



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)



**Approved by AICTE, Recognized by UGC & Affiliated to Anna University
Accredited by NBA-AICTE, NAAC-UGC with 'A+' Grade**

Saravanampatti , Coimbatore -641035

CURRICULA AND SYLLABI REGULATION 2019 CHOICE BASED CREDIT SYSTEM

DEPARTMENT OF MECHATRONICS

B.E. – MECHATRONICS



SNS COLLEGE OF TECHNOLOGY

(Autonomous)
COIMBATORE-35



DEPARTMENT OF MECHATRONICS ENGINEERING

SUGGESTED CURRICULUM R2019

SUBJECT AREA	AICTE	SNSCT – MCT Suggested	CREDITS PER SEMESTER							
			I	II	III	IV	V	VI	VII	VIII
Humanities, Social Sciences And Management Courses(HSMC)	12	21	3	2	4	4	4	2	2	
Basic Science Courses (BSC)	25	24	8	8	3	5				
Engineering Sciences Courses (ESC)	24	22	8	12	2					
Professional Core Courses (PCC)	48	63			14	14	19	10	4	2
Professional Elective Courses (PEC)	18	9					3	3	3	
Open Elective Courses (OEC)	18	6						3	3	
Project/Seminar/Internship (EEC)	15	24	3	1	1	2	1	2	2	12
Mandatory Courses (MC)	(Non Credit)									
TOTAL	160	169	22	23	24	25	27	20	14	14

SEMESTER I										
S No.	Course Code	Course Name	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category
Theory Courses										
1.	19MAT101	Linear Algebra and Calculus	3	1	0	0	4	4	50/50	BSC
2.	19MET101	Engineering Drawing	1	0	4	0	5	3	50/50	ESC
3.	19EET101	Basic Electrical and Electronics Engineering	3	0	0	0	3	3	50/50	ESC
Theory Integrated Practical Courses										
4.	19CHB101	Chemistry for Engineers	3	0	2	0	5	4	60/40	BSC
5.	19ENB101	Communicative English	2	0	2	0	4	3	60/40	HSMC
6.	19GEB101	Design Thinking and Innovation	1	0	0	4	5	3	100/0	EEC
Practical courses										
7.	19GEP101	Workshop Practices Laboratory	0	0	4	0	4	2	60/40	ESC
Mandatory Course										
8.	19HST103	Indian Constitution	2	0	0	0	2	0	100/0	MC
9.	19HST101	3 Weeks Induction Program								
	Total		15/1/12/4				32	22		

SEMESTER II										
S No.	Course Code	Course Name	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category
Theory Courses										
1.	19ITT101	Programming in C and Data Structures	3	0	0	0	3	3	50/50	ESC
2.	19MET102	Engineering Mechanics	3	1	0	0	4	4	50/50	ESC
3.	19MCT102	Engineering Materials	3	0	0	0	3	3	50/50	ESC
Theory Integrated Practical Courses										
4.	19MAB102	Integral Calculus and Laplace Transforms	3	0	2	0	5	4	60/40	BSC
5.	19PYB103	Physics for Engineers	3	0	2	0	5	4	60/40	BSC
Practical courses										
6.	19ENP101	Professional Communication	0	0	4	0	4	2	60/40	HSMC
7.	19ITP101	Programming in C and Data Structures Laboratory	0	0	4	0	4	2	60/40	ESC
8.	19MCP102	Mini Project - I	0	0	0	2	2	1	100/0	EEC
Mandatory Course										
9.	19HST102	Environmental Sciences	2	0	0	0	2	0	100/0	MC
	Total		17/1/12/2				32	23		

SEMESTER III											
S No.	Course Code	CourseName	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES
Theory Courses											
1.	19MAT201	Transforms and Partial Differential Equations	3	0	0	0	3	3	50/50	BSC	19MAT101
2.	19MCT201	Design of Digital Circuits	3	0	0	0	3	3	50/50	PCC	19EET101
3.	19MCT202	Fluid Mechanics and Thermal System	3	0	0	0	3	3	50/50	PCC	
4.	19GET275	VQAR-I	2	0	0	0	2	2	50/50	HSMC	
Theory Integrated Practical Courses											
5.	19MCB201	Production Technology	3	0	2	0	5	4	60/40	PCC	19MCT102
6.	19MCB202	Applied Instrumentation and Control System	3	0	2	0	5	4	60/40	PCC	
Practical Courses											
7.	19ITP202	Python Programming	0	0	4	0	4	2	60/40	ESC	
8.	19GEP275	Personality Development	1	0	2	0	3	2	60/40	HSMC	
9.	19MCP201	Mini Project - II	0	0	0	2	2	1	100/0	EEC	
Total			18/0/10/2				30	24			

SEMESTER IV											
S No.	Course Code	Course Name	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES
Theory Courses											
1.	19MAT205	Probability, Statistics & Numerical Methods	3	0	0	0	3	3	50/50	BSC	19MAT201
2.	19MCT203	Mechanics of Machines	3	0	0	0	3	3	50/50	PCC	
3.	19MCT204	Electrical Drives and Control	3	0	0	0	3	3	50/50	PCC	19EET101
4.	19MCT205	Biology for Mechatronics Engineers	2	0	0	0	2	2	50/50	BSC	
5.	19GET276	VQAR-II	2	0	0	0	2	2	50/50	HSMC	19GET275
Theory Integrated Practical Courses											
6.	19MCB203	Microprocessor, Microcontroller and Interfacing	3	0	2	0	5	4	60/40	PCC	19MCT201
7.	19MCB204	Solid Mechanics	3	0	2	0	5	4	60/40	PCC	
8.		Language Elective	1	0	2	0	3	2	60/40	HSMC	
Mandatory Course											
9.	19MCP202	Internship-I	2 Weeks					2	100/0	EEC	
Total			20/0/6/0				26	25			

SEMESTER V											
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES
Theory Courses											
1.	19MCT301	Machine Design	4	0	0	0	4	4	50/50	PCC	19MCT203
2.	19MCT302	CNC Technology	2	0	0	0	2	2	50/50	PCC	19MCB201
3.	19CST251	Object Oriented Programming using C++	3	0	0	0	3	3	50/50	PCC	19ITT101
4.		Professional Elective - I	3	0	0	0	3	3	50/50	PEC	
5.		Career Course -I & II	4	0	0	0	4	4	--	HSMC	
Theory Integrated Practical Courses											
6.	19MCB301	Integrated Automation	2	0	2	0	4	3	60/40	PCC	19MCB203
7.	19MCB302	Industrial Electronics	2	0	2	0	4	3	60/40	PCC	19MCT204
Practical Courses											
8.	19MCP301	Solid Modelling & Analysis Laboratory	0	0	4	0	4	2	60/40	PCC	
9.	19CSP251	Object Oriented Programming using C++ Laboratory	0	0	4	0	4	2	60/40	PCC	
10.	19MCP302	Mini Project – III	0	0	0	2	2	1	100/0	EEC	
	Total		20/0/12/2				34	27			

SEMESTER VI											
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES
Theory Courses											
1.	19MCT303	IoT for fluid power systems	2	0	0	0	2	2	50/50	PCC	19MCT202
2.		Professional Elective - II	3	0	0	0	3	3	50/50	PEC	
3.		Open Elective - I	3	0	0	0	3	3	50/50	OEC	
4.		Career Course -III	2	0	0	0	2	2	--	HSMC	
Theory Integrated Practical Courses											
5.	19MCB303	Sensors and Signal Processing	2	0	2	0	4	3	60/40	PCC	
6.	19MCB304	Robotics and Machine Vision System	2	0	2	0	4	3	60/40	PCC	19MCT203
Practical Courses											
7.	19MCP303	Simulation of Mechatronics Systems Laboratory	0	0	4	0	4	2	60/40	PCC	
Mandatory Course											
8.	19HST105	Essence of Indian Traditional Knowledge	2	0	0	0	2	0	100/0	MC	
9.	19MCP304	Internship-II	2 Weeks					2	100/0	EEC	
	Total		16/0/8/0				24	20			

SEMESTER VII											
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES
Theory Courses											
1.	19MCT401	Data Analytics in Automation systems	2	0	0	0	2	2	50/50	PCC	
2.	19MCT402	Applied Mechatronics Engineering	2	0	0	0	2	2	50/50	PCC	
3.	19GET201	Professional Ethics and Human Values	2	0	0	0	2	2	50/50	HSMC	
4.		Professional Elective - III	3	0	0	0	3	3	50/50	PEC	
5.		Open Elective - II	3	0	0	0	3	3	50/50	OEC	
Practical courses											
6.	19MCP401	Project - I	0	0	0	4	4	2	60/40	EEC	
	Total		12/0/0/4				16	14			

SEMESTER VIII											
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES
Theory Courses											
1.		MOOC / NPTEL	2	0	0	0	2	2	50/50	PCC	
Mandatory Course											
2.	19MCP402	Project - II	0	0	0	24	24	12	60/40	EEC	
	Total		2/0/0/24				26	14			

PROFESSIONAL ELECTIVES (PE)

S. No	Course Code	Courses Offered	L	T	P	J	C
Professional Elective - I							
1.	19MEE312	Principles of Management	3	0	0	0	3
2.	19MCE301	Design of Mechatronics System	3	0	0	0	3
3.	19MCE302	Intelligent Manufacturing Technology	3	0	0	0	3
4.	19MCE303	Modelling and Simulation	3	0	0	0	3
5.	19MCE304	Design of Embedded Systems	3	0	0	0	3
Professional Elective – II							
1.	19MEE304	Total Quality Management	3	0	0	0	3
2.	19MCE305	Medical Mechatronics	3	0	0	0	3
3.	19MCE306	Computer Integrated Manufacturing	3	0	0	0	3
4.	19MCE307	Artificial Intelligence for Robotics	3	0	0	0	3
5.	19MCE308	Virtual Reality and Haptics	3	0	0	0	3
Professional Elective – III							
1.	19MEE301	Engineering Economics and Cost Analysis	3	0	0	0	3
2.	19MCE401	Process Planning and Product Development	3	0	0	0	3
3.	19MCE402	Autotronics	3	0	0	0	3
4.	19MCE403	Robotic Sensors and Actuators	3	0	0	0	3
5.	19MCE404	Factory Automation	3	0	0	0	3

LANGUAGE ELECTIVES

S. No	Course Code	Courses Offered	L	T	P	J	C
1	19GEB202	HINDI	1	0	2	0	2
2	19GEB203	JAPANESE	1	0	2	0	2
3	19GEB204	GERMAN	1	0	2	0	2
4	19GEB205	FRENCH	1	0	2	0	2

