(ME 401) STRENGTH OF MATERIALS

1. COURSE OBJECTIVES:

Through this course the students will able to understand the fundamentals of solid mechanics, acquire the elementary knowledge of stresses, strains and their effects. They will also analyze the behavior of machine parts under various loads.It is important to understand and analyze various types of loads, stresses and strains, which are the main causes of failure of machine parts. The subject also deals with understanding the properties of engineering materials and applying the same in solving engineering problems.

2. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(ME 401) Strength of Materials		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**
		3	**1**	**1**	**5**	**75**	**25**	**25**	**-**

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

ME401CO1: Describe behaviour of engineering materials under the action of external loads.
ME401CO2: Represent simple stress & strain, SF & BM, Moment of inertia, bending stresses & torsion.
ME401CO3: Solve various problems on simple stresses & strains, SF & BM diagrams, bending stresses, moment of inertia & torsion.
ME401CO4: Analyse the behaviour of materials under various loads.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimenting& Testing	Engg. Practices for Society, Sustainabilit	Project Management	Life -long Learning		
CO1	3	1	0	0	2	0	2	1	1
CO2	3	3	1	1	0	1	1	2	
CO3	3	2	2	1	0	0	2	3	1
CO4	3	3	2	1	1	1	2	2	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**				
Units:			**M**	**Thr**	**CO**
1. SIMPLE STRESS AND STRAIN			15	10	
1.1 Definition of stress and strain (Numericals on stress and strain)					
1.2 Stress – strain Curve for Ductile Material labeling the significant points on the curve.					
1.3 Concept of elastic limit, Hooks law &Young's Modulus of Elasticity					
1.4 Deformation expression of a body subjected to single force [δl = PL/AE]					
1.5Numericals based on concept of principle of Superposition [Bars of uniform cross section & Bars of different cross sections only]					**CO1** **CO2**
1.6Concept of lateral strain and Poisson's Ratio. [Numericals on lateral strain & Poisson's Ratio to be covered]					**CO3** **CO4**
1.7Concept of shear stress, shear strain and Modulus of Rigidity.					
1.8Definition of term- volumetric strain and bulk Modulus [No Numericals] Note: - [Numericals on stresses in composite sections are to be excluded.]					
2.SHEAR FORCE & BENDING MOMENT			15	10	

2.1 Types of beams and Supports.			
2.2 Concepts of shear force & Bending Moment.			**CO1**
2.3 Sign Conventions for shear force & Bending Moment.			**CO2**
2.4 Shear force and bending moment diagram for simple cantilever and simply supported beams subjected to point and uniformly distributed load only.			**CO3** **CO4**
3. MOMENT OF INERTIA	15	10	
3.1 Definition of Moment of Inertia			
3.2 Perpendicular & Parallel Axis Theorem.			**CO1**
3.3 Expression of M.I of Rectangular, circular, Triangular & hollow Rectangular sections (No derivations, simple numericals).			**CO2** **CO3**
3.5 Numericals on sections like L section, T section and I section			
4. THEORY OF SIMPLE BENDING	15	09	
4.1 Concept of pure Bending.			**CO1**
4.2 Theory of simple Bending, Neutral Axis and Bending equation.			**CO2**
4.3 Bending stress distribution diagram			**CO3**
4.4 Application of bending equation for solid rectangular, solid circular section, hollow rectangular and hollow circular section. (simple numericals)			**CO4**
5. TORSION	15	09	
5.1 Concept of pure Torsion			
5.2 Torsion equation assumptions in Theory of pure torsion.			**CO1**
5.3 Strength of circular solid &hollow shaft in pure torsion.			**CO2**
5.4 Shear stress distribution diagram.			**CO3**
5.5 Polar Modulus, power transmitted by shaft.			**CO4**
Total	**75**	**48**	

N.B: - Question paper will not carry questions on derivations

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and tutorials.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	SIMPLE STRESS AND STRAIN	10	18
2	SHEAR FORCE & BENDING MOMENT	10	18
3	MOMENT OF INERTIA	10	15
4	THEORY OF SIMPLE BENDING	09	12
5	TORSION	09	12
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK &PRACTICALS.

