GUJARAT TECHNOLOGICAL UNIVERSITY

CYBER SECURITY
SUBJECT CODE: 2150002
B.E. 5th SEMESTER

Type of course: NA

Prerequisite: Basic fundamental knowledge of computers, Internet and network

Rationale: NA.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
0	1	2	3	0	0	0	50	30	20	100

Content:

Sr. No.	Topics	Weightage %
1	**Systems Vulnerability Scanning** Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet	25
2	**Network Defense tools** Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System	25
3	**Web Application Tools** Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra	25
4	**Introduction to Cyber Crime and law** Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.	10
5	**Introduction to Cyber Crime Investigation** Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks	15

Reference Books:

1. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw Hill.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley

Course Outcome:

After learning the course the students should be able to: student should understand cyber-attack, types of cybercrimes, cyber laws and also how to protect them self and ultimately society from such attacks

List of Experiments:

1. TCP scanning using NMAP
2. Port scanning using NMAP
3. TCP / UDP connectivity using Netcat
4. Network vulnerability using OpenVAS
5. Web application testing using DVWA
6. Manual SQL injection using DVWA
7. XSS using DVWA
8. Automated SQL injection with SqlMap

Design based Problems (DP)/Open Ended Problem:

GUJARAT TECHNOLOGICAL UNIVERSITY

DISASTER MANAGEMENT
SUBJECT CODE: 2150003
B.E. 5th SEMESTER

Type of course: Applied Mechanics

Prerequisite: NA

Rationale: This subject is conceptual applications of principles of management to mitigate various disasters.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	0	3	70	20	10	0	0	0	100

ESE-End Semester Exam, PA-Progressive Assessment, E-External, M-Mid semester, V-Viva (External) , I-Internal

Sr. No.	Topics	Teaching Hrs.	Weightage %
1	**Understanding Disasters** Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management	4	10
2	**Types, Trends, Causes, Consequences and Control of Disasters** Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves); Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Man-made Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters); Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters	8	20
3	**Disaster Management Cycle and Framework** Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action	8	20
4	**Disaster Management in India** Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter-Governmental Agencies	10	20
5	**Applications of Science and Technology for Disaster Management & Mitigation** Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination)	12	30

	Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India		

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**50**	**30**	**10**	**0**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1 Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
3. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
4. World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland
5. Encyclopedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
6. Encyclopedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2,Angus M. Gunn, Greenwood Press, 2008
7 Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur
8. Management of Natural Disasters in developing countries, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
9. Natural Disasters, David Alexander, Kluwer Academic London, 1999, 632 pages
10 Disaster Management Act 2005, Publisher by Govt. of India
11 Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management
12 NIDM Publications
13 High Power Committee Report, 2001, J.C. Pant
14 Disaster Mitigation in Asia & Pacific, Asian Development Bank
15 National Disaster Management Policy, 2009, GoI
16 Disaster Preparedness Kit, American Red Cross
17 Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
18 Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila.
19 Sahni, Pardeep et.al. (eds.) 2002, Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi.
20 Roy, P.S. (2000): Space Technology for Disaster management: A Remote Sensing & GIS Perspective, Indian Institute of Remote Sensing (NRSA) Dehradun.
21 Sharma, R.K. & Sharma, G. (2005) (ed) Natural Disaster, APH Publishing Corporation, New Delhi.
22 Kasperson, J.X., R.E. Kasperson, and B.L. Turner III (Eds.), 1995, Regions at Risk: Comparisons of Threatened Environments, United Nations University Press, Tokyo
23 Singh Satendra (2003): Disaster Management in the Hills, Concept Publishing Company, New Delhi.
24 Taori, K (2005) Disaster Management through Panchayati Raj, Concept Publishing Company, New Delhi.

Course Outcome:

After learning the course the students should be able to:

(a) Understand disasters, disaster preparedness and mitigation measures

(b) Understand role of IT, remote sensing, GIS and GPS in risk reduction

(c) Understand disaster management acts and guidelines along with role of various stack-holders during disasters

List of Open Source Software/learning website:
www.GIS. Development.net
www.iirs.nrsa.org
http://quake.usgs.gov
www.nidmindia.nic.in

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL ENGINEERING (19)
THEORY OF MACHINES
SUBJECT CODE: 2151902
B.E. 5th SEMESTER

Type of course: Under Graduate

Prerequisite: None**.**

Rationale: Theory of Machines is a fundamental course for Mechanical engineers to understand the working principals of any machine. This course is essential to understand the motion, transmission of the motion and the forces responsible for the motion