OPEN ELECTIVES OFFERED TO OTHER PROGRAMMES (OEC)

S. No	Course Code	Courses offered	L	T	P	J	C
1.	19MCO301	Introduction to Robotics	3	0	0	0	3
2.	19MCO302	Fundamentals of MEMS	3	0	0	0	3
3.	19MCO303	Automation & Applications	3	0	0	0	3
4.	19MCO304	Human Machine Interface	3	0	0	0	3
5.	19MCO305	Mobile Robotics	3	0	0	0	3

HUMANITIES, SOCIAL SCIENCES AND MANAGEMENT COURSES (HSMC)

Course Code	Course Title	L	T	P	J	C
19ENB101	Communicative English	2	0	2	0	3
19ENP101	Professional Communication	0	0	4	0	2
19GET275	VQAR – I	2	0	0	0	2
19GET276	VQAR - II	2	0	0	0	2
19GEP275	Personality Development	1	0	2	0	2
Language Electives						
19GEB202	Hindi	1	0	2	0	2
19GEB203	Japanese					
19GEB204	German					
19GEB205	French					
	Career Courses-I-II III					6
19GET201	Professional Ethics and Human Values	2	0	0	0	2

BASIC SCIENCE COURSES (BSC)

Course Code	Course Title	L	T	P	J	C
19MAT101	Linear Algebra and Calculus	3	1	0	0	4
19CHB101	Chemistry for Engineers	3	0	2	0	4
19PYB103	Physics for Engineers	3	0	2	0	4
19MAB102	Integral Calculus and Laplace Transforms	3	0	2	0	4
19MAT201	Transforms and Partial Differential Equations	3	0	0	0	3
19MAT202	Statistics and Numerical Methods	3	0	0	0	3
19GET277	Biology for Engineers	2	0	0	0	2

ENGINEERING SCIENCE COURSES- (ESC)

Course Code	Course Title	L	T	P	J	C
19MET101	Engineering Drawing	1	0	4	0	3
19EET101	Basics of Electrical and Electronics Engineering	3	0	0	0	3
19GEP101	Workshop Practice Laboratory	0	0	4	0	2
19ITT101	Programming in C & Data Structures	3	0	0	0	3
19MET102	Engineering Mechanics	3	1	0	0	4
19MCT102	Engineering Mechanics	3	0	0	0	3
19ITP101	Programming in C & Data Structures Lab	0	0	4	0	2
19ITP202	Python Programming	0	0	4	0	2

PROFESSIONAL CORE COURSES(PCC)

Course Code	Courses Title	L	T	P	J	C
19MCT201	Design of Digital Circuits	3	0	0	0	3
19MCT202	Fluid Mechanics and Thermal System	3	0	0	0	3
19MCB201	Production Technology	3	0	2	0	4
19MCB202	Applied Instrumentation and Control System	3	0	2	0	4
19MCT203	Mechanics of Machines	3	0	0	0	3
19MCT204	Electrical Drives and Control	3	0	0	0	3
19MCB203	Microprocessor, Microcontroller and Interfacing	3	0	2	0	4
19MCB204	Solid Mechanics	3	0	2	0	4
19MCT301	Machine Design	4	0	0	0	4
19MCT302	CNC Technology	2	0	0	0	2
19CST251	Object Oriented Programming using C++	3	0	0	0	3
19MCB301	Integrated Automation	2	0	2	0	3
19MCB302	Industrial Electronics	2	0	2	0	3
19MCP301	Solid Modelling & Analysis	0	0	4	0	2
19CSP251	Object Oriented Programming using C++ Laboratory	0	0	4	0	2
19MCT303	IoT for fluid power systems	2	0	0	0	2
19MCB303	Sensors and Signal Processing	2	0	2	0	3
19MCB304	Robotics and Machine Vision System	2	0	2	0	3
19MCP303	Simulation of Mechatronics Systems Laboratory	0	0	4	0	2
19MCT401	Data Analytics in Automation systems	2	0	0	0	2
19MCT402	Applied Mechatronics Engineering	2	0	0	0	2
	MOOC / NPTEL	2	0	0	0	2

EMPLOYABILITY ENHANCEMENT COURSE (EEC)

Course Code	Course Title	L	T	P	J	C
19GEB101	Design Thinking and Innovation	1	0	0	4	3
19MCP102	Mini Project - I	0	0	0	2	1
19MCP201	Mini Project - II	0	0	0	2	1
19MCP202	Internship-I	2 Weeks				2

19MCP302	Mini Project – III	0	0	0	2	1
19MCP304	Internship-II	2 Weeks				2
19MCP401	Project - I	0	0	0	4	2
19MCP402	Project - II	0	0	0	24	12

CAREER COURSES (UG)

S.No	Course Code	Courses Offered	Sem	L	T	P	J	C
Track 1 Job (6 Credits)	19GEP375	Technical Interviewing	V Semester	0	0	4	0	2
	19GEB375	Personnel Psychology	V Semester	1	0	2	0	2
	19GEB379	Employable Skill Development	VI Semester	1	0	2	0	2
Track 2 Entrepreneurship (6 Credits)	19GEB376	Entrepreneurship & Business Canvas Model	V Semester	2	0	4	0	4
	19GET376	Economics, Finance & Accounting	VI Semester	1	0	0	0	1
	19GET377	Intellectual Property Rights	VI Semester	1	0	0	0	1
Track 3 Higher Education (6 Credits)	19GEB377	Advanced Verbal Quantitative Aptitude & Reasoning	V Semester	2	0	2	0	3
	19GET375	Networking	V Semester	1	0	0	0	1
	19GEB380	Higher Studies in Abroad & India	VI Semester	1	0	2	0	2
Track 4 Govt. /RRB/ Bank (6 credits)	19GEB378	Foundation Course on Competitive Exams	V Semester	2	0	4	0	4
	19GEB381	Personnel Psychology for Govt. Jobs	VI Semester	1	0	2	0	2

MANDATORY COURSES (UG)

Course Code	Course Title	L	T	P	J	C
19HST101	Induction Program (3 Weeks)	0	0	0	0	0
19HST102	Environmental Sciences	2	0	0	0	0
19HST103	Indian Constitution	2	0	0	0	0
19HST105	Essence of Indian Traditional Knowledge	2	0	0	0	0

SUBJECT AREA	AICTE	SNSCT – MCT Suggested	CREDITS PER SEMESTER							
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HSMC	12	21	3	2	4	4	4	2	2	
Basic Science Courses (BSC)	25	24	8	8	3	5				
Engineering Sciences Courses (ESC)	24	22	8	12	2					
Professional Core Courses (PCC)	48	63			14	14	19	10	4	2
Professional Elective Courses (PEC)	18	9					3	3	3	
Open Elective Courses (OEC)	18	6						3	3	
Project/Seminar/Internship (EEC)	15	24	3	1	1	2	1	2	2	12
Mandatory Courses (Non Credit)	--									
TOTAL	160	169	22	23	24	25	27	20	14	14

SEMESTER I

19MAT101	LINEAR ALGEBRA & CALCULUS	L	T	P	J	C
	(Common to all B.E. / B. Tech. Courses)	3	1	0	0	4

UNIT I MATRIX EIGEN VALUE PROBLEM 9+3

Determining Eigen values and Eigenvectors – Properties of Eigen values and Eigenvectors - Some applications of Eigen value problems – Eigen value problems arising from population models (Leslie model) – Elastic deformations – Cayley Hamilton Theorem (statement only) and its applications.

UNIT II ORTHOGONAL TRANSFORMATION OF REAL SYMMETRIC MATRIX 9+3

Diagonalization of a real symmetric matrix–Quadratic form– Canonical form – Nature of the quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation – Some Applications: Transformation to Principal axes- Conic sections – Solving first order linear system using diagonalization.

UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3

Radius of Curvature in Cartesian co-ordinates – Centre and circle of curvature in Cartesian co-ordinates – Evolutes – Envelopes.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES 9+3

Partial derivatives –Total derivatives – Jacobians – Taylor's expansion of functions of two variables – Errors and Approximations – Maxima and Minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V SECOND ORDER LINEAR ORDINARY DIFFERENTIAL EQUATIONS 9+3

Homogeneous Linear ODEs with constant coefficients – Linear ODE with variable coefficients - Cauchy's and Legendre's Equations – Method of variation of parameters – Methods of undetermined coefficients - Applications: Modelling of Free Oscillations of a Mass-Spring system.

L : 45 T:15 P: 0 J: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015.
2. James Stewart, Calculus, 7th Edition, Cengage Learning, 2012.

REFERENCES

- 1 Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2018.
- 2 Howard Anton, Elementary Linear Algebra, 11th Edition, Wiley, 2013.
- 3 David C Lay, Linear Algebra and its applications, Pearson, 2018.
- 4 G.B.Thomas, Calculus, 12th Edition, Pearson Education India, 2015.
- 5 T.Veerarajan, Engineering Mathematics, 3rd Edition, Tata McGraw-Hill, New Delhi, 2011.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about Eigen values and Eigen vectors and its role in the system of equations.
- CO2** Transform the real symmetric matrix from quadratic form to canonical form by means of orthogonal transformation.
- CO3** Determine the radius, centre and circle of curvature of any curve.
- CO4** Expand the given function as series and locate the maximum and minimum for multivariate function and also using mathematical software.
- CO5** Solve the second order linear differential equations with various methods and apply them in some physical situations.

19MET101	ENGINEERING DRAWING	L	T	P	J	C
	(Common to all Non Circuit Branches)	1	0	4	0	3
UNIT I	PROJECTION OF POINTS, LINES AND PLANE SURFACES	3+12				
Projection of points - Projection of straight lines located in the first quadrant -Determination of true lengths and true inclinations - Projection of polygonal surface and circular lamina inclined to both reference planes.						
UNIT II	PROJECTION OF SOLIDS	3+12				
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method						
UNIT III	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	3+12				
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other -Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids -Prisms, pyramids, cylinders and cones.						
UNIT IV	PICTORIAL PROJECTIONS AND FREE HAND SKETCHING	3+12				
Principles of isometric projection -isometric scale -isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method (Not for Examination).						
Free hand sketching:						
Representation of Three Dimensional objects -Need for importance of multiple views and their placement -First angle projection -layout views -Developing visualization skills through free hand sketching of multiple views from pictorial drawing.						
UNIT V	BUILDING DRAWING	3+12				
Drawing of a plan, Elevation and sectioning of security room and residential building (Two bed rooms, kitchen, hall, etc.)						

L : 15 T: 0 P: 60 J: 0 Total: 75 PERIODS

TEXT BOOKS

1. N.D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2016.
2. K. R. Gopalakrishnan, "Engineering Drawing" (Vol.I& II), Subhas Publications, 2014.

