<b>Design and Drafting</b>	Test	I/II/III	Sem	III/IV
Course Code	<b>20AT42P</b>	Duration	80 Min	Marks	30
<b>Note:</b> 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							<b>5</b>

**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
<b>Total Marks</b>			<b>100</b>

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

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

<b>Sl. No.</b>	<b>Particulars</b>	<b>Specification</b>	<b>Quantity</b>
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**

<b>Programme</b>	Automobile Engineering	<b>Semester</b>	IV
<b>Course Code</b>	20AT43P	<b>Type of Course</b>	Programme Core
<b>Course Name</b>	Vehicle Body Engineering and Dynamics	<b>Contact Hours</b>	8 hours/week 104 hours/semester
<b>Teaching Scheme</b>	L:T:P :: 3:1:4	<b>Credits</b>	6
<b>CIE Marks</b>	60	<b>SEE Marks</b>	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 instability 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. <b>Vehicle body</b> -Need- body styles- Materials. 2. Composite materials- Advantage - types- Application. GRP, FRP, carbon reinforced plastics, insulating materials- need-types- properties. 3. <b>Automotive Adhesives &amp; Sealant</b> -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. <b>Note:</b> Use Personal Protective gears & follow the safety rules.

2	1	1,4	<p><b>1. Automotive Glass</b> – types- toughened glass, laminated glass, Bullet resistance glass. Difference between Toughened glass, sheet glass &amp; Laminated glass.</p> <p>2. Defrosting of windshield glass. Window winding mechanisms-types-mechanical &amp; electrical.</p> <p><b>3.</b> 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><b>Note:</b> Use Personal Protective gear &amp; follow the safety rules.</p>
3	1		<p><b>1. Vehicle body repair</b> - 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 &amp; chassis alignment- Reasons &amp; 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><b>Note:</b> Use Personal Protective gears &amp; follow the safety rules.</p>
4	3	1,4	<p><b>1. Body painting</b>- 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 &amp; 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><b>Note:</b> Use Personal Protective gears &amp; follow the safety rules.</p>

5	3,5	1,4,7	<p>1. Spray painting - Types, air spray painting-procedure.</p> <p>2. <b>Corrosion:</b> Causes and effects of corrosion on automobile bodies. Methods of corrosion protection.</p> <p>3. <b>Interior aesthetics:</b> -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><b>Note:</b> Use Personal Protective gears &amp; follow the safety rules.</p>
6	4	1,4	<p>1. <b>HVAC system</b> - 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.<b>Body Dynamics:</b> 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). <b>or</b> 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. <b>Vehicle Aerodynamics:</b> 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><b>Braking System:</b></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	<p><b>Steering System:</b></p> <p>1.True steering, over steering, under steering, minimum turning circle radius of vehicle.</p> <p>2. Collapsible steering column- types, - Construction and working.</p> <p>3. tilt-telescopic steering columns- construction and working.</p>	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	<p>1. <b>Bus Body Details:</b> Types, Bus Body Lay Out: Floor height, engine location, entrance and exit location.</p> <p>2. seating dimensions, Dimensions of driver's seat in relation to controls, driver's cabin design.</p>	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.	<b>Note:</b> Use Personal Protective gears & follow the safety rules.
13	5	2,4,7	<p>1. <b>Wind tunnels for automotive aerodynamics:</b> Introduction – Principles of wind tunnel technology.</p> <p>2. Flow visualization techniques. Testing with wind tunnel balance (scale models).</p> <p>3. Road Testing -Need-Equipment used in road testing. Crash test- need- types- Equipment needed- government regulation- rating.</p>	Study the latest technological changes in this course and present the impact of these changes on industry.	<p>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.</p> <p>2. Case study to improve safety rating of a given vehicle.</p>
<b>Total in hours</b>			<b>39</b>	<b>13</b>	<b>52</b>

\* 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
<b>Total Marks</b>					<b>100</b>

#### 5. a) Format for CIE written Test

Course Name	<b>Vehicle Body Engineering and Dynamics</b>	Test	I/II/III	Sem	III/IV
Course Code	<b>20AT42P</b>	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
<b>Total Marks</b>			<b>100</b>

