Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

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

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

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

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

3. Course Content

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

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

			2. Design of Shafts subjected to twisting & bending moment (Hollow and Solid) using strength and rigidity criteria. Simple problems 3. Keys-need, types. Design of keys under different load conditions-shear and crush. Simple problems.		CAD software like-solid edge, UG-NX etc. 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.
6	3	1,2,3,4	1. Couplings-purpose-requirements-types- applications. 2. Design of Muff coupling. Simple problems. 3. Design of Flange coupling-Unprotected. Simple problems.	Refer Table 1	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. 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.
7	3	1,2,3	1. Coil spring-terms used in helical compression spring. Simple problems 2. Stresses & deflection of helical spring. Simple problems 3. Leaf springs- Effective & ineffective length, camber, stresses & deflection of semi elliptic leaf. Simple problems.	Refer Table 1	1. Using part modelling work bench tools create a helical spring CAD software like-solid edge, UG-NX etc. 2. Using part modelling work bench tools and assembly workbench tools create a leaf spring assembly.
8	3	1,2,3,4	1. Design concepts of piston. 2. Design of piston, piston pin & piston rings based on strength and heat transfer. 3. Simple problems.	Refer Table 1	1. Create an 3D-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. 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.
9	3	1,2,3,4	1. Forces acting on connecting rod. 2. Design parameters of connecting rod. 3. Design of connecting rod. Simple problems.	Refer Table 1	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. 2. Create an assembly model of connecting rod and then create a 2D drawing using any CAD software like-solid edge, UG-NX, etc.
10	3	1,2,3,4	1. Design of flywheel. Simple Problems. 2. Cam and followers-types, Cam profile-types. 3. Construct a cam profile using uniform velocity method. Simple Problems.	Refer Table 1	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. 2. Create an 3D-assembly model of camshaft and then create a 2D drawing using any CAD software like-solid edge, UG-NX, etc..
11	3	1,2,3,4,7	1. Torque transmitted through single and multi-plate clutches.	Refer Table 1,	1. Create an 3D-assembly model of single plate-clutch assembly and then

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

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

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

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

4. CIE and SEE Assessment Methodologies

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

5. Format for CIE written Test

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

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

6. Rubrics for Assessment of Activity (Qualitative Assessment)

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

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

7. Reference:

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

8. CIE Skill Test and SEE Scheme of Evaluation

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

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

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

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

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