REFERENCES

- 1 K.V.Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai ,2015.
- 2 M.S.Kumar, "Engineering Graphics", D.D. Publications, 2011.
- 3 K.Venugopal&V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited ,2014.
- 4 M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education ,2011.
- 5 K.L. Narayanan and P. Kannaiah, "Engineering Drawing" SciTech Publications, 2nd edition, 2012.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Sketch the projections of a points, straight lines and plane surfaces.
- CO2** Illustrate top view and front view of the solids
- CO3** Sketch sectioned views and develop area required.
- CO4** Demonstrate knowledge about isometric, perspective and orthographic projections
- CO5** Design simple buildings with detailed plan and sectional elevation.

19EET101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	J	C
	RING					
	(Common to all Non circuit branches)	3	0	0	0	3
UNIT I	ELECTRICAL CIRCUITS & MEASUREMENTS					9
Elementary concepts of electric circuits - Ohm's Law–Kirchoff's Laws– Introduction to AC Circuits – Peak value and RMS values – Power and Power factor						
Operating Principles of Moving coil and Moving iron instruments (Ammeters and Voltmeters), Dynamometer type wattmeter, Energy meter						
UNIT II	ELECTRICAL MACHINES					9
Construction, Principle of operation, Basic equations and applications of DC Generator, DC Motor- Elementary treatment of Single phase Transformer, Single and three phase Induction Motors						
UNIT III	WIRING, GROUNDING AND SAFETY					9
Wiring: General Rules, materials and accessories, Types of wiring - Conduit wiring – Wiring layout of Residential building, Grounding: Importance of grounding, Types of grounding - Safety: Causes of accidents, Accident prevention.						
Design of residential wiring using DT concept.						
UNIT IV	ANALOG ELECTRONICS					9
Construction, working principle and VI characteristics of Diode, Zener diode, BJT, MOSFET, Applications: Half wave and Full wave Rectifiers, Voltage regulators, UPS						
UNIT V	LINEAR AND DIGITAL ELECTRONICS					9
Ideal OP-AMP characteristics, Inverting and Non-inverting Amplifiers, Applications: summer, clipper and clamper						
Boolean Algebra-Theorems-Logic Gates - Half Adder and Full Adders - Flip flops, A/D and D/A Conversion (Any one concept)						
		L : 45	T : 0	P : 0	J : 0	Total: 45 PERIODS

TEXT BOOKS

- 1 Muthusubramanian R, Salivahanan S, "Basic Electrical and Electronics Engineering", Tata McGraw Hill Publishers, (2009).
- 2 Bhattacharya. S.K, "Basic Electrical and Electronics Engineering", Pearson Education, (2017).

REFERENCES

- 1 V.Mittle "Basic Electrical Engineering", Tata McGraw Hill Publishers, (2017)
- 2 Mehta VK, Mehta Rohit, "Principles of Electrical Engineering and Electronics", S.Chand & Company Ltd, (2010)
- 3 Black & Decker, "The complete guide to Electrical Wiring", S.Chand & Company Ltd, (2012)
- 4 Nagrath. I.J, "Electronics: Analog and Digital", Prentice Hall India Pvt. Ltd., (2013),
- 5 Mehta V K, Mehta Rohit, "Principles of Electronics", S.Chand & Company Ltd, (2005)

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Familiarize the elementary concept of electric circuits and measuring instruments
- CO2** Understand the construction, operation and applications of electrical machines
- CO3** Apply the concept of wiring and acquire the importance of grounding and safety
- CO4** Gain knowledge on electronic devices and its applications
- CO5** Acquire knowledge on basics of linear and digital electronics

19CHB101	CHEMISTRY FOR ENGINEERS	L	T	P	J	C
	(Common to MECH, MCT, AUTO, AERO, AGRI, CIVIL & FT)	3	0	2	0	4
UNIT I	CORROSION AND ITS CONTROL					9

Corrosion: Classification- Chemical corrosion (Oxidation corrosion), Electrochemical corrosion-mechanism.-Corrosion control-Corrosion inhibitors- Cathodic protection (Sacrificial anodic protection, Impressed current cathodic protection) – Protective coating- Paint and Electroplating (Au)

UNIT II	NANO CHEMISTRY	9
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Basics-Distinction between nanoparticles and bulk materials-Top down and Bottom up approach- -Sol gel method-Chemical vapour deposition- -Types (Nano clusters, Nano rods, Nanotubes and Nanowires)-Application of nanomaterials.

UNIT III	FUELS AND COMBUSTION	9
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Fuels-types-Coal-Classification-manufacture of metallurgical coke by Otto-Hoffmann method- Petroleum -Synthetic petrol-Fischer and Bergius method- Knocking-Octane number and Cetane number - Gaseous fuels-Biogas, CNG and LPG.-Combustion- Calorific value-Gross and Net calorific value (Definition only) -Flue gas analysis by Orsat Apparatus.

UNIT IV	WATER AND INSTRUMENTAL ANALYSIS	9
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Water - Water quality parameters pH, TDS, chloride, sulphate, iron, fluoride, nitrate, BOD, COD and heavy metals - Hardness-Types - Water softening method -External treatment-Demineralization-Desalination – Reverse osmosis- Municipal water treatment - Principle and instrumentation of UV-Vis AAS and Flame photometry. (Block Diagram only).

UNIT V	ALLOYS AND ENGINEERING MATERIALS	9
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Alloys-classification - Ferrous alloys (Nichrome and stainless steel only)-Non-ferrous alloys (brass and bronze) Heat treatment of steel-Refractory bricks – Classification –Manufacture of refractory bricks- Glass – types of glasses- Soft glass, hard glass and pyrex glass - Manufacture of glass-Cement –Types – Portland cement-Chemical composition of Portland cement- Functions and Limitations of cement ingredients.

LIST OF EXPERIMENTS(ANY FIVE)	30
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1. Estimation of alkalinity by indicator method
2. Determination of Total and permanent hardness by EDTA method
3. Estimation of DO by winkler's method
4. Determination of corrosion rate of mild steel by weight loss method
5. Synthesis of nanomaterials by wet chemical technique
6. Estimation of strength of iron by spectrophotometry
7. Separation of components by column chromatography technique
8. Estimation of copper in brass by EDTA method
9. Estimation of calcium in mik powder by EDTA method

10. Estimation of Iodine in common salt by Iodometry

L :45 T: 0 P: 30 J: 0 T:75 PERIODS

TEXT BOOKS

- 1 O.G.Palanna, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi.2017.
2. Wiley, "Engineering Chemistry", John Wiley & Sons, Inc, USA (2014]

REFERENCES

- 1 B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2009).
- 2 R. Sivakumar and N Sivakumar, "Engineering Chemistry" Tata McGraw-Hill, Pub.Co.Ltd. New Delhi.2009
- 3 Dr.Sivanesan and Nandagopal, "Engineering Chemistry-I" V.K.Pub.Pvt.Ltd. 2011.
- 4 P.C.Jain & Monica Jain, "Engineering Chemistry" , Dhanapathi Publishing Company Pvt.Ltd. 2017.
- 5 Engineering chemistry (NPTEL e-Web book) by B.L.Tembe, Kamaluddin and M.S.Krishnan

COURSE OUTCOMES :

At the end of the course student should be able to:

- CO1** Develop new strategy for protection of metals and to improve engineering design
- CO2** Design environmentally benign method for nanoparticle synthesis
- CO3** Acquire knowledge on various types of fuels and applications of engineering materials.
- CO4** Develop innovative and eco-friendly method for water purification .
- CO5** Develop analytical proficiency through lab skill sets to demonstrate in professional practice

19ENB101	COMMUNICATIVE ENGLISH	L	T	P	J	C
	(Common to all B.E. / B. Tech. Courses)	2	0	2	0	3
	SYNTAX & COMPREHENSIVE SKILLS					
UNIT I	FUNCTIONAL GRAMMAR					12
Vocabulary building – (Word formation –Prefixes & Suffixes, root words, One word substitution) – Parts of speech - Tenses - Voice - Concord (Subject & Verb agreement) – Articles – Prepositions – Cause and Effect Expressions – ‘If’ Conditionals.						
UNIT II	READING					10
Reading techniques – SQ3R– Reading and understanding the Context - Cloze exercises – Reading & note-making –Transfer of information (bar chart, flowchart & Pie chart) – Reading and reviewing Books/Articles.						
UNIT III	WRITING					13
Syntax and Sentence construction - Permission letter (for Industrial Visit & In-plant training) - Expository writing – Discourse markers – Technical writing – (Recommendation – Report Writing) – Checklist.						
	AUDITORY AND ORATORICAL SKILLS					
UNIT IV	LISTENING					10
Listening for general content – Listening for specific information - Listening to telephonic Conversation – Listening and note-taking – Listening and synthesizing information.						
UNIT V	ORAL COMMUNICATION					15
Greetings, Formal and informal introduction of self and others – Stress and Intonation – Word stress & Sentence stress – Describing an object or an event – Presentation skills(General topic) – Conversational skills – four types of speeches – Extempore, Manuscript, Impromptu, Memorized.						
		L : 30	T: 0	P:30	J: 0	Total: 60 PERIODS

TEXT BOOKS

- 1 Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi, 2011.
2. Rizvi, Ashraf. M. Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005.

REFERENCES

- 1 Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
- 2 Mitra K. Barun, “Effective Technical Communication – A Guide for Scientists and Engineers”, Oxford University Press, New Delhi, 2006.
- 3 Leo Jones, Richard Alexander, New International Business English, updated Edition, Cambridge University Press, NY, USA.
- 4 Smith—Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA.
- 5 Sharon J. Gerson, Steven M. Gerson, “Technical Writing – Process & Product”. 3rd Edition, Pearson Education (Singapore) (P) Ltd., New Delhi.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Use their active and passive vocabulary and construct basic sentence structures.
- CO2** Become active readers who comprehend ambiguity and complexity, and can articulate their own interpretations.
- CO3** Write effectively and flawlessly avoiding grammatical errors for a variety of professional and social settings.
- CO4** Make learners acquire listening skills in both formal and informal contexts.
- CO5** Exhibit their skills for effective communication in personal and official conversations/ situations.