No	Practical (no 1 and 2 are compulsory and any 03 from 3 to 8)	Marks
1.	Tensile Test on M.S or Al using UTM	4
2.	Compression Test on wood/Resin sample using UTM	3
3.	Shear Test on M.S using UTM	3
4.	Brinell Hardness Test on Hardness Testing Machine	3
5.	Rockwell Hardness Test on Hardness Testing Machine	3
6.	Izod Impact Test on M.S or Al.	3
7.	Charpy Impact Test on M.S. or Al.	3
8.	Torsion Test on M.S Specimen.	3
	Total	25
No	**Tutorial Exercise**	
1	Solve atleast 5 problems on unit 1	
2	Solve atleast 5 problems on unit 2	
3	Solve atleast 5 problems on unit 3	
4	Solve atleast 5 problems on unit 4	
5.	Solve atleast 5 problems on unit 5	

9. LEARNING RESOURCES

9.1Text Books

S. No.	Author	Title of Books	Publishers
1	R.S Khurmi	Strength of Materials	S.Chand Publisher
2	S.S. Bhavikatti	Strength of Materials	Vikas Publishing
3	S. Ramamurtham	Strength of Materials	DhanpatRai&Sons
4	R. K. Rajput	Strength of Materials	S.Chand Publisher

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	F.L. Singer	Strength of Materials	London Harper & row
2	Timoshenko & Gere	Mechanics of Materials	CBS Publisher &Distributors, New Delhi

(MC402) MECHANICAL WORKSHOP PRACTICE

1.COURSE OBJECTIVES:

The students will be able to acquire knowledgetoPlan methodology and prepare the job as per given specification by selecting and applying appropriate manufacturing process and Understand the concepts, procedures, types of cutting tools, work holding devices, various operations performed on these machines, their working principles and practices related to various manufacturing processes.

2. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(MC402) MECHANICAL WORKSHOP PRACTICE		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**
		-	**-**	**04**	**-**	**-**	**-**	**50**	**50**	**100**

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

MC402CO1: Identify different types of machine tools and machining processes to produce a component.

MC402CO2: Outline a manufacturing sequence to produce a given part.

MC402CO3: Apply basic skills in the use of various machine tools (milling m/c, grinding machine, shaper and lathe) to perform job following safety guidelines.

MC402CO4: Plan a maintenance schedule for effective functioning of machine tools.

4. Mapping Course Outcomes with Program Outcomes

Relationship:1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO 1	3	1	1	2	2	1	1	1	1
CO 2	3	2	2	1				1	1
CO 3	3	2	2	3	1	1	1	2	2
CO 4	2	1	2	3	1	1	1	1	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Phr = Practical hours**	

Unit	**M**	**Phr**	**CO**
1. LATHE.			
1.1 Introduction to types of Lathe.			
1.2 Centre Lathe: Tool nomenclature, thread cutting operation. Preventive maintenance, maintenance schedule and lubrication chart. Types of Coolants.			
1.3 Introduction to Capstan and turret lathe, Principal parts of capstan and turret lathe.			
1.4 Introduction to CNC lathe, main elements of CNC lathe, Hand operation, operating element. CNC operation- operating and control elements, co-ordinate system. CNC programming- methods of programming-absolute system and Incremental system, Preparatory functions (G-functions), CNC program input format.			**CO1** **CO2** **CO3**
2. Milling machine			
2.1 Introduction, column and knee type milling machine (horizontal and vertical), milling cutters, milling operations.			**CO1** **CO2**
2.2 Universal dividing head-construction and working, Indexing-direct and simple indexing only.			**CO3**
2.3 Preventive maintenance, maintenance schedule and lubrication charts. Coolants.			**CO4**
3 Grinding.			
3.1 Introduction, grinding machine types. Work holding devices.			**CO1**
3.2 Types of abrasive and bond. Grite, Grade and structure of wheel, dressing and truing of wheel, marking system, mounting of wheel, balancing of wheel.			**CO2** **CO3**
3.2 Use of Coolant			
4 Shaper.			
4.1 Introduction to Shaper.			**CO1**
4.2 Main parts of standard shaper, work holding devices shaper operations.			**CO2**
4.3 Preventive maintenance schedule and lubrication chart.			**CO3** **CO4**
Total		**64**	

6. COURSE DELIVERY:
The Course will be delivered through shop talk, shop floor interactions, demonstrations, assignments, video clips and Practicals.

7. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

Sr. No	Unit No	Practicals/Assignment	Phrs
1	1	Job on external threading	04
2	1	Prepare simple job on CNC machine	04
3	2	Produce a hexagonal head/spur gear by indexing device	08
4	2	Machine sides of a rectangular block (centre lathe/milling machine) and mill two slot or opposite sides and a V-groove on one side (V-block)	08
5	3	Prepare job on the following grinding machine 1) Surface grinder-flat surface-01 2) Cylindrical grinder-cylindrical surface-01	04
6	3	Grind lathe tool	04
7	4	Machine two flat horizontal opposite sides of the rectangular block on a shaper (to complete V-block. at Sr. No 4)	08
8	1,2,4	Prepare a preventive maintenance schedule(daily/monthly) and a lubrication chart for any one of the following machine tools (1) Centre lathe (2) Milling machine (3) Shaper	06
09	1,2,4	Identify different types of machine tools in your workshop and write down its specifications and uses	04

Note: A field visit to modern workshop to be arranged during the semester

8. LEARNING RESOURCES
8.1 Text Books

S. No.	Author	Title of Books	Publishers
1	S.K Hajara Chaudhary	Elements of W/s Technology Vol I & II	Media Promoter & Publisher Pvt. Ltd
2	Raghuwanshi	Workshop Technology Vol II	DhanpatRai& Co
3	P.C Sharma	Production Technology	S. Chand & Co
4	Kaushik and Gupta	Workshop Technology	

8.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	R.K Jain	Production Technology	Khanna Publishers
2	W.A.J Chapman	Workshop Technology Vol I& II	CBS

(AU401) AUTOMOBILE ENGINES

1. COURSE OBJECTIVES :

The students will able to understand fundamentals of IC engines and associated systems. They will know the construction, working and function of engine components, engine cooling, lubrication and fuel feed systems. They will be able to dismantle and assemble engines using appropriate tools and following safety procedures.They will also learn to trouble shoot faults and suggest remedies to problems with engine and associated systems.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV								
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks	Total Marks
AU401		L	T	P	H	TH	TM	TW	PR/OR	
AUTOMOBILE ENGINES		3	-	2	5	75	25	25	25	150

3.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

AU401CO1. List the components of automobile, IC engine and associated systems and state the functions of each.

AU401CO2. Describe terminology and fundamentals of automobile engines and associated systems.

AU401CO3. Explain constructionand working of engine components and associated systems.

AU401CO4. Apply the knowledge of automobile engines and associated systems for trouble shooting of faults.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	1	1			1	1	2	1	1
CO2	2	1	1	1	1	1	2	1	1
CO3	2	2	2	2	2	1	2	2	2
CO4	3	3	2	2	2	1	2	2	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			**M**	**Thr**	**CO**
1. ENGINE PRINCIPLES AND FUNDAMENTALS			**9**	**6**	
1.1 Introduction- Components of an automobile					**CO1**
1.2 Basic engine terminology, Engine cycles, Classification of automobile engines.					**CO2**
1.3 Working of 2-stroke and 4 stroke cycle petrol and diesel engines, Comparison of2 - stroke & 4- stroke engines, Comparison of C.I. & S.I. engines,Firing order, Comparison of single and Multi cylinder engines, Number and arrangement of engine cylinders, Numbering of Engine cylinders.					
2. CONSTRUCTIONAL DETAILS OF BASIC ENGINE COMPONENTS			**18**	**12**	
2.1 Introduction-Parts of engine					**CO1**
2.2 Constructional details-I Cylinder block, Cylinder head, Crank case, Oil pan, Manifolds,Gaskets, Cylinder liners, Piston, Piston rings, Connecting rod and Piston pin.					**CO2** **CO3** **CO4**
2.3 Constructional details-II Crankshaft, Engine bearings, Valve timing, Poppet valves, Valve cooling, Valve seats, Valve actuating mechanisms, Camshafts, Camshaft arrangements, Flywheel, Vibration damper and Mufflers.					
2.4 Engine Service					
3.ENGINE COOLING SYSTEM			**15**	**10**	
3.1 Introduction- Heat developed in an engine, Purpose of cooling system					**CO1**
3.2 Methods of cooling- Air cooling system, Water cooling system (pump circulation system), Comparison of air and water cooling system.					**CO2** **CO3**
3.3 Main components of water cooling system - Water jackets, Radiator, Expansion tank, Radiator pressure cap, Thermostat, Water pump, Radiator fan, Drive belt, Coolant temperature indicator and gauges, Coolant level indicator.					**CO4**
3.4 Coolants and anti-freeze solutions.					
3.5 Cooling system trouble shooting.					
4. LUBRICATION SYSTEM			**15**	**10**	