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Gyroscope:** Principle of gyroscope, Definition of axes, active and reactive couples; Roll, Yaw and Pitch motions; Gyroscopic effect in a rotor, two wheelers, Four wheelers, ship and aeroplane.	**10**	**20%**
2	**Friction Devices: Clutches, Brakes and Dynamometers** Classification of clutches, torque transmission capacity, considerations for uniform wear and uniform pressure theory, single plate and multi-plate clutch, centrifugal clutch, Energy equation and thermal considerations. Classification of brakes, Braking effect, Analysis of Brakes: Block Brake, Band Brake, Band and Block Brake, Internal expansion shoe brake; Braking analysis of four wheelers. Classification of Dynamometers, Analysis of Dynamometers: Prony brake, Rope brake, Hydraulic, Belt Transmission, Epicyclic-Train and Bevis-Gibson torsion.	**12**	**30%**
3	**Flywheels:** Significance of flywheel, Turning moment and crank effort diagrams for reciprocating machines, coefficient of fluctuation of speed and energy, Limiting velocity of flywheel, Design of flywheels for engines and punching machines.	**5**	**15%**
4	**Governors:** Necessity of governor, Classification of Governors, Working principle of centrifugal governors, Concept of control force, Control force diagram, Stability of governor, Condition for stability, Concept of isochronism, Sensitivity of governor, Characteristics of governors, Hunting of governors.	****	**5%**

5	**Introduction to Dynamics:** Newton's Laws of Motion, Applied and constraint forces, Free-body diagrams, conditions for equilibrium, Two and Three forces members, Four force members, Friction forces, Static force analysis with friction. Centroid and Centre of Mass, Mass Moments and products of inertia, Inertia forces and D'alembert's Principle. Planar rotation about fixed centre, Shaking forces and moments, Complex algebra approach, Equation of motion. Application of concepts to dynamic analysis of slider-crank mechanism and 4-bar mechanism. Spatial: Measuring mass moment of Inertia, Transformation of Inertia axes, Euler's equation of motion, Impulse and momentum, Angular impulse and momentum.	**15**	**30%**

**** Should be covered during practical session only.**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. S S Rattan 4/e, Theory of Machines, McGraw-Hill.
2. J.Uicker , Gordon R Penstock & J.E. Shigley, Theory of Machines and Mechanisms, Oxford.
3. A G Ambekar, Mechanism and Machine Theory, PHI.
4. R L Norton, Kinematics and Dynamics of Machinery, McGraw-Hill.
5. Kenneth J Waldron , Gary L Kinzel, Kinematics, Dynamics and Design of Machinery, Wiley.
6. Meriam, J L and Kraige, L G, Engineering Mechanics: Dynamics, Wiley.

Course Outcome:

After learning the course the students should be able to:

1. Analyse effect of gyroscopic couple on vehicles, ships and aeroplanes.
2. Design flywheels for IC engines and punching press.
3. Apply fundamentals of dynamics analysis to various mechanical systems.
4. Design and analyse clutches and brakes.
5. Perform power measurement using dynamometers.
6. Analyse governors.

List of Experiments:

1. Performance on gravity controlled governors.
2. Analysis of gyroscopic effect.
3. Performance on spring controlled governors.
4. Analysis of clutch.
5. Analysis of brakes.
6. Power measurement using dynamometers.
7. Dynamic force analysis of 4-bar mechanism and slider crank mechanism (Analytical Methods)
8. Design of Flywheel for IC engine and Punch press.

9. Measurement of mass moment of inertia.
10. Measurement of radius of gyration of various components.

Design based Problems (DP)/Open Ended Problem:

1. Carryout mechanism analysis using CAD tools.
2. Write program for analysis of mechanism.
3. Conceptualize a system to replace a clutch.
4. Perform analysis of braking system for various vehicles.