19GEB101	DESIGN THINKING AND INNOVATION	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	1	0	0	4	3
UNIT I	INTRODUCTION TO DESIGN THINKING				3+12	
A brief insight to Design Thinking and Innovation- People Centered Design & Evoking the 'right problem' - Purpose of Design Thinking- Design Thinking Framework.						
UNIT II	PROCESS IN DESIGN THINKING (EMPATHY, DEFINE)				3+12	
Design Thinking Process – Empathy – Uncovering and Investigating Community Concerns - Define: Examine and Reflect on the problem.						
UNIT III	CONCEPTING AND BUILDING (IDEA, CREATE)				3+12	
Generating Ideas-Identifying top three ideas-Bundling the Ideas and create concepts-Rapid Prototyping						
UNIT IV	TESTING, REFINING AND PITCHING THE IDEAS				3+12	
Importance & Testing the Design with People-Retest and Redefine Results-Creating a Pitch for the design.						
UNIT V	VALUE PROPOSITION DESIGN				3+12	
Business Vs Startup-Briefing the Problem-Problem Validation and User Discovery- Challenge Brief.						
L :15 T: 0 P: 0 J: 60 T:75 PERIODS						

TEXT BOOKS

- 1 Robert A Curedale0, Design Thinking Process & Methods 4th Edition, December 2017, Design Community College Inc.
- 2 Andrew Pressman, Design Thinking: A Guide to Creative Problem Solving for Everyone, First Edition, Nov 2018, Routledge.

REFERENCES

- 1 Idris Mootee, Design Thinking for Strategic Innovation - What They Can't Teach You at Business or Design School, First Edition, 2017, Wiley.
- 2 Yves Pigneur, Greg Bernarda, Alan Smith, Trish Papadacos Alex Osterwalder, Value Proposition Design: How to Create Products and Services Customers Want, 2015, Wiley.
- 3 Brown, Tim, and Barry Katz. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, 2009, Harper Business.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Learn new approach-design thinking—that enhances innovation activities in terms of market impact, value creation, and speed.
- CO2** Feel the Empathy and can define their problems based on the Community Concerns
- CO3** Strengthen their individual and collaborative capabilities to identify customer needs, create sound concept hypotheses, collect appropriate data, and develop a prototype that allows for meaningful feedback in a real-world environment
- CO4** Translate broadly defined opportunities into actionable innovation possibilities and recommendations for client organization
- CO5** Become an Entrepreneurs

19GEP101	WORKSHOP PRACTICES LABORATORY	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	0	0	4	0	2

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL) 30

CIVIL ENGINEERING 12

Study of plumbing tools and Components

Preparation of threads in pipes

Preparation of single and multi-tap connections for domestic

Study of carpentry tools and its applications

Preparation of Cross Lap and Dove Tail Joints.

MECHANICAL ENGINEERING 18

Study of different types of Welding and its applications

Preparation of Butt, Lap and Tee joints

Study of sheet metal and its applications

Preparation of Rectangular, Square Trays and Funnel

Demonstration of Lathe and Drilling Operations

Demonstration of Smithy and Foundry tools.

GROUP B (ELECTRICAL AND ELECTRONICS) 30

ELECTRICAL ENGINEERING PRACTICE 18

Residential house wiring using switches, fuse, miniature circuit breaker, indicator, Lamp and energy meter.

Fluorescent lamp wiring.

Stair-case wiring.

Measurement of electrical quantities –voltage, current, power & power factor in RL Circuit.

Measurement of energy using single phase energy meter.

Measurement of insulation resistance to earth of electrical equipment.

Measurement of single and three phase voltages.

Study of Iron Box, Emergency Lamp and Fan.

ELECTRONICS ENGINEERING PRACTICE 12

Study of Electronic components and equipments –Resistor, color coding, measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.

Verification of logic gates: AND, OR, Ex-OR and NOT.

Generation of Clock Signal.

Soldering practice –Components Devices and Circuits Using general purpose PCB.

Characteristics of a PN Junction diode

L : 0 T: 0 P: 60 J: 0 Total:60 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Demonstrate plumbing system and Carpentry for the required applications.

CO2 Relate the basic machining operations with engineering problems.

CO3 Apply different types of Welding processes and Sheet metal processes for the Industrial applications.

CO4 Illustrate Residential House wiring and simple wiring circuits.

CO5 Employ knowledge on measuring electrical quantities and usage of energy meters.

19HST103	INDIAN CONSTITUTION	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	2	0	0	0	0
UNIT I	INTRODUCTION				6	
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.						
UNIT II	STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT				6	
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.						
UNIT III	STRUCTURE AND FUNCTION OF STATE GOVERNMENT				6	
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.						
UNIT IV	CONSTITUTION FUNCTIONS				6	
Indian Federal System – Center – State Relations – President’s Rule – Constitutional Amendments – Constitutional Functionaries – Assessment of working of the Parliamentary System in India.						
UNIT V	ELECTION COMMISSION				6	
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.						
L :30 T: 0 P: 0 J: 0 T:30 PERIODS						

TEXT BOOKS

- 1 Durga Das Basu, “Introduction to the Constitution of India”, Prentice Hall of India, New Delhi.
- 2 R.C.Agarwal, “Indian Political System”, S.Chand and Company, New Delhi. (1997)

REFERENCES

- 1 Maciver and Page, “ Society: An Introduction Analysis “, Mac Milan India Ltd., New Delhi.
- 2 K.L.Sharma, “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi. (1997)
- 3 Sharma, Brij Kishore, “Introduction to the Constitution of India”, Prentice Hall of India, NewDelhi.
- 4 U.R.Gahai, “Indian Political System”, New Academic Publishing House, Jalaendhar.
- 5 R.N. Sharma, “Indian Social Problems”, Media Promoters and Publishers Pvt. Ltd.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Understand the functions of the Indian government
- CO2** Know the structure and functioning of central government.
- CO3** Understand functioning of Indian constituent.
- CO4** Analyze the functions of the Indian government
- CO5** Summarize the functioning of election commission.

SEMESTER II

19ITT101	PROGRAMMING IN C AND DATA STRUCTURES	L	T	P	J	C
	(Common to Aero, Agri, Auto, Civil, FT, Mech, MCT)	3	0	0	0	3
UNIT I	INTRODUCTION TO C					8
Basic blocks of computers – Algorithm, Pseudo code, Flowchart - Structure of C program- Data types - Variables - Constants, Operators - Input and Output Statements						
UNIT II	DECISIONS STATEMENTS AND FUNCTIONS					11
Decision making and Branching statements - Looping statements, Functions, Call by value, Call by reference						
UNIT III	ARRAYS AND INTRODUCTION TO DATA STRUCTURES					10
Arrays - One dimensional arrays - Two dimensional Arrays - Structures – Pointers Introduction to Data structures - Types of Data structures - ADT						
UNIT IV	STACK AND QUEUE					9
Stack ADT - Queue ADT - Array implementation of Queue and Stack ADT - Infix to Postfix conversion - Postfix expression evaluation						
UNIT V	TREES					7
Trees - Binary Tree - Binary Search Tree - Insertion and Deletion Operation - Tree Traversal						
		L : 45	T: 0	P:0	J: 0	Total: 45 PERIODS

TEXT BOOKS

- 1 Kamthane Ashok, "Programming in C, Pearson Education India 3/e, 3rd Edition, 2015.
- 2 Aaron M. Tenenbaum, Yedidyah Langsam, Moshe Augenstein, "Data Structures Using C", Prentice-Hall of India, 2003

REFERENCES

- 1 A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, 2nd Edition, 2007. (Unit III-V)
- 2 A. M. Tenenbaum, Y. Langsam and M. J. Augenstein, "Data Structures using C", Pearson Education, 2nd Edition, 1998.(Unit III-V)
- 3 E. Balagurusamy, "Fundamentals of Computing and Computer Programming", Tata McGraw-Hill Publishing Company Limited, (2011). (UNIT I, II)

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand and describe the role of front-end development in modern web applications
- CO2** Act like a professional front-end developer.
- CO3** Able to analyze problems, seek for needed information, apply a solution, verify it
- CO4** See the alternative ways for creating a front-end
- CO5** Able to discuss and take into use more front-end technologies.

19MET102	ENGINEERING MECHANICS	L	T	P	J	C
	(Common to All Non Circuit Branches)	3	1	0	0	4
UNIT I	BASICS & STATICS OF PARTICLES					9+3
Introduction -Units and Dimensions -Vectorial representation of forces and moments -Coplanar Forces -Laws of Mechanics -Lame's theorem, Parallelogram and triangular Law of forces - Resolution and Composition of forces -Equilibrium of a particle - Principle of transmissibility - Single equivalent force - Free body diagram						
UNIT II	EQUILIBRIUM OF RIGID BODIES					9+3
Types of supports and their reactions -requirements of stable equilibrium -Moments and Couples- Moment of a force about a point and about an axis -Vectorial representation of moments and couples - Scalar components of a moment -Varignon's theorem -Equilibrium of Rigid bodies in two dimensions -Forces in space -Equilibrium of a particle in space - Equivalent systems of forces - Equilibrium of Rigid bodies in three dimensions-Examples						
UNIT III	PROPERTIES OF SURFACES AND SOLIDS					9+3
Determination of centroid of areas, volumes and mass - Pappus and Guldinus theorems - moment of inertia of plane and areas- Parallel axis theorem and perpendicular axis theorem, radius of gyration of area- product of inertia- mass moment of inertia.						
UNIT IV	DYNAMICS OF PARTICLES					9+3
Displacements, Velocity and acceleration, their relationship - Relative motion -Curvilinear motion - Newton's law -Work Energy Equation of particles -Impulse and Momentum -Impact of elasticbodies.						
UNIT V	FRICTION AND RIGID BODY DYNAMICS					9+3
Friction force - Laws of sliding friction - equilibrium analysis of simple systems with sliding friction -wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.						
		L : 45	T: 0	P: 15	J: 0	Total: 60 PERIODS

TEXT BOOKS

1. Ferdinand P.Beer, E.Russell Johnston Jr "Vector Mechanics for Engineers", 11th Edition, McGraw-Hill Education, (India) Pvt Ltd, 2016.
2. J.L.Meriam& L.G. Karidge, "Engineering Mechanics: Dynamics", 8th edition, Wiley student edition, 2016.