4.1 Introduction- Purpose of lubrication, Parts to be lubricated.			**CO1**
4.2 Requirements of lubricants, Types of lubricants, Viscosity rating, Service rating, Additives for lubricants, Effects of engine conditions on lubricating oil, Critical lubrication conditions for engines, Consumption of lubricating oil.			**CO2** **CO3** **CO4**
4.3 Engine Lubrication systems – Petroil lubrication system, Wet sump lubrication system, Splash lubrication system, Pressure lubrication system, Dry sump lubrication system, Pre-Lubrication system.			
4.4 Main components of Pressure lubrication system – Oil strainers, Oil pumps, Pressure relief valve, Oil filters, Oil coolers, Oil level indicators, Oil pressure gauges, Oil pressure warning light.			
4.5 Lubrication system trouble shooting.			
5. FUELS AND FUEL SYSTEMS	**18**	**10**	
5.1 Introduction- Petroleum, Hydrocarbons, Refining of crude oil, Desirable properties of engine fuels.			**CO1** **CO2**
5.2 Types of auto engine fuels- Petrol (Gasoline) as fuel, Characteristics of gasoline, Octane rating, Diesel as fuel, Characteristics of diesel, Cetane rating. Alternative fuels – Alcohols, CNG, LNG, LPG, Bio-diesel.			**CO3** **CO4**
5.3 Auto fuel safety considerations.			
5.4 Fuel supply systems- Components of fuel feed system in petrol engine, Functions of a carburetor, Construction and working of a simple carburetor, Basic working principle of Petrol injection system, Comparison of petrol injection system with carburetor method.			
5.5 Components and basic working principle of fuel feed system in Diesel engine, Air fuel mixture ratio in petrol and diesel engines.			
5.6 Fuel supply system trouble shooting.			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Engine principles and fundamentals	6	9
2	Constructional details of basic Engine components	12	18
3	Engine cooling system	10	15
4	Lubrication system	10	15
5	Fuel and fuel systems	10	18
	Total	**48**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Operate a cut section model to explain 2-stroke engine.	
2.	Operate a cut section model to explain 4-stroke engine.	
3.	Dismantling, examination and re-assembling of different engine parts of Petrol Engine.	
4.	Dismantling, examination and re-assembling of different engine parts of Diesel Engine.	
5.	Dismantling, checking, cleaning and refitting of various parts of water cooling system in automobiles.	
6.	Maintenance of Lubrication system in automobiles.	
7.	Carburettor overhauling, float adjustment and tuning.	
	Total	**25**

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Dr. Kirpal Singh	Automobile Engineering Vol. 2	Standard Publisher Distributors
2	Crouse/Anglin	Automotive Mechanics	McGraw Hill Education
3	Anil Chhikara	Automobile Engineering Vol. 1 - Engine System	SatyaPrakashan, New Delhi
4	G.B.S. Narang	Automobile Engineering	Khanna Publishers

9.2Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	M.L Mathur, R.P Sharma	Internal Combustion Engines	DhanpatRai Publications
2	K. Newton, W. Steeds, T. K. Garrett	The Motor Vehicle	Butterworth-Heinemann

(AU402) AUTOMOBILE TRANSMISSION SYSTEMS

1. COURSE OBJECTIVES:

The students will able to illustrate the vehicle layouts, chassis frame & location of various systems.
They will know the principle, construction and working of clutch, gearboxes, propeller shafts, universal joints, slip joints & final drive in the transmission system. They will understand the terminology of wheels & tyres. They will be able to dismantle and assemble different transmission systems using appropriate tools and following safety procedures.

2. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
AU402		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**
Automobile Transmission Systems		**3**	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

AU402CO1. List the different types of units and components which comprise the chassis and drive systems of an automobile and state the functions of each.
AU402CO2.Explain the construction and working of the different components of the chassis and drive systems of an automobile.
AU402CO3. Illustrate the construction of the various components of the chassis and the drive systems of an automobile.
AU402CO4. Apply the knowledge of the various components of the chassis and drive systems of an automobile for trouble shooting of faults.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	1	0	0	1	1	2	1	1
CO2	3	2	2	2	2	2	2	2	2
CO3	3	1	1	2	0	1	3	2	1
CO4	1	2	2	3	2	2	2	3	2

Relationship :Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1 Vehicle layout and Chassis frame:			15	10	
1.1 Classification and specifications of Chassis- 2-Wheeler, Passenger car, Commercial Vehicle.					**CO1** **CO2**
1.2 Vehicle layout & its types—2 Wheel Drive- Front Engine Front Wheel Drive, Rear Engine Rear Wheel Drive, Front Engine Rear Wheel Drive & 4 Wheel Drive.					**CO3** **CO4**
1.3 Major assemblies – their locations and functions.					
1.4 Various loads acting on chassis frame.					
1.5 Functions of frames, Type of frames-Conventional frame, Integral or unit construction, Monocoque and Space frame construction, Half integral and half frame chassis.					
1.6 Trouble shooting					
2 Clutch			15	10	
2.1 Functions of Clutch.					**CO1**
2.2 Principles of operation of clutch.					**CO2**
2.3 Various types of clutches used in Automobiles – single plate diaphragm clutch, multiplate clutch - dry & wet clutches					**CO3** **CO4**
2.4 Materials used for clutch lining.					

2.5 Hydraulic& mechanical clutch linkage, Cable operated clutch linkage.			
2.6 Trouble shooting			
3 Gear Box	15	10	
3.1 Function and necessity of Gear Box.			**CO1**
3.2 Types, construction and working of gear boxes & their layouts such as sliding mesh, constant mesh, synchromesh type, vario - drive, transfer case.			**CO2** **CO3**
3.3 Gear shift mechanism.			**CO4**
3.4 Concepts of automatic gear box.			
3.5 Torque Converter- principle, construction and working			
3.6 Trouble shooting			
4 Propeller shafts, universal joints, slip joints, Wheels and Tyres	15	10	
4.1 Necessity and function of Propeller Shaft.			**CO1**
4.2 Drive line for front wheel drive-Constant velocity joint.			**CO2**
4.3 Drive line for rear wheel drive-Universal joint and slip joint.			**CO3**
4.4 Types of wheels, rims and tyres.			**CO4**
4.5 Tyre materials, construction.			
4.6 Necessity and types of treads.			
4.7 Tyre inflation and its effect.			
4.8 Tyre rotation and nomenclature.			
4.9 Trouble shooting			
5 Final drive	15	08	
5.1 Principle, Necessity and function of final drive and differential.			**CO1**
5.2 Construction & Working of differential			**CO2**
5.3 Limited slip differential.			**CO3**
5.4 Types of rear axles such as full floating type, semi – floating and three quarter floating.			**CO4**
5.5 Transmission in two wheeler- chain drive and belt drive.			

5.6 Trouble shooting			
Total	**75**	**48**	

6. COURSE DELIVERY:
The Course will be delivered through lectures and class room interactions.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Vehicle layout and Chassis frame	10	15
2	Clutch	10	15
3	Gear Box	10	15
4	Propeller shafts, universal joints, slip joints, Wheels and Tyres	10	15
5	Final drive	08	15
	Total	**48**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**	**Marks**
1.	Identify different parts of the chassis.	
2.	Dismantling and Assembling of a single plate clutch.	
3.	Dismantling and Assembling of a multi plate clutch used in two wheelers.	
4.	Dismantling and assembling of a Synchromesh gear box.	
5.	Dismantling and assembling of automatic transmission devices such as torque converter, vario drives.	
6.	Dismantling and assembling of propeller shaft, universal joint and slip joint.	
7.	Dismantling and assembling of a differential.	