Major Equipment:

1. Governors.
2. Dynamometers.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL ENGINEERING (19)
FLUID POWER ENGINEERING
SUBJECT CODE: 2151903
B.E. 5th SEMESTER

Type of course: Fundamental

Prerequisite: Elements of Mechanical Engineering

Rationale: The course is designed to provide the detailed understanding of fluid power and different major equipment which can produce power from fluid.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Hydropower Plant:** Introduction, Major applications of hydropower plant, Classification of hydropower plant, Essential components of hydropower plant, Advantages and disadvantages of hydropower plant, selection of site for a hydropower plant	**2**	**5**
2	**Impact of Jet:** Introduction, Force exerted on stationary plate held normal and inclined to jet, Force exerted on curved plate, force exerted on moving plate held normal and inclined in direction of moving jet, Force on a plate when vane is moving in direction of jet, jet striking on curved vane tangentially at one tip and leaving at other end, jet propulsion in ships	**7**	**20**
3	**Hydraulic Turbines:** Introduction, Classification of turbines, Impulse and reaction turbines, construction, working and performance of Pelton, Francis and Kaplan Turbines, Draft tube, Governing of hydraulic turbines, Cavitation	**7**	**20**
4	**Centrifugal Pumps:** Pump classification and selection criterion, Centrifugal pumps, Velocity vector diagrams, Pump losses and efficiencies, Net positive suction head, Pressure rise in impeller, Characteristic curves of centrifugal pumps, priming, maximum suction limit - minimum starting speed to deliver the discharge, Multistage pumps, cavitation, pump selection	**6**	**12**
5	**Reciprocating Pumps:** Operation of Reciprocating pumps, discharge co-efficient, volumetric efficiency, slip, work done and power required to drive reciprocating pumps, effect of air vessels, effect of friction on performance of reciprocating pump	**3**	**8**
6	**Reciprocating Compressors:** Construction and working, Multistage	**3**	**5**

	conditions for minimum work, Intercooling, Efficiency and control of air compressors		
7	**Rotary Compressors:** Introduction, Classification, roots blower, Vane type, Screw compressor, Scroll compressor	**3**	**5**
8	**Centrifugal Compressors:** Essential parts, Static and total head properties, Velocity diagram, Degree of reaction, surging and choking, Losses in centrifugal compressor	**3**	**5**
9	**Axial Flow Compressors:** Construction of an axial flow compressor, Aerofoil blading, Lift and drag, Performance characteristics	**3**	**5**
10	**Hydraulic Machines:** Construction and working of hydraulic press, Hydraulic accumulator, Hydraulic intensifier, Hydraulic crane, Hydraulic jack, hydraulic lift, Hydraulic ram, Fluid couplings, Fluid torque converter and air lift pump	**5**	**15**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**25**	**25**	**15**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria & Sons.
2. Fluid Power Engineering by R.N. Patel and V.L. Patel Mahajan Publication
3. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan.
4. Fluid Mechanics and Hydraulic Machines by R.K. Rajput , S.Chand & Co.
5. Turbines, Compressors and Fans by S.M. Yahya., TMH Publishers
6. Fluid Mechanics and Turbomachines by Das, Madan Mohan, PHI Lerning

Course Outcome:

After learning the course the students should be able to:

- Learn the benefits and limitations of fluid power compared with other power transmission technologies.
- Understand the operation and use of different hydraulic machines like hydraulic crane, fluid coupling and fluid torque convertor etc.
- Formulate and analyze models of hydraulic components.
- Design and predict the performance of fluid power components.

List of Experiments:

1. To study about hydropower plant.
2. To Verify Impulse-momentum principle for impact of jet on stationary vane.
3. Performance test on Pelton turbine.
4. Performance test on Kaplan turbine.
5. Performance test on Francis turbine.
6. Performance test on Centrifugal pump.
7. Performance test on Reciprocating pump.

8. Performance test on Reciprocating compressor.
9. To study the constructional details of axial flow compressor and draw its characteristics curve.
10. Performance test on Centrifugal compressor.
11. Performance test on Hydraulic ram.
12. To study about hydraulic machines.

Design based Problems (DP)/Open Ended Problem:

1. Develop a working model of hydraulic car lift.
2. Develop a working model of hydraulic crane.
3. Develop a working model of hydraulic turbine (Pelton, Francis and Kaplan).
4. Study about Hydraulics used in Airplane/Jet plane.
5. Study about Optimal selection of Turbines for Hydroelectric power plant.

