

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHATRONICS

SUBJECT NAME: CONCEPTS IN MECHATRONICS ENGINEERING

SUBJECT CODE: 3714701

M.E. 1st SEMESTER

Type of course: Engineering

Prerequisite: N.A.

Rationale: The course aims to present the basic concepts of Mechatronics Engineering to graduate students. The course should enhance their ability to develop a multidisciplinary approach incorporating Mechanical and Electronics streams to solve real life problems.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	ELECTRICAL ACTUATION SYSTEM Electrical Switches, Relay, Solenoid, DC motors, AC motors, stepper motors and servo motors.	8	20
2	BASICS OF ELECTRONICS Conductors and Semiconductors, Silicon Crystal, Intrinsic Semiconductors, Extrinsic Semiconductors, Ideal diode, Reading a datasheet.	2	5
3	SOLID-STATE ELECTRONIC DEVICES Construction, operating mechanism and characteristics of PN Junction Diode, Transistors, MOSFET, Thyristor (SCR), DIAC and TRIAC. Half Wave and Full Wave rectifiers and Converters.	7	18
4	ELECTRIC DRIVES Parts of electrical drives, Motor Characteristics and equations, Converter and chopper based drives.	3	7
5	MECHANISMS Link, kinematic pair, mechanism, machines, DOF of mechanisms, inversion of mechanism, mechanisms with lower pair, pantograph	5	12
6	MOTION TRANSMISSION Introduction to belt drives, cams and followers, gears	5	12
7	DESIGN OF MACHINE ELEMENTS Material selection, stress strain relationship, factor of safety, types of stresses, principle stresses, and consideration for fatigue failure	8	20
8	MECHANICAL VIBRATION FOR SINGLE DEGREE OF FREEDOM SYSTEM Introduction of vibrations : free vibration, damped vibration, forced vibration, torsional vibration	2	6

Reference Books:

1. K.P. Ramchandran, G.K. Vijayaraghavan, M.S. Balasundaram, Mechatronics – Integrated mechanical electronic systems, Wiley India Pvt. Ltd.
2. Dr. B.M. Bimbhra Power Electronics, Khanna publishers
3. G.K. Dubey, Fundamentals of Electrical Drives, Narosa publication
4. S.S.Rattan, Theory of machines, Tata McGraw Hill Publication

Course Outcome:

After learning the course the students should be able to:

- Understand the multidisciplinary approach of Mechatronics Engineering.
- Analyze linkage mechanism from mechanical engg point of view and motion transfer to activate it.
- Study basic electronic components and its circuits to make any mechanical device working

List of Experiments:

1. Study of Relay Driver Circuit using transistor SL100.
2. To study and obtain V-I characteristics of P-N junction diode and Light Emitting Diode (LED).
3. Study of Half Wave and Full Wave Rectifiers.
4. To study Capacitance Filter and calculation of related parameters.
5. Modeling and Speed Control of DC Motor.
6. Inversion of 4-bar mechanism
7. Inversion of slider crank mechanism
8. Study of mechanical actuating systems
9. To study the longitudinal vibrations of helical spring and determine frequency of period of vibration theoretically and actually by experiment
10. To study the torsional vibration (undamped) of single rotor shaft system
11. To understand the working of pantograph mechanism

Major Equipment:

1. Electrical Relay, P-N Junction Diodes and LED, Transistors, Resistors, Bread Board, Power supply, DC Motor, MATLAB software.
2. Models of different types of gears, cams, followers, belt drives, bearings, etc.
3. Universal vibration apparatus
4. Model (or actual) pantograph

List of Open Source Software/learning website:

Demo versions of MATLAB and C language are available free of cost for limited periods. Student versions are also available freely