8.	Dismantling and assembling of tyres, wheels and rims.	
	Total	**25**

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Anthony Schwaller	Motor automotive technology	Delmar Publisher Inc.
2	Tim Gills	Automotive service	Delmar Publisher Inc.
3	Anil Chikkara	Automobile Engineering Vol. II	SatyaPrakashan New Delhi
4	Crouse / Anglin.	Automobile Mechanics	TATA McGraw – HILL
5	Kirpal Singh	Automobile Engineering Vol.I	Standard Publication
6	HarbansSingth Royat	The Automobile	S. Chand Publication
7	R.B. Gupta	Automobile Engineering	SatyaPrakashan New Delhi
8	S. Srinivisan	Automotive Mechanics	TATA McGraw – HILL
9	H M Sethi	Automotive Technology	TATA McGraw – HILL

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	R.K Rajput	A text book of Automobile Engineering	Firewall Media
2	John Whipp	Transmission Chassis & related systems	Cengage Learning EMEA

MC 404) Fluid Machinery

1. COURSE OBJECTIVES:

The students will be able to acquire knowledgeto apply the concept introduced in Fluid Machinery to engineering applications such as turbo machinery and flow measurement.Fluid machinery plays an important role in the conversion of hydraulic energy tomechanical energy and vice-versa. Hydraulic turbines are used for meeting our day-to-daypower demands. Also, different types of pumps are essential equipment in all the industries. Hydraulic systems have a wide range of applications in machine tools, material handling,marine, mining, metal processing, equipment and other fields.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV									
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(MC 404) Fluid Machinery		L	T	P	H	TH	TM	TW	PR/OR	
		03	-	02	05	75	25	25	-	125

3.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

MC404CO1: Define various terms related to fluid mechanics & fluid machineries.
MC404CO2: Explain fluid properties, fluid pressure, fluid flow, water turbine, pumps, accumulator & intensifier.
MC404CO3: Apply laws and theorems on statics and dynamics to calculate various parameters of fluids, flowing through pipes and various devices.
MC404CO4: Classify fluids, fluid flow, water turbines & pumps.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	1		1			1	1	1
CO2	2	1	1	1	1	1	2	2	1
CO3	3	3	3	2	1	1	2	2	1
CO4	3	2	1	1	2	1	3	1	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**				
Unit			**M**	**Thr**	**CO**
1 Introduction to fluid mechanics and Pressure Measurement			**12**	**10**	
1.1 Definition and classification of fluids, Branches of hydraulic -Hydrostatics & Hydrodynamics					
1.2 Fluid properties Density, Specific gravity, specific weight - (Simple Numerical) Viscosity, surface tension, capillarity, compressibility (No Numerical)					
1.3 SI Units of Pressure, Pressure head, Atmospheric pressure, Positive and Negative Gauge pressure, Absolute pressure (Simple Numerical on pressure, pressure head and conversion to equivalent heads of other liquids)					
1.4 Pascal's Law and its applications.					
1.5 Pressure measuring devices Manometers-principle & working of piezometer tube, simple 'U' tube, differential 'U' tube and inverted 'U' tube manometers (Simple Numerical)					
1.6 Bourdon pressure gauge-its working principle & constructions, Calibration of pressure gauges					**CO1** **CO2** **CO3** **CO4**
2 Hydrostatics			**12**	**06**	
2.1 Total pressure, Centre of Pressure					
2.2 Pressure on plane surfaces immersed in liquid – horizontally, vertically & inclined to free surface, calculation of total pressure and determination of position of centre of pressure for circular, triangular & rectangular surfaces immersed vertically and inclined in one type liquid. (Simple Numerical)					**CO1** **CO2** **CO3**
3 Hydrodynamics			**21**	**14**	
3.1 Types of flow - steady; unsteady, - uniform, non-uniform, laminar and turbulent flow, compressible, incompressible flow.					