Major Equipment:

1. Test rig of Pelton turbine
2. Test rig of Kaplan turbine
3. Test rig of Francis turbine
4. Test rig of Centrifugal pump
5. Test rig of Reciprocating pump
6. Test rig of Centrifugal compressor
7. Test rig of Reciprocating compressor
8. Impact of jet apparatus
9. Test rig of Hydraulic ram

List of Open Source Software/learning website:

1. http://nptel.ac.in/
2. http://www.nfpa.com/

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GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL ENGINEERING (19)
DESIGN OF MACHINE ELEMENTS
SUBJECT CODE: 2151907
B.E. 5th SEMESTER

Type of course: Under Graduate

Prerequisite: Machine Design and Industrial Drafting**.**

Rationale: Determining configurations and parameters of various components of a mechanical system is a crucial stage of development. This requires functional and structural analysis of elements. The course aims to provide fundamental knowledge for material selection, analysis of components subjected to fluctuating loads, design of components like spring, pressure vessels and transmission system like belts, chain and ropes.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction:** Design procedure, Selection of preferred sizes, Aesthetic and Ergonomic considerations in Design, Manufacturing considerations in Design, Mechanical Properties of Materials, Effect of Alloying elements and heat treatment on properties of steels, Materials Selection in Machine Design, IS coding of steels and Cast Irons.	**7**	**15%**
2	**Design Against Fluctuating Loads:** Stress Concentration, Endurance limit and Fatigue failure, Factors affecting endurance limit, S-N Diagram, Design for reversed stresses and cumulative damage, Fluctuating stresses: Soderberg, Gerber, Goodman and Modified-Goodman criteria, Combined stresses.	**7**	**20%**
3	**Design of Springs:** Classification of springs, Helical Spring: Style of ends, Stresses, Correction Factors, and Deflection, Design against static and fluctuating loads, Concentric springs, surge phenomenon. Helical Torsion and Spiral Springs, Belleville spring, shot peening of springs. Multi-Leaf Spring: Terminology, Nipping, and Design of multi-leaf spring.	**8**	**15%**
4	**Belt and Chain Drives:** Flat Belt Drive: Belt Construction, Flat Belt Drive: Length of the Belt: Open and Cross drive types, Ratio of Tensions on tight side to slack side, Condition for maximum power transmission, Creep phenomenon, Methods for tensioning, Selection of Belts from catalogues, Design of Pulley for flat belt drive. Timing belt selection. V-Belt Drive: Nomenclature, Selection of V-Belts from catalogues. Chain Drive: Nomenclature of roller chains, Length and power rating of	**11**	**25%**

	chains, Design of chain drive.		
5	**Pressure Vessels:** Thin cylinders and spherical vessels, Wire wound cylinders. Thick cylinders: Principal stresses in cylinder subjected to internal/external pressure, Lame's equation, Clavarion's and Bernie's equations, Autofrettage, Compounding of cylinders, Gasketted Joints, Thickness of cylindrical and spherical shells, Design of End closures, Area compensations for nozzles. Introduction to Design codes.	**11**	**25%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. V B Bhandari, Design of Machine Elements, 3/e, McGraw Hill.
2. R C Juvinall, Fundamentals of Machine Component Design, 4/e, Wiley.
3. P C Gope, Machine Design: Fundamentals and Applications, 1/e PHI.
4. R L Norton, Machine Design An Introduction, Pearson.
5. E J Hearn, Mechanics of Materials, BH.

Course Outcome:

After learning the course the students should be able to:

1. Carryout preliminary selection of materials for mechanical components.
2. Analyse components subjected to fluctuating loads.
3. Design springs for mechanical application.
4. Design and select belt and chain drives.

List of Experiments:

1. Exercise on material selection for given application.
2. Measure and compare properties of steel with different alloying elements.
3. Design of mechanical components subjected to fluctuating loads.
4. Determine fatigue strength of a material.
5. Design of springs.
6. Design of belt drives.
7. Design of chain drives.
8. Study performance of a belt drive for different tension (tightening) levels.
9. Design of pressure vessels. Exercise should include demonstration of use of codes (ASME Section VIII Div 2 and IS 2825 (1969)).

Design based Problems (DP)/Open Ended Problem:

1. Design a spring for suspension system of a vehicle and validate the same.
2. Design a pressure vessel using conventional method learned, and using standard codes. Compare both the design.

Major Equipment:

1. Belt drive setup.
2. Moore's Test rig.

List of Open Source Software/learning website:

1. www.nptel.com

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL ENGINEERING (19)
CONTROL ENGINEERING
SUBJECT CODE: 2151908
B.E. 5th SEMESTER