### 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							<b>5</b>

**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&amp; type and repair/glass materials and refitting."</p> <p>a) Identification of the material type - 10 m b) Removing &amp; 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 b) Troubleshooting/ simulation technique - 25m</p>	30
2	2,3,4	<p>One skill- oriented question on "adessive/metal corrosion / painting"</p> <p>a) Safety precautions followed - 5 b) Identification of problem -10 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 b) Identification of problem -10 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
<b>Total Marks</b>			<b>100</b>

### 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**

<b>Programme</b>	Automobile Engineering	<b>Semester</b>	IV
<b>Course Code</b>	20AT44P	<b>Type of Course</b>	Programme Core
<b>Course Name</b>	Fuels and Pollution Control	<b>Contact Hours</b>	8 hours/week 104 hours/semester
<b>Teaching Scheme</b>	L:T:P :: 3:1:4	<b>Credits</b>	6
<b>CIE Marks</b>	60	<b>SEE Marks</b>	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. <b>Pollutants from an automobile</b> – 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 <sub>2</sub> , O <sub>2</sub> using exhaust gas analyzer. 2. Measurement of smoke of Diesel engine using Smoke meter.
6	3	5	1. <b>Methods of controlling pollution:</b> 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"> <li>1. <b>Emission norms</b>-need- different emission standards for different engines in India. Driving cycles-need-types.</li> <li>2. Bharath stage emission standards and norms.</li> <li>3. Comparison of Bharath stage with European standards.</li> </ol>	Refer Table 1	<ol style="list-style-type: none"> <li>1. Case study on implantation of BS VI norms.</li> <li>2. Test fuel consumption of a vehicle under different driving cycles.</li> </ol>
11	4	4,5,7	<ol style="list-style-type: none"> <li>1. ARAI- Formation- functions.</li> <li>2. Formulation of standards. Central Motor vehicle rules. Automotive pollution – air pollution &amp; human health</li> <li>3. Exhaust manifold- function, Exhaust manifold components, Muffler, Electronic muffler, Exhaust manifold reactor.</li> </ol>	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"> <li>1. Case study on standardization/ Formulation/ Certification.</li> <li>2. Case study on effects of exhaust gas and advancement in exhaust manifold to control exhaust emission level.</li> </ol>
12	4	4,5,7	<ol style="list-style-type: none"> <li>1. Performance of SI engine using different blends of ethanol- modifications to engine and fuel feed system.</li> <li>2. Performance of SI engine using different blends of methanol. modifications to engine and fuel feed system.</li> <li>3. Comparison of above emissions (1 &amp; 2).</li> </ol>	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"> <li>1. Measure ethanol &amp; methanol emission on a SI engine.</li> <li>2. Conduct an experiment to measure various performance parameters of a SI engine using ethanol blend.</li> </ol>
13	4	4,5,7	<ol style="list-style-type: none"> <li>1. Performance of Diesel engine using CNG- Modifications to engine and fuel feed system.</li> <li>2. Performance of Diesel engine using biofuel- Modifications to engine and fuel feed system.</li> <li>3. Comparison of above emissions (1 &amp; 2).</li> </ol>	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"> <li>1. Measure CNG emission on CI engine.</li> <li>2. Conduct an experiment to measure various performance parameters of a CI engine using biofuel blend.</li> </ol>

			changes on industry.	
<b>Total in hours</b>			<b>39</b>	<b>13</b>
				<b>52</b>

\* 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
<b>Total Marks</b>					<b>100</b>

#### 5. a) Format for CIE written Test

Course Name	<b>Fuels and Pollution Control</b>	Test	I/II/III	Sem	III/IV
Course Code	<b>20AT44P</b>	Duration	80 Min	Marks	30
<b>Note:</b> 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
<b>Total Marks</b>			<b>100</b>

### 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
<b>Total Marks</b>			<b>100</b>

### 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							<b>5</b>

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

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

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

<b>Sl. No.</b>	<b>Particulars</b>	<b>Specification</b>	<b>Quantity</b>
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**

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

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

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

**2. Course Content**

<b>Week</b>	<b>CO</b>	<b>Detailed Course Content</b>	<b>Contact Hours</b>
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
<b>Total in Hours</b>			<b>26 Hrs</b>

#### 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)			-	-	-
<b>Total Marks</b>					<b>50</b>