GUJARAT TECHNOLOGICAL UNIVERSITY

MECHATRONICS (47)

CONCEPTS IN MECHATRONICS ENGINEERING

SUBJECT CODE: 2714701

SEMESTER: I

Type of course: Engineering

Prerequisite: NA

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	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
4	0	2#	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**ELECTRICAL ACTUATION SYSTEM** Electrical systems, solid state switches, DC motors, AC motors, stepper motors, servo motors.	5	10
2	**POWER CIRCUITS** Construction, operating mechanism and characteristics of power MOSFET, IGBT, Thiristor devices – SCR, DIAC, TRIAC. Full wave and half wave phase controlled converters – single phase and 3 phase, choppers.	10	20
3	**ELECTRIC DRIVES** Controlled converter and chopper based DC drives, converter based 3 phase induction motor drives	10	20
4	**MECHANISMS** Link, kinematic pair, mechanism, machines, DOF of mechanisms, inversion of mechanism, mechanisms with lower pair, pantograph, straight line mechanism, introduction of synthesis of mechanism	7	14
5	**MOTION TRANSMISSION** Belt drives, chain drive, power screws, gear and gear trains, cam and followers	6	12
6	**DESIGN OF MACHINE ELEMENTS** Material selection, stress strain relationship, factor of safety, types of stresses, principle stresses, and consideration for fatigue failure	10	20
7	**MECHANICAL VIBRATION FOR SINGLE DEGREE OF FREEDOM SYSTEM.** Introduction of vibrations : free vibration, damped vibration, forced	2	4

	vibration, torsional vibration		

Reference Books:

1. K.P. Ramchandran, G.K. Vijayaraghavan, M.S. Balasundaram
   Mechatronics – Integrated mechanical electronic systems, Wiley IndP.Ltd.
2. Dr. B.M. Bimbhra Power Electronics, Khanna publishers
3. G.K. Dubey Fundamentals of Electric Drives, Narosa publication

Course Outcome:

After learning the course the students will be able to:

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

List of Experiments:

1. Inversion of 4-bar mechanism
2. Inversion of slider crank mechanism
3. Study of mechanical actuating systems
4. To study the longitudinal vibrations of helical spring and determine frequency of period of vibration theoretically and actually by experiment
5. To study the torsional vibration (undamped) of single rotor shaft system
6. To understand the working of pantograph mechanism
7. Performance of relay driver circuit using transistor SL100
8. To understand Half-wave and Full-wave rectifier using MATLAB software
9. To find V-I Characteristics of SCR
10. To understand working of Thyristor and different triggering method of gate terminal
11. Control of Stepper motor
12. Speed control of DC motor

Open Ended Problems:

Students with background of mechanical engineering may be given a task of studying any application based actuation system and its circuit, whereas students with background of electronics / electrical may be a given a task to study application based mechanical system and its working and motion transfer

Major Equipments:

1. Models of different types of gears, cams, followers, belt drives, bearings, etc.
2. Universal vibration apparatus
3. Model (or actual) pantograph
4. Relay, Transister , Resistance, Bread board, Power supply etc.
5. MATLAB software
6. Bread board, SCR, Resistance, Power supply etc.
7. Bread board, Stepper motor, Power supply etc.
8. DC motor, bread board, Power supply, etc.

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