Type of course: Engineering Science

Prerequisite: Zeal to learn the subject

Rationale: To develop comprehensive knowledge and understanding of classical and modern control theory, industrial automation, and systems analysis. Control engineering is a diverse and rapidly expanding discipline which has become increasingly important in a wide range of industries.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No	Topic	Lectures	Weightage
1	**Basic concepts of control system:** Terminology - plant, process, system, disturbances, controlled variable, manipulated variable etc., Block diagram of basic control system, application areas with examples. Classifications of control systems, Concept of superposition for linear systems with examples.	**3**	**10%**
2	**Mathematical modelling of systems:** Translational and rotational mechanical, electrical, thermal, hydraulic and pneumatic systems, Force voltage and force current analogy, Position servo mechanism. Block diagram and signal flow graph representation of physical systems along with rules, properties, comparison and limitation, Mason's gain formula	**11**	**20%**
3	**Time response analysis:** Standard test signals along with examples of their usage, steady state errors for step, ramp and parabolic inputs, analysis of first and second order systems, Transient response specifications with numerical examples, Basic control actions and two position, proportional, PI, PID and rate feedback controllers, Limitations of time domain analysis.	**7**	**15%**
4	**Frequency response analysis:** Need of frequency response analysis, Sinusoidal response of linear system, methods used in frequency response, Frequency domain specifications.	**4**	**10%**
5	**Stability:** Concept of stability, types of stability, Routh's stability criterion, special cases with numerical examples, stability of closed loop system, concept of root locus,	**6**	**15%**

	open loop and closed loop transfer poles, step by step procedure for root loci, numerical examples		
6	**Hydraulic control system:** Basic elements of hydraulic circuit, Principle used in hydraulic circuit, Sources of hydraulic power, Integral, Derivative, PD & PID controller with its transfer function, Comparison between hydraulic and electrical control system.	**5**	**10%**
7	**Pneumatic control system:** Basic elements of pneumatic circuit, Difference between pneumatic and hydraulic control systems, Force balance and force distance type controllers, Nozzle-flapper amplifier, PD, PI and PID control system along with its transfer function.	**4**	**10%**
8	**State space analysis:** State space representation, state variables, state, state vector, state space, formulation of state space equations for mechanical and electrical systems, advantages over classical technique.	**3**	**10%**

Course Outcome:

On completion of this course students will:

1. Understand the methodology for modelling dynamic systems with concept of stability
2. Know the transfer function, signal flow graph representation of linear systems & their controlling actions
3. Understand concept of time, frequency response as well as concept of state-space models and their relation to frequency domain models
4. Control system of hydraulic and pneumatic system

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

References:

1. Modern control theory, Katsuhiko Ogata, Pearson Education International, Fifth edition.
2. Control system engineering, Norman S Nise, John Wiley & Sons, Inc., Sixth edition
3. Modern control systems, Richard C. Dorf, Robert H Bishop, Pearson Education International, Twelfth edition.
4. Automatic control systems, Farid Golnaraghi, Benjamin C Kuo, John Wiley & Sons, Inc., Nineth edition
5. J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007

List of Experiments:

1. Development of block diagram of various physical systems given by instructor ex. Toster system, watt governor etc.

2. Introduction to simulation software like MATLAB/LABVIEW
3. Modelling of physical system using simulation software
4. Simulation of linear system to different inputs
5. Given a system transfer function, plot the location of the system zeros and poles using simulation software
6. Simulation of root locus plot using simulation software
7. Performance measurement of first and second order system using simulation system as given by instructor
8. Introduction to hydraulic trainer system/software
9. Development & performance of given hydraulic circuit
10. Introduction to pneumatic trainer system/software
11. Development & performance of given pneumatic circuit
12. Introduction of programmable logic controller and ladder diagram

Design based problems (DP)/open ended problem:

1. Apply the knowledge of control systems on vibration system, fluid flow system, thermal system monitoring as an open or closed loop system.
2. Give a task to develop an open loop or closed loop control of physical system
3. Develop open or closed loop simulation program for mechanical mechanisms using software showing current position of each link with respect to specified reference.

Major Equipment:

- Hydraulic trainer
- Pneumatic trainer
- MATLAB/ LABVIEW/Simulation software for hydraulic and pneumatic systems

List of Open source software/learning website:

- https://www.scilab.org
- www.simscale.com

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL ENGINEERING (19)
HEAT TRANSFER
SUBJECT CODE: 2151909
B.E. 5th SEMESTER

Type of course: Core course

Prerequisite: Thermodynamics

Rationale: The course is prepared to provide the detailed understating of heat transfer principles