3.2 Continuity equation, Energies of liquid - pressure head, Datum head, velocity head, Total energy of liquid, Bernoulli's theorem (Simple Numerical)			
3.3 Application of Bernoulli's theorem: Pitot tube, Venturi-meter (Simple Numerical on Discharge through Horizontal Venturi-meter)			**CO1**
3.4 Definition of orifice, types, Vena contracta, Hydraulic coefficients Cc, Cv and Cd, Discharge through a circular orifice. (Simple Numerical)			**CO2**
3.5 Laws of fluid friction, Reynold's number and it significance, Various losses in pipe flow- major and minor losses- loss of head due to entrance, sudden enlargement, sudden contraction. (Simple numerical on loss of head due to friction, sudden expansion and contraction)			**CO3** **CO4**
3.6 Hydraulic gradient line, Total energy line (No numerical)			
3.7 Water hammer in pipes - causes, effect and remedial measures			
4 Water Turbines (No numerical in this unit)	**12**	**08**	
4.4 Water Turbines: Classification of water-turbines			
4.5 Impulse turbines: Pelton Turbine-Construction and working			
4.6 Reaction Turbines: Francis Turbine- construction and working, Kaplan turbine – Construction and working			**CO1**
4.7 Difference between Impulse turbine and Reaction Turbine			**CO2**
4.8 Advantages and Disadvantages of Francis Turbine over a Pelton wheel			**CO4**
5 Pumps, Accumulator and Intensifier (No numerical in this Unit)	**18**	**10**	
5.1 Centrifugal Pumps: Classification, construction & working, Types of casings, Types of impellers, Multistage centrifugal pumps, pumps in series, pumps in parallel, Priming, Cavitation, faults & remedies of centrifugal pumps. Definition of Static head, delivery head, manometric head, NPSH			
5.2 Reciprocating pumps: Classification of reciprocating pumps, Construction and working of single acting reciprocating pump, Slip and negative slip, Air vessels, functions of air vessels.			
5.3 Difference between centrifugal pump and reciprocating pump.			**CO1**
5.4 Construction, working and application of rotary vane pump, External Gear pumps			**CO2**
5.5 Construction, working and application of Accumulator and Intensifier			**CO4**
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction to fluid mechanics and Pressure Measurement	10	12
2	Hydrostatics	06	12
3	Hydrodynamics	14	21
4	Water Turbines	08	12
5	Pumps, Accumulator and Intensifier	10	18
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1.	Measurement of pressure of water in a pipe by manometer	03
2.	Verification of Bernoulli's theorem	03
3.	Determination of coefficient of Discharge of Venturi meter	03
4.	To determine the relationship between loss of head and velocity for pipe flow	03
5.	Demonstrate the construction and operation of a Pelton Turbine	04
6.	Demonstrate the construction and operation of a Francis Turbine	03
7.	Demonstrate the construction and operation of a Centrifugal Pump	03
8.	Demonstrate the construction and operation of a Reciprocating Pump	03
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.K. Rajput	Fluid Mechanics and Hydraulic Machines	S. Chand Ltd
2	R.K. Bansal	Fluid Mechanics and Hydraulic Machines	LaximiPvt. Ltd
3	R.S. Khurmi	A Text book of Hydraulics, Fluid Mechanics and Hydraulic Machines	S. Chand Ltd
4	P.N. Modi/S.M. Seth	Hydraulics and Fluid Mechanics including Hydraulic Machines	RajsonsPvt. Ltd

(AU403) ORGANISATIONAL BEHAVIOUR

1. COURSE OBJECTIVES:

The students will be able to link the theories of Organisational Behaviour with all the managerial actions undertaken during the course of their careers as Engineers, while also exhibiting the appropriate etiquette in both social as well as professional environments.

2. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
AU403		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
OrganisationalBehaviour		4	0	0	4	75	25	-	-	100

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

AU403CO1: Understand the scope and implications of various life skills & concepts of Organisational Behaviour in any Industrial setup.

AU403CO2: Explain the relationships between various life skills and Organisational Structures and cultures in any industrial setup.

AU403CO3: Identify appropriate behavioural pattern and etiquettes while operating in both a social and professional environment.

AU403CO4: Propose various measures, using the appropriate life skills to manage real life management situations occurring in a variety of Organisational settings.