REFERENCES

- 1 Vela Murali, "Engineering Mechanics", Oxford University Press ,2010
- 2 D.P.Sharma "Engineering Mechanics", Dorling Kindersley (India) Pvt. Ltd, New Delhi,2010.
- 3 Dr.I.S Gujral "Engineering Mechanics",Second edition, , Lakshmi Publication (P).Ltd,2011.
- 4 Arthur P.Boresi and Richard J.Schmidt, "Engineering Mechanics : Statics and Dynamics",Thomson Asia Private Limited, Singapore, 2010.
- 5 Hibbeler, R.C., "Engineering Mechanics", 14th edition, Prentice hall ,2016.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Recognize the basics of equilibrium of particles in 2D and 3D
- CO2** Review the requirements of equilibrium of rigid bodies in 2D and 3D
- CO3** Compute the center of mass and moment of inertia of surfaces and solids
- CO4** Predict displacement, velocity and acceleration of dynamic particles
- CO5** Solve for friction force and rigid body dynamics

UNIT I PHASE DIAGRAM

Home Ruthur theory - Phase rule, lever rule, Free energy of phase mixture Lecture, Unary systems, Effect of pressure on phase diagrams, Phase Diagrams of Binary, Eutectic, Eutectoid, peritectic, peritectoid systems, Iron carbon equilibrium diagram

UNIT II FERROUS AND NON-FERROUS MATERIALS**9**

Properties, Compositions and uses of Grey cast iron, Malleable iron, SG iron and steel, Properties, Compositions and uses of Aluminium, Copper, Titanium, and Magnesium alloys. Properties of ceramic materials – Al₂O₃, SiC, Composite materials – Types, Manufacturing Properties and application.

UNIT III PROPERTIES OF MATERIALS**9**

Mechanical Properties - Stress-strain diagrams of metallic, ceramic and polymeric materials, modulus of elasticity, yield strength, tensile strength, toughness, elongation, plastic deformation, viscoelasticity, hardness, impact strength, creep, fatigue, ductile and brittle fracture. Thermal Properties - Heat capacity, thermal conductivity, thermal expansion of materials. Environmental Degradation - Corrosion and oxidation of materials, prevention

UNIT IV TESTING OF MATERIALS**9**

Introduction; Indentation hardness testing: Brinell, Rockwell, Meyer, Vicker and Knoop hardness testing. Meyer's law. Micro- and nano-hardness testing. Impact testing with Charpy and Izod specimens. Drop weight testing. Fatigue and creep testing. NDE Methods – Visual, liquid penetrant testing, magnetic particle testing, ultrasonic testing, Eddy current testing

UNIT V ADVANCED MATERIALS AND TOOLS**8**

Smart materials, exhibiting ferroelectric, piezoelectric, optoelectric, semiconducting behavior, lasers and optical fibers, photoconductivity and superconductivity, nanomaterials, synthesis, properties and applications, biomaterials, superalloys, shape memory alloys. Materials characterization techniques such as, scanning electron microscopy, transmission electron microscopy, atomic force microscopy.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**TEXT BOOKS**

1. Callister, W.D., Materials Science & Engineering: An Introduction, Wiley & Sons (2001).
2. Smith, W., Principles of Materials Science and Engineering. McGraw Hill (1990).

REFERENCES

1. Dieter George E. Mechanical Metallurgy, Mc-Graw-Hill Book Company (SI ed.) (1989).
2. Suryanarayana C. Experimental Techniques in Materials and Mechanics, CRC Press (1980).
3. Rangwala, S.C., "Engineering Materials", Charotar Publishing House, Anand, 2016.
4. Surendra Singh, "Building Materials" Vikas Publishing Company, New Delhi, 2016.

COURSE OUTCOMES

At the end of the course student should be able to:

- | | |
|------------|---|
| CO1 | Explain basic relationships between structure and properties of metallic, ceramic and polymeric materials as well as composites, |
| CO2 | Make qualitative comparisons between materials and application areas for the most common technical materials in the various materials categories, |
| CO3 | Interpret and use binary phase diagrams, |
| CO4 | Explain the underlying mechanisms for hardening of metals, |
| CO5 | Describe various methods for characterization material properties |

UNIT I CRYSTAL PHYSICS

9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures.

UNIT II QUANTUM PHYSICS

9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jean's Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Physical significance of wave function -Schrödinger's wave equation – Time independent and time dependent equations– Particle in a one dimensional box –Electron microscope-Tunnelling electron microscope.

UNIT III ELASTICITY

9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT IV NON-DESTRUCTIVE TESTING

9

Introduction- Types of defects-Methods of NDT-Visual inspection- Liquid/Dye penetrant testing- Magnetic particle testing-Eddy current testing- Ultrasonic inspection method-Advantages-X-Ray radiography- X-ray fluoroscopy-Comparision of conventional and real time radiography.

UNIT V VACUUM TECHNOLOGY

9

Introduction-Units of Vacuum- Vacuum ranges- Production of Vacuum- Classification of Vacuum pumps-Rotary Oil pumps-Diffusion oil pump-turbomolecular pump-cryopumps-Vacuum gauges-thermocouple gauge- vacuum technology-Application of vacuum-High vacuum systems- Thin film deposition.

LIST OF EXPERIMENTS(ANY FIVE)

1. Determination of Young's modulus of the material – uniform bending.
2. Tensional Pendulum - determination of rigidity modulus of wire and moment of inertia of disc.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4. Determination of viscosity of liquid – Poiseuille's method.
5. Determination of thickness of a thin wire – Air wedge method.
6. Determination of Band gap of semiconductor material.

L :45 T: 0 P: 30 J: 0 T: 75 PERIODS**TEXT BOOKS**

- 1 Gaur R.K. And Gupta S.L, "Engineering Physics", Dhanpat Rai publishers, 2013
- 2 Dr.M.N.Avandhanulu, Dr.P.G.Kshirsagar, "A Text book of Engineering Physics", S.Chand,

REFERENCES

- 1 Rajendran.V, Engineering Physics,TataMcgraw-Hill Publishing Company Limited, New Delhi.2017
- 2 Engineering Physics, Wiley, 2013
- 3 A.S.Vasudeva, "Modern Engineering Physics", S.Chand, 2001
- 4 B.K.Pandey Chaturvedi, "Engineering Physics", Cengage Learning, 2012
- 5 Charles Kittel, "Solid State Physics", Wiley(2009)

COURSE OUTCOMES:

At the end of the course student should be able to:

- CO1** Understand the properties of the crystalline materials.
- CO2** Understand the basics of quantum mechanics
- CO3** Analyze the elastic properties of the materials.
- CO4** Understand various Non-Destructive testing methods.
- CO5** Understand various Non-Destructive testing methods.

(Common to all B.E. / B. Tech. Courses) **3 0 2 0 4**

Double integration (Cartesian co-ordinates) – Change of order of integration – Applications of double integral (Area) – Triple Integration (Cartesian co-ordinates) – Applications: Volume as triple integrals and solids of revolution.

Derivatives: Gradient of a scalar field. Directional derivative – Divergence of a vector field – Curl of a vector field – Solenoidal and Irrotational of a vector – Theorems in divergence of Gauss, Stoke's and Greens (statements only) – Verification of theorem.

Derivatives of $f(z)$ – Analytic function – Cauchy-Riemann Equations – Harmonic function – Harmonic conjugate – Construction of Analytic function – Conformal Mapping – Conformality of $w = z + c$, cz , $1/z$ – Mobius transformations – Application to flow problems.

Cauchy's integral theorem – Cauchy's integral formula – Taylor's series – Zeros of an analytic function – singularities – Laurent's series – Residues – Cauchy Residue theorem.

Conditions – Transforms of elementary functions – Properties - Transform of derivatives and integrals – Unit step function (Heaviside function) –Dirac’s Delta function – Laplace transform of periodic functions – Inverse Laplace transforms - Convolution theorem – Partial fraction method – Applications to solution of linear ordinary differential equations of second order with constant coefficients – Simultaneous linear equations with constant coefficients.

1. Introduction to SCILAB / MATLAB.
2. Determining the roots of polynomial equations.
3. Basic integration problems.
4. Evaluating double & triple integrals.
5. Calculating area using double integration.
6. Calculating volume – Simple problems.
7. Curve fitting.
8. Graph with 2D & 3D plots.

TEXT BOOKS

1. B.S.Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2015.
2. Dennis G.Zill and Michael P. Cullen, Advanced Engineering Mathematics, 2nd Edition, CBSPublishers, 2012.

1 Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2018.
2 G.B.Thomas, Calculus, 12th Edition, Pearson Education India, 2015.
3 T.Veerarajan, Engineering Mathematics, 3rd Edition, Tata McGraw-Hill, 2011.
4 N.P. Bali and Manish Goyal A, Advanced Engineering Mathematics, 7th Ed, Laxmi Publications, 2010.
5 Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill, 2017.

At the end of the course student should be able to:

- | | |
|------------|--|
| CO1 | Evaluate area and volume in Cartesian coordinates using double and triple integrals and also using mathematical software. |
| CO2 | Evaluate gradient, divergence and curl and solve engineering problems involving cubes, rectangular parallelepipeds by applying various integral theorems. Apply mathematical software to find gradient, divergence and curl. |
| CO3 | Test the analyticity, construct the analytic function and transform complex functions from z-plane to w-plane graphically by using conformal mapping. |
| CO4 | Evaluate real and complex integrals over suitable closed path using various integral theorems. |
| CO5 | Apply Laplace transform techniques, transform functions in time domain to frequency domain and solve ordinary differential equation by using mathematical software. |

19ENP101	PROFESSIONAL COMMUNICATION	L	T	P	J	C
	(Common to all B.E. / B. Tech. Courses)	0	0	4	0	2
UNIT I	INTRODUCTION TO COMMUNICATION					10
Introduction to communication, The process of communication, Barriers to communication – Verbal & Nonverbal communication, Body language.						
UNIT II	READING AND LISTENING SKILLS					10
Reading and Summarizing – Precis writing – Phrase Reading – Listening to TED Talks – Listening to conversations.						
UNIT III	PROFESSIONAL WRITING					10
Resume & cover letter – Proposal writing (Project/Business proposal) - Business Letter (Quotations, Clarification, Placing orders & Complaint letter).						
UNIT IV	SPEAKING					15
Persuasive Speaking – Public Speaking – Negotiation Skills – Telephone Etiquettes – Group Discussion - Team building – Interview skills.						
UNIT V	SOFT SKILLS					15
Time Management - Stress Management – Inter & Intra personal skills –Professional ethics - Professional Networking & Social Skill.						

L : 0 T : 0 P:60 J: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi, 2011.
2. Professional Communication - ArunaKoneru—Oxford University Press, New Delhi.

REFERENCES

- 1 A Modern Approach to Verbal and Non-verbal Reasoning-R.S.Agarwal- S.Chand& Co., New Delhi.
- 2 Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007.
- 3 Mitra K. Barun, “ Effective Technical Communication – A Guide for Scientists and Engineers”, Oxford University Press, New Delhi, 2006.
- 4 Jeff Butterfield, “Soft skills for everyone”, Cengage Learning, New Delhi, 2011.
- 5 Leo Jones, Richard Alexander, New International Business English, updated Edition, Cambridge University Press, NY, USA.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Perceive the importance of verbal and non-verbal communication in the professional world along with its uses.
- CO2** Develop reading skills and listening skills by familiarizing them with different strategies.
- CO3** Acquire letter writing skills for effective communication both in formal and informal situations.
- CO4** Speak clearly, confidently, comprehensively, and communicate with one or many listeners using appropriate communicative strategies.
- CO5** Face the challenges of the globalized world with confidence and with the best communicative skills.