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Fundamental:** Modes of heat transfer, effect of temperature on thermal conductivity of different solids, liquids and gases, derivation of generalized equation in Cartesian, cylindrical and spherical coordinates and its reduction to specific cases, General laws of heat transfer	**3**	7
2	**Conduction:** Fourier's law, One dimensional steady state conduction, heat conduction through plane and composite walls, cylinders and spheres, electrical analogy, critical radius of insulation for cylinder and sphere, overall heat transfer coefficient. **Transient heat conduction**- lumped heat capacity analysis, time constant, transient heat conduction in solids with finite conduction and convective resistances **Heat transfer from extended surface:** Types of fin, heat flow through rectangular fin, infinitely long fin, fin insulated at the tip and fin losing heat at the tip, efficiency and effectiveness of fin, Biot number, Estimation of error in temperature measurement in a thermometer well	**10**	24
3	**Convection:** Newton's law of cooling, Dimensional analysis applied to forced and free convection, dimensionless numbers and their physical significance, empirical correlations for free and forced convection Continuity, momentum and energy equations, thermal and hydrodynamic boundary layer, Blasius solution for laminar boundary layer, General solution of Von-Karman integral momentum equation	**9**	21
4	**Radiation:** Absorptivity, reflectivity and transmissivity, black, white and grey body, emissive power and emissivity, laws of radiation – Planck, Stefan-Boltzmann, Wein's displacement, Kirchhoff's law, intensity of radiation and solid angle, Lambert's cosine law Radiation heat exchange between black bodies, shape factor, heat exchange between non-black bodies- infinite parallel planes and infinite long concentric cylinders,	**9**	21

	radiation shield, heat exchange between two grey surfaces, electrical analogy		
5	**Heat exchanger:** Classification, heat exchanger analysis, LMTD for parallel and counter flow exchanger, condenser and evaporator, overall heat transfer coefficient, fouling factor, correction factors for multi pass arrangement, effectiveness and number of transfer unit for parallel and counter flow heat exchanger, introduction of heat pipe and compact heat exchanger	**7**	17
6	**Two-phase heat transfer:** Boiling of liquids, Pool boiling curve, different types of pool boiling, condensation of vapor. Film wise & drop wise condensation.	**4**	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**25**	**20**	**15**	**15**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. Heat & Mass Transfer by P.K. Nag, McGraw Hill
2. Heat and Mass Transfer: Fundamentals and Application by Yunus Cengel, McGraw Hill
3. Fundamental of Heat and Mass Transfer by Incropera and Dewitt, Wiley Publication
4. Heat Transfer by Mills and Ganesan, Pearson Education
5. Heat Transfer by J P Holman , McGraw Hill
6. Heat and Mass Transfer by R K Rajput, S.Chand Publication
7. Heat Transfer: Principles and Applications by Dutta, Binay K, PHI Publication

Course outcome:

After learning the course the students should be able to:

- Understand basic concept of heat transfer
- Able to do basic calculations involving heat transfer as is typical for a mechanical engineer. This includes conduction, convection and radiation heat transfer as well as heat exchanger design.
- Apply scientific and engineering principles to analyze and design aspects of engineering systems that relate to conduction, convection and radiation heat transfer.

List of laboratory experiments: (Any 10 of the following experiments)

1. To determine the thermal conductivity of given metal rod
2. To determine the thermal conductivity of the given composite walls.
3. To determine Stephan Boltzmann constant experimentally.
4. To determine heat transfer co-efficient by forced convection.
5. To determine heat transfer co-efficient by natural convection.
6. To determine the overall heat transfer co-efficient of shell and tube type heat exchangers.
7. To determine the emissivity of gray body.
8. To study drop & film wise condensation & determine the film co-efficient
9. To measure convective heat transfer co-efficient and effectiveness of the fin under forced convection.
10. To measure convective heat transfer co-efficient and effectiveness of the fin under natural convection.
11. To determine heat transfer co-efficient for tube and tube heat exchanger.
12. To determine heat transfer co-efficient for transient heat transfer apparatus.
13. To determine critical radius of insulation for critical radius apparatus.

Design based Problems (DP)/Open Ended Problem:

- Calculate cooling capacity of domestic refrigerator
- Study the effect of circulation of fan in a room having air conditioner
- Analyze the performance of electric water heater with different flow rate
- Comparison of composite wall made of different materials

Major equipment:

- Apparatus to determine thermal conductivity of metal rod
- Guarded hot plate method apparatus
- Composite wall apparatus
- Double pipe heat exchanger
- Shell and tube heat exchanger
- Pin fin apparatus
- Emissivity measurement apparatus
- Stefan Boltzmann apparatus
- Natural and force convection apparatus

List of Open Source Software/learning website:

- nptel.ac.in
- www.learnerstv.com
- cosmolearning.org

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