4. Mapping Course Outcomes with Program Outcomes

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	1	0	0	0	2	3	3	0	2
CO2	1	0	1	0	2	3	3	0	3
CO3	1	0	1	0	2	3	3	0	2
CO4	1	0	2	0	2	3	3	0	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1. Fundamentals of Organisational Behaviour			**9**	**5**	
1.1 Definition of OB					**CO1**
1.2 Scope & Implications of OB					
1.3 Relationship between OB & Industry					
1.4 Evolution of OB					
1.5Limitations of OB					
2. Individual Behaviour			**27**	**18**	
2.1 Attitudes at the workplace – Definition of Attitudes, Components of Attitude, Types of job-related Attitude					**CO1** **CO2** **CO3** **CO4**
2.2 Job Satisfaction – Factors conducive to job satisfaction, Effect of Job Satisfaction on Employee Performance. Importance of high job satisfaction.					
2.3 Values – Definition of Values, Value System, Importance of Values, Sources for our value systems, Types of Values.					
2.4 Assertiveness – Necessity for Assertiveness, Non-assertive Behaviour, Aggressive Behaviour, Tips or Techniques to develop assertive Behaviour.					
2.5 Emotional Intelligence – Gender differences in Emotions, Skills involved in					

Emotional Intelligence.			
2.6 Time Management – Benefits of Time Management, Obstacles to Effective Time Management.			
2.7 Motivation – Types of Motivation, Locus of Control, Creators & Victims, Theories of Motivation – Theory of Wage Incentive, Maslow's theory of Motivation.			
2.8Stress Management-Work Stress, Sources of work Stress, Consequences of Work Stress, Managing Stress			
3. Group Behaviour	**24**	**15**	
3.1 Work Teams – Definitions of Work Groups & Work Teams, Types of Teams – Problem Solving, Self Managed Work Teams & Cross functional Teams. Lessons for effective Team building.			**CO1** **CO2** **CO3** **CO4**
3.2 Leadership – Styles of Leadership, Leadership Qualities, Significance of Leadership			
3.3 Conflict Resolution Skills – definition of Conflict, Views on Conflict, Levels of Conflict, Causes of Conflict, Methods of avoiding conflicts, Constructive and Destructive Conflict, Advantages & disadvantages of Conflict, Conflict Management Styles, Conflict Resolution Process.			
3.4Negotiation Skills – Need for Negotiation, Features of Negotiation, Negotiation process, Negotiation Types, Negotiation Concepts (BATNA and ZOPA)			
4. Organization Systems	**9**	**6**	
4.1 Organization structure, Key Elements in design of Organization Structure – work Specialization, Departmentalization,, Chain of Command, Span of Control, Centralization and decentralization, Formalization.			**CO1** **CO2** **CO3** **CO4**
4.2 Virtual Organization, Boundary-less Organization			
4.3 Organization Culture, Characteristics of Organization Culture.			
5.Corporate Ethics & Etiquette	**6**	**4**	

5.1 Basic courtesy & Good mannerism			**CO1**
5.1 General Rules of Behaviour			**CO2**
5.2 Body Language			**CO3**
5.3 Personal Dressing & Grooming			**CO4**
5.4 Telephone Etiquette			
5.5 Dining Etiquette			

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	**Fundamentals of OrganisationalBehaviour**	5	9
2	**Individual Behaviour**	18	27
3	**Group Behaviour**	15	24
4	**Organization Systems**	6	9
5	**Corporate Ethics & Etiquette**	4	6
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**	**Marks**
1.	Exercise on Attitude Survey	3
2	Exercise on Values	3
3	Exercise on Motivation	3
4	Exercise on Group Behaviour	5

5	Exercise on Conflict Handling	3
6	Exercise on Bureaucratic Orientation Test	3
7	Exercise on Stress Analysis	5
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Stephen Robins Timothy Judge Neharika Vohra	OrganisationalBehaviour	
2	M. N. Mishra	OrganisationalBehaviour	
3	K. Ashwathappa	OrganisationalBehaviour	
4	Fred Luthans	OrganisationalBehaviour	

9.2Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	UdayPareek	Understanding OrganisationalBehaviour.	
2	Niraj Kumar	OrganisationalBehaviour	