LIST OF EXPERIMENTS

1. Algorithms and Flow Chart
 - i. Sequential
 - ii. Branching and Looping
2. Operators & Expressions
 - i. Arithmetic
 - ii. Logical
 - iii. Relational
3. Condition Statements
 - i. Nested if else
 - ii. Else-if Ladder
4. Looping
 - i. For
 - ii. While
 - iii. Do-while
5. Functions
 - i. With and without arguments
 - ii. With and without return type
 - iii. Call by value and Call by reference
6. Arrays
 - i. Searching element in one dimensional array
 - ii. Matrix multiplication
7. Structures
8. Pointers
9. Implementation of Stack ADT
10. Implementation of Queue ADT
11. Implementation of Tree Traversal
12. Implementation of Binary Search Tree ADT

L : 0 T : 0 P : 60 J : 0

Total:60 PERIODS**HARDWARE / SOFTWARE (For a Batch of 30 Students)**

- | | |
|-----------------|---|
| Hardware | <ul style="list-style-type: none"> ▪ 30 PCs with Processor-2.0 GHz orHigher ▪ RAM-1 GB orHigher ▪ Hard disk-20 GB orHigher |
| Software | <ul style="list-style-type: none"> ▪ TURBO C version 3 (or) GCC version3.3.4 ▪ OS-Windows2000/WindowsXP/NT |

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** develop algorithm and draw flow chart to solve problem.
- CO2** write simple programs using basic concepts and control statements in C language.
- CO3** write programs using arrays, structures and pointers.
- CO4** implement stack and queue data structure
- CO5** implement binary search tree ADT

Guidelines

1. The scope of the project work is to enable the students in convenient groups (not more than 4 members) involving theoretical and experimental studies through Design Thinking approach.
2. The aim of the project work is to deepen comprehension of principles by applying them to a new problem based on the courses such as Physics, Chemistry, Electrical & Electronics, Material science, Engineering mechanics, Basics of Mechatronics, Programming in C, Data structures studied by the students in the first year of study but not limited to.
3. Project periods shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
4. Create a model/fabricate a model/conduct experiment/simulate mechanical system/implement the same. Analyze data, evaluate the results and conclude the appropriate solution, suggestion for future work.
5. The continuous assessment shall be made according to the regulation which is tabulated below.
6. The progress of the project is evaluated based on a minimum of two reviews.
7. The review committee may be constituted by the Head of the Department
8. Each student shall finally produce a comprehensive report covering background information, empathy, problem statement, project work details, result, conclusion and publications.
9. This final report shall be typewritten form as specified in the guidelines.

L : 0 T: 0 P: 0 J: 30 Total: 30 PERIODS

19HST102	ENVIRONMENTAL SCIENCES	L	T	P	J	C
	(Common to all B.E / B.Tech)	2	0	0	0	0
UNIT I	ECOSYSTEM					6
Ecosystem- Foodchains, Foodwebs and Ecological pyramids - (a) Forest ecosystem (b) Aquatic ecosystems (Ponds & Oceans). Field study of simple ecosystems– pond, river, hill slopes.						
UNIT II	BIODIVERSITY					6
Introduction to biodiversity– Values of biodiversity– threats to biodiversity–endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds, etc.,						
UNIT III	ENVIRONMENTAL POLLUTION					6
Definition–causes, effects and control measures of:(a) Air pollution(b) Water pollution (c) Soil pollution (d) Noise pollution (e) Nuclear hazards. Field study of local polluted site–Urban/ Rural / Industrial/ Agricultural.						
UNIT IV	ENERGY RESOURCES					6
Introduction – (a) Solar energy (b) Wind energy (c) Tidal energy (d) Geothermal energy (e) Nuclear Energy Field study of local area.						
UNIT V	ENVIRONMENTAL MANAGEMENT					6
Sustainable development - Role of information technology in environment and human health – environmental protection Acts -Solid waste management and Rain water harvesting - E -waste and Concepts of Green Chemistry-Radiation hazards- Case studies.						
		L :30	T: 0	P: 0	J: 0	T: 30 PERIODS

TEXT BOOKS

- 1 Dr.A.Ravikrishnan, “Environmental Science & Engineering” Sri Krishna Hitech Pub.Co.Pvt.Ltd.2013
- 2 Benny Joseph, “Environmental Science & Engineering” Tata McGraw-Hill Pub.Co.Ltd, New Delhi.2009

REFERENCES

- 1 G.Tyler Miller, “Environmental Science” Cengage Learning India Pvt.Ltd.New Delhi.2011
- 2 Dr.Debang Solanki, “Principles of Environmental Chemistry” Prateeksha Pub. Jaipur.2011.
- 3 Gilbert M. Masters and Wendell. P.Ela, “Introduction to Environmental Engineering and Science” PHI Learning Pvt. Ltd. New Delhi.2010
- 4 Deeksha Dave and S.S. Katewa, “Environmental Science & Engineering” Learning India Pvt.Ltd.New Delhi.2011
- 5 Benny Joseph “Environmental Science & Engineering” Tata McGraw-Hill Pub.Co.Ltd, New Delhi. 2009

COURSE OUTCOMES :

At the end of the course student should be able to:

- CO1** Gain basic knowledge of Ecosystem.
- CO2** Understand the role and conservation of biodiversity
- CO3** Gain competency in solving environmental issues of pollution
- CO4** Adopt the methodologies in find the changes in renewable energy
- CO5** Understand the development and improvement in standard of living has led to serious Environmental management.

SEMESTER III

19MAT201	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	J	C
	(Common to all B.E. / B. Tech. Courses)	3	0	0	0	3
UNIT I	FOURIER SERIES					9
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.						
UNIT II	FOURIER TRANSFORMS					9
Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem– Parseval's identity.						
UNIT III	PARTIAL DIFFERENTIAL EQUATIONS					9
Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second order with constant coefficients (Homogeneous Problems).						
UNIT IV	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS					9
Classification of partial differential equations -Solutions of one dimensional wave equation – One dimensional equation of heat Conduction – Steady state solution of two-dimensional equation of heat conduction (Excluding Infinite plate & Insulated edges).						
UNIT V	Z -TRANSFORMS					9
Z-transforms – Elementary properties – Inverse Z - Transform – Convolution theorem –Formation of difference equation –Solution of difference equations using z-transforms.						
		L : 45	T:0	P: 0	J: 0	Total: 45 PERIODS

TEXT BOOKS

- 1 Grewal, B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publications, Delhi, 2017.
2. Ramana, B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2014.

REFERENCES

- 1 Bali, N.P. and Manish Goyal, "A Textbook of Engineering Mathematics", Fifth Edition, Laxmi Publications (P) Ltd., 2014.
- 2 Glyn James, "Advanced Modern Engineering Mathematics", Fourth Edition, Pearson Education, 2013.
- 3 Erwin Kreyszig, "Advanced Engineering Mathematics", Tenth Edition, Wiley India, 2015.
- 4 Dr. Sanjay Sharma., "Signals and Systems", S.K.Kataria & Sons, Publisher of Engineering & Computer Books, New Delhi, 2012.
- 5 Whlie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics" Tata Mcgraw Hill Education Pvt.Ltd, 6th Edition, New Delhi, 2012.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- CO2** Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- CO3** Form partial differential equations and solve certain types of partial differential equations.
- CO4** Know how to solve one dimensional wave equation, one dimensional heat equation and two dimensional heat equation in steady state using Fourier Series.
- CO5** Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

L	T	P	J	C
3	0	0	0	3

UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES**9**

Minimization Techniques: Boolean postulates and laws – De-Morgan's Theorem – Principle of Duality – Boolean expression – Minimization of Boolean expressions — Minterm – Maxterm – Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions – Quine – McCluskey method of minimization.

Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR Implementations of Logic Functions using gates, NAND-NOR implementations

UNIT II COMBINATIONAL CIRCUITS**9**

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor – BCD adder – Binary Multiplier – Binary Divider - Multiplexer/

Demultiplexer – decoder - encoder – parity checker – parity generators – code converters - Magnitude Comparator.

UNIT III SEQUENTIAL CIRCUITS**9**

Latches, Edge triggered Flip flops SR, JK, T, D and Master slave – Characteristic table and equation, Application table, Synchronous counters, Design of synchronous counters, up/down counter, Modulo-n counter, Decade counters.

UNIT IV DESIGN OF SEQUENTIAL CIRCUITS**9**

Register, shift registers, Universal shift register, Ring counters, Classification of sequential circuits: Moore and Mealy, Design of synchronous sequential circuits, state diagram, State table, State minimization, State assignment, Introduction to Hazards: Static, Dynamic

UNIT V DIGITAL LOGIC FAMILIES AND PLD**9**

Memories: ROM, PROM, EEPROM, RAM, Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Implementation of combinational logic using PROM, PLA and PAL, Digital logic families: TTL, ECL and CMOS.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**TEXT BOOKS**

- 1 M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
- 2 John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006

REFERENCES

- 1 John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008.
- 2 Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
- 3 Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.
- 4 S.Salivahanan and S.Arivazhagan, —Digital Circuits and Design, Third Edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2007.
- 5 Donald D.Givone, —Digital Principles and Design, Tata Mc-Graw Hill Publishing company limited, New Delhi, 2002.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the different methods used for simplification of Boolean expressions.
- CO2** Analyze the Combinational circuits.
- CO3** Describe the Sequential building blocks & Memory elements..
- CO4** Design a sequential circuits
- CO5** Classify the different memories and implement the digital circuits

UNIT I FLUID CONCEPTS AND PROPERTIES**9**

Fluid – Definition, real and ideal fluids - Distinction between solid and fluid - Units and dimensions - Properties of fluids - Density, Specific weight, Specific volume, Specific gravity, Viscosity, Capillary and Surface tension, Compressibility and Vapour pressure – Temperature influence on fluid properties. Concept of fluid static pressure - pressure measurements by manometers

UNIT II FLUID KINEMATICS AND DYNAMICS**9**

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration – continuity equation (one, two and three dimensional differential forms) – Equation of stream line – stream function – velocity potential function Fluid dynamics – Euler's equation of motion – Euler's equation of motion along a streamline – Bernoulli equation and its application - Fluid flow - Flow through pipes - Darcy - Weisbach equation - Friction factor – Major and minor losses.

UNIT III HYDRAULIC TURBINES AND PUMPS**9**

Hydro turbines - Definition, types and classifications – Pelton and Francis turbines - Velocity triangles and simple applications - Work done - Specific speed – Efficiencies. Pumps (Descriptive treatment only) - Definition and classifications – Positive Displacement – Dynamic Pumps – Classifications and working principle - Velocity triangles, Work done – Specific speed – Efficiency.

UNIT IV I.C. ENGINES AND AIR COMPRESSORS**9**

Classifications - Four stroke SI & CI engines, Two stroke SI & CI engines, Power developed by engines – Comparison of two stroke and four stroke engines, SI and CI engines. Application of SI & CI engines and simple problems in engine efficiency. Reciprocating air compressors: calculation of volumetric, Isothermal and Isentropic efficiencies - Introduction to multistage compression and its advantages (Descriptive treatment only).

UNIT V REFRIGERATION AND AIR-CONDITIONING (Qualitative Treatment Only)**9**

Principles of refrigeration, refrigerator & heat pump cycle, refrigerants, refrigerant properties, refrigerant selection, vapour compression refrigeration cycle, vapour absorption cycle, dry bulb temperature, wet bulb temperature, relative humidity, comfort air-conditioning, Psychrometric chart, humidification, de-humidification, air coolers, cooling towers.

L : 45 T : 0 P : 0 J : 0 Total: 45 PERIODS**TEXT BOOKS**

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", 5th edition, Laxmi Publications (P) Ltd, New Delhi, 1995.
2. Rajput R K, "Thermal Engineering", Lakshmi Publications 2010.

REFERENCES

1. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd, New Delhi (7th edition), 1995
2. Kothandaraman. C.P., Domkundwar. S. & Domkundwar. A.V., "A course in Thermal Engineering" Dhanpatrai & Co (P) Ltd, Fifth edition, Reprint 2004.
3. Som, S.K., and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill, 2nd Edition, 2004.
4. Ballaney P L, "Thermal Engineering", Khanna Publishers, 2010.
5. Pandya N. C & Shah C. S., "Elements of Heat Engines", Charotar Publishers, 2005.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Gather the basics of fluids and principles behind incompressible fluid.
- CO2** Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- CO3** Analyze the performance of pumps and turbines
- CO4** Understand the basics of engine performance and various efficiencies
- CO5** Understand the working & use of air Compressor and its functionalities

19GET275	VQAR-I	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	2	0	0	0	2
UNIT I	QUANTITATIVE ABILITY I					8
Number theory- Shortcuts, Divisibility rule- Unit place deduction-LCM &HCF, Square root and Cube Root, Decimal & Fraction Percentage, Profit, loss and discount, Simple and compound interest, Ratio & Proportions, Mixtures & Allegation, Partnership.						
UNIT II	QUANTITATIVE ABILITY II					6
Problems on Ages, Average, Clocks, Calendar, Data Interpretation- Bar chart- Pie chart- Line chart- Tables chart.						
UNIT III	VERBAL REASONING I					7
Analytical reasoning– Linear and circular arrangement, Blood relation, Direction Problems, Puzzles. Logical reasoning - Number and Alpha series, Odd man out, Element series and Logical series, Coding and decoding, Analogy, Classification, Logical sequence of words.						
UNIT IV	LINGUISTICS SKILLSI					6
Parts of Speech- Noun, Verb, Participle, Articles, Pronoun, Preposition, Adverb, Conjunction. Logical sequence of words, Tense & Voice, Comparison.						
UNIT V	LINGUISTICS SKILLSII					3
Comprehension - Comprehend and understand a paragraph, Paragraph writing.						
		L :30	T: 0	P: 0	J: 0	T: 30 PERIODS

TEXT BOOKS

- 1 Rajesh Varma, “Fast Track Objective Arithmetic”, Arihant Publications.
- 2 M.K.Panday, “Analytical Reasoning”, Magical Series.
- 3 BS Sijwali- Indu Sijwali, A New Approach to “Reasoning Verbal, Non-Verbal & Analytical”, Arihant Publications.
- 4 John Eastwood, “Oxford Practice Grammar”, Oxford.

REFERENCES

- 1 R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication.
- 2 R.S.Agarwal, “Quantitative Aptitude for Competitive Examinations”, S.Chand & Company Pvt Limited.
- 3 R.S.Agarwal, “A modern approach to Verbal & Non-verbal reasoning”, S.Chand & Company Pvt Limited.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO 1** Apply the number system for solving application orientated concepts in quantitative aptitude.
- CO 2** Apply the financial ability for solving application orientated concepts in quantitative aptitude and in the data interpretation techniques.
- CO 3** Analyze the analytical reasoning and logical reasoning in verbal aptitude applications.
- CO 4** Apply appropriate grammar in both speaking and writing.
- CO 5** Analyze the given content and write a creative content.

L	T	P	J	C
3	0	2	0	4
9+6				

UNIT I Metal Cutting

Principles of metal cutting, classification of Metal cutting/machining processes: Orthogonal and oblique cutting, Effect of tool geometry and other cutting parameters, Mechanisms of formation of chips, types of chips formed, chip Breakers, concept of specific cutting pressure, The forces acting on the cutting tool and their measurement, Merchant's circle diagram, force and velocity relationship, Tool wear, Factors causing wear, tool life, variables affecting tool life, economical cutting speed, machinability of metals.

UNIT II Thermal Aspects in Machining, Gear and Thread Manufacturing 9+6

Sources of heat generation in machining and its effects, Temperature Measurement techniques in machining, types of cutting fluids, Functions of cutting fluid, Characteristics of cutting fluid, Application of cutting fluids, Economics of Metal Cutting Operations. Different types of Threads manufacturing methods, and tools involved, Different gear forming and generating methods with their special features, Gears finishing processes

Gear Manufacturing process**UNIT III Joining Processes 9+6**

Operating principle, basic equipment, merits and applications of : Fusion welding processes : Gas welding – Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding – Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of : Resistance welding – Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.

Arc welding and gas welding**UNIT IV Casting and Forging process 9+6**

CASTING-Pattern and Core making – Moulding sand – Melting furnaces, Defects in casting process. Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – forging operations. Rolling of metals– Types of Rolling – Flat strip rolling– shape rolling operations – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion.

Sheet metal work – Formation of square tray, cone.**UNIT V Non-conventional Machining 9+6**

EDM, ECM, AJM, USM, LBM process principle, process parameters and their applications. Process capabilities and their applications. Basics of CNC programming.

CNC programming.

L : 45 T : 0 P : 30 J : 0 Total: 75 PERIODS

TEXT BOOKS

- 1 Hajra Choudhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997.
2. Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2004.

REFERENCES

- 1 Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition, 2006
- 2 Gowri P. Hariharan, A.Suresh Babu, "Manufacturing Technology I", Pearson Education, 2008
- 3 Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson education, 2006
- 4 Paul Degarmo E, Black J.T and Ronald A. Kosher, "Materials and Processes, in Manufacturing" Eight Edition, Prentice – Hall of India, 1997.
- 5 Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 2nd Edition, TMH-2003;

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the basics of cutting, cutting tools, and tool wear. machining processes.
- CO2** Characterize the major machining operations of gear and thread manufacturing.
- CO3** Have an exposure to joining process.
- CO4** Gather knowledge about the casting and forging.
- CO5** Gather knowledge about the CNC and unconventional

UNIT I SIGNAL GENERATORS AND ANALYZERS**9+6**

Function generators –RF signal generators – Sweep generators – Frequency synthesizer – wave analyzer – Harmonic distortion analyzer – spectrum analyzer :- digital spectrum analyzer, Vector Network Analyzer.

Generation of square wave signal using Schmitt trigger

UNIT II DIGITAL INSTRUMENTS**9+6**

Comparison of analog and digital techniques –Types of digital voltmeter – Multimeter — Automation in digital instruments: Automatic polarity indication, automatic ranging, automatic zeroing, fully automatic digital instruments.

To measure and calculate the electrical quantities using multimeters

UNIT III CONTROL SYSTEMS REPRESENTATION**9+6**

Basic elements in control systems – Transfer function - Open and closed loop systems – Transfer function analysis of Electrical and mechanical systems - Block diagram reduction techniques – Signal flow graphs.

To Develop the transfer function for electrical system using MATLAB

UNIT IV TIME RESPONSE AND FREQUENCY RESPONSE ANALYSIS**9+6**

Time response – Time domain specifications – Response of First order and Second order for unit step input - Frequency response –Bode plot-Polar plot – gain margin and phase margin. Design of P, PI, PD, PID Control

To develop the bode plot to analyze the stability factor using MATLAB

UNIT V STABILITY ANALYSIS AND COMPENSATORS**9+6**

Positive real functions- Routh Hurwitz stability criterion - Basics of Lag, lead and lag-lead compensation networks and its related responses, Introduction to State space representation.

Design basic compensators using MATLAB

L : 45 T: 0 P: 30 J: 0 Total: 75 PERIODS**TEXT BOOKS**

- 1 Albert D.Helfrick and William D.Cooper “Modern Electronic Instrumentation and Measurement Techniques”, Pearson / Prentice Hall of India, 2007.
2. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003

REFERENCES

- 1 Benjamin C. Kuo, “Automatic Control systems”, Pearson Education, New Delhi, 2003
- 2 Joseph J.Carr, “Elements of Electronics Instrumentation and Measurement”, Pearson Education, 2003
- 3 Alan. S. Morris, “Principles of Measurements and Instrumentation”, 2nd Edition, Prentice Hall of India, 2003
- 4 David A. Bell, “Electronic Instrumentation and measurements”, Prentice Hall of India Pvt Ltd, 2003

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know the concepts of signal generators and various analyzers.
- CO2** Understand the working principle of digital instrument.
- CO3** Derive the transfer function for Electrical and mechanical system
- CO4** Determine the Stability of a system using time and frequency response
- CO5** Design the various compensators for system

UNIT I INTRODUCTION TO PYTHON

12

Features of Python- Fundamentals of Python – Variables – Data Types

Suggested Experiments

1. Use interactive Shell to print the Hello Example : print 'Hello World'
2. Write a Python Program Using String Variable
3. Write a Python program to store data in list and then try to print them

Write a Python Program to display the following messages "Hello World, Python is High level, General-purpose Programming language"

UNIT II CONTROL FLOW & ARRAYS

12

Conditional Statements – Iteration - List and Arrays

Suggested Experiments

1. Write a Python program to find SUM and MULTIPLICATION of any three numbers.
2. Write a Python program to find the average of any five numbers.
3. Write a Python program to find simple interest.
4. Scenario: A courier company has number of items to be delivered to its intended customers through its salesman. The salesman visits following cities to deliver the respective items:

S. NO.	CITIES	NO. OF ITEMS
1	Aligarh	18
2	Agra	25
3	Baroda	13
4	Banaras	43
5	Chennai	8
6	New Delhi	67
7	New Jalpaiguri	29
8	Howrah	11
9	Kolkata	56
10	Mumbai	33

Solve the following problems based on the above mentioned scenario using Python:

- a) Write a Python program to store and display the above mentioned cities and corresponding items using arrays.
- b) Write a Python program to display name of cities where salesman has delivered maximum and minimum number of items.
- c) Write a Python program to search the number of items to be delivered for a user
- d) Suppose the cover price of a book is Rs 240.95, but bookstores get a 40% discount. Shipping costs Rs 30 for the first copy and 75 cents for each additional copy. What is the total wholesale cost for 60 copies? Calculate using Python Code.

UNIT III CLASSES & FUNCTIONS

12

Classes – Built-in Functions – Type Conversion – User Defined Functions – Flow of Execution

Suggested Experiments

Scenario: A university has different entities such as Department, Programs and Student whose data members and member functions are given below:

Teacher- { **Data Members:** Name, department, hours, programs Taught; **Member Function:** setDetails(), getDetails() }

Program- { **Data Members:** Name, department, duration; **Member Functions:** setDetails(), getDetails() }

Student- { **Data Members:** Name, RollNo, Program, Department; **Member Function:** setDetails(), getDetails() }

Solve the following problems based on the above mentioned scenario using Python:

1. Write a Python program to create Teacher, Program and Student Classes with above mentioned data members and member functions.
2. Add following functionalities in the above program, the default department of Teacher, Program and Student should be Computer Science, however a different department could be assigned at run time.
3. Write a Python program to overload “+” operator to add the hours of two teachers.

Write a Python program to create two subclasses Residential Student and Non Residential Student inherited from Student class. Residential Student would have a data member Hall of Residence and Non-Residential Student would have Address as its data member.

UNIT IV FILE HANDLING

12

Files and exception: text files, reading and writing files, handling exceptions

Suggested Experiments

1. Write a Python program to print number of days in a month.
2. Write a Python program to find the area of triangle
3. Write a Python program which takes a character as input from the keyboard and convert it into capital letter, if it is a small letter and Vice-Versa.
4. Write a Python program to find those numbers which are divisible by 7 and multiple of 5, between 1500 and 2700 (both included)

Write a Python program that asks the user for a number. Depending on whether the number is even or odd, print out an appropriate message to the user

UNIT V TEMPLATES

12

Function Template – Class Template – Infinite Recursion in Python

1. Write a function in Python to swap two numbers using function template. The numbers could be Integer or float that depends on the user inputs
2. Create a class Matrix with data members and member functions. Write a program in Python to perform Matrix operations (2-D array implementation), Add and Multiplication using class template
3. Write a Program Python to check whether the given number is Armstrong number or not
4. Write a Python Program to print factorial of a number
5. Write a Python Program to generate first n Fibonacci terms recursively

Write a Python Program to compute factorial of an integer n recursively

L:0 T:0 P:60 J:0 Total:60 Periods

COURSE OUTCOMES

At the end of the course the student should be able to :

- CO 1 Write clear and effective python code
- CO 2 Create applications using python programming
- CO 3 Define Python functions and call them
- CO 4 Use Python data structures -- lists, tuples, dictionaries
- CO 5 Understand the object oriented features using Python

19GEP275	PERSONALITY DEVELOPMENT	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	1	0	2	0	2

UNIT I SELF-AWARENESS & PERSONAL DEVELOPMENT 3+6

Self-Awareness: Key Areas -Personality, Values, Habits, Needs & Emotions, Impact of Self Awareness on Personal Development.

Personality –Definition, Elements, Determinants, Needs and Benefits, Personality traits.ersonality development skills, Positive traits for effective people, SWOT :Analysing Strength and weakness (SWOT), Building Esteem & Self-Confidence, Working on attitudes (aggressive, assertive, submissive), Self-Motivation

UNIT II BODY LANGUAGE 3+6

Body Language-Postures and Gestures, Personal Grooming, Personal Hygiene, Social Effectiveness, Business Etiquettes, Interpersonal Relationship

UNIT III COMMUNICATION AND LEADERSHIP 3+10

Communication: LRSW, Verbal & Non-Verbal Communication, Communication Barriers, Resume Building, Video Resume, Email writing, Presentation Skills, Self-Introduction, Extempore speech, Group Discussion, Mock Interview.

Leadership: Leadership Styles, Leadership Traits, Group Dynamics, Team Building - Conflict management, Time Management, Stress management.

UNIT IV SOCIAL IMAGE TRAITS 3+6

Social etiquettes -Positive Social Image, Social Graces, Online Etiquettes, , Dinning Etiquettes, Public speaking, Voice Modulation, Telephone etiquettes, Interview etiquettes – Networking - Case Study and Company website References

UNIT V PERSONALITY TEST 3+2

Big Five Personality Test, Open DISC Assessment Test.

L :15 T: 0 P: 30 J: 0 T:45 PERIODS

TEXT BOOKS

- 1 Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi:Tata McGraw Hill.
- 2 Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition: PrenticeHall.

REFERENCES

- 1 Smith, B. Body Language. Delhi: Rohan Book Company.2004
- 2 Personality Development and Career management: By R.M.Onkar (SChand Publications)

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Evaluate the quality of personality for self-development incareer perspective.
- CO2** Apply the body languages in his professional interviewmodes.
- CO3** Apply the communication and leadership styles in the publicspeeking.
- CO4** Apply the social imaging qualities in their presentationskill.
- CO5** Demonstrate the personality development in mockinterview.

Guidelines

1. The scope of the project work is to enable the students in convenient groups (not more than 4 members) involving theoretical and experimental studies through Design Thinking approach.
2. The aim of the project work is to deepen comprehension of principles by applying them to a new problem based on the courses such as Digital Circuits, IoT & Fluid Mechanics, Strength of Materials, Fluid Mechanics and Thermal System, Applied Instrumentation and Control System, Electrical Drives and Control, Mechanics of Machines studied by the students in the second year of study but not limited to.
3. Project periods shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
4. Create a model/fabricate a model/conduct experiment/simulate mechanical system/implement the same. Analyze data, evaluate the results and conclude the appropriate solution, suggestion for future work.
5. The continuous assessment shall be made according to the regulation which is tabulated below.
6. The progress of the project is evaluated based on a minimum of two reviews.
7. The review committee may be constituted by the Head of the Department
8. Each student shall finally produce a comprehensive report covering background information, empathy, problem statement, project work details, result and conclusion.
9. This final report shall be typewritten form as specified in the guidelines.

L : 0 T: 0 P: 0 J: 30 Total: 30 PERIODS

SEMESTER IV

19MAT205	PROBABILITY, STATISTICS & NUMERICAL METHODS	L	T	P	J	C
	(Common to CIVIL & MCT)	3	0	0	0	3
UNIT I	PROBABILITY AND RANDOM VARIABLES					9
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Exponential and Normal distributions.						
UNIT II	TESTING OF HYPOTHESIS					9
Sampling distributions – Statistical hypothesis – Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit.						
UNIT III	SOLUTIONS OF EQUATIONS					9
Newton Raphson method –Pivoting Gauss Jordan methods – Iterative methods of Gauss-Seidal – Matrix Inversion by Gauss-Jordan method.						
UNIT IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION					9
Lagrange's interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3rd rules.						
UNIT V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS					9
Single step methods: Taylor's series method – Euler's method – Modified Euler's Method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods: Milne's predictor-corrector methods for solving first order equations.						

L :45 T:0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Milton, J. S. and Arnold, J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2. Grewal, B.S and Grewal, J.S, "Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2012.

REFERENCES

- 1 Johnson, R.A., Miller, I and Freund, J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
- 2 Walpole, R.E., Myers, R.H., Myers, S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
- 3 Kandasamy, P., Thilagavathy. K and Gunavathy, K., "Numerical Methods", 3rd Edition, S.Chand & Company Pvt. Ltd, 2013.
- 4 Gerald, C.F. and Wheatley, P.O. "Applied Numerical Analysis", 8th Edition, Pearson Education, Asia, New Delhi, 2014.
- 5 Chapra, S.C and Canale, R.P. "Numerical Methods for Engineers", 6th Edition, Tata McGraw Hill Edition, 2014.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Utilize the skills in handling more than one random variable, standard distributions and functions of random variables.
- CO2** Apply the statistical concepts and tools for engineering applications and to use different types of research methodology techniques for decision making under uncertainty.
- CO3** Solve a set of algebraic equations representing steady state models formed in engineering problems.
- CO4** Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration.
- CO5** Predict the system dynamic behavior through solution of ODEs modeling the system.

L	T	P	J	C
3	0	0	0	3

UNIT I KINEMATICS OF MECHANISMS**9**

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons (Velocity, Acceleration and Displacement diagram only graphical method)

UNIT II FORCE ANALYSIS**9**

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D'Alembert's principle – superposition principle

UNIT III GEARS AND GEAR TRAINS**9**

Spur gear – law of toothed gearing – Involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclical gear trains – automotive transmission gear trains.

UNIT IV CAMS AND FOLLOWERS**9**

Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller followers with and without offsets for various types of follower motions..

UNIT V BALANCING**9**

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines – Governors: Introduction – Types – Watt, Porter, Proell Governors

L : 45 T : 0 P : 0 J : 0 Total: 45 PERIODS**TEXT BOOKS**

- 1 Rattan.S.S, "Theory of Machines", Tata McGraw Hill Education Private Limited, 3rd Edition, 2009.
- 2 Thomas Bevan, "The Theory of Machines" 3rd Edition, CBS Publisher, 2005

REFERENCES

- 1 Rao, J.S and Duggipati, R.V, "Mechanism and Machine Theory", Second Edition, New Age International (P) Ltd. Reprint, 2006.
- 2 Ballaney.P.L, "Theory of Machines", Khanna Book Publishing Co. (P) Ltd, New Delhi, 2008.
- 3 Gosh, A. and Mallick, A.K., "Theory of Machines and Mechanisms", East West Press, 3rd Edition, 2006.
- 4 R.S.Khurmi&J.K.Gupta, Theory of Machines - S.Chand and company Pvt Ltd, 14th Edition, 2005.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Describe different mechanisms and Linkages.
- CO2** Analyze the contribution of force equilibrium in the machines.
- CO3** Understand the gear and Cam profile with follower motion.
- CO4** Describe the methods of balancing the moving parts of the machines.
- CO5** Determine the phenomenon of direction of rotation, speed and torque systems for simple, compound and planetary gear

UNIT I OVERVIEW OF ELECTRICAL DRIVE**9**

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and load variation factors

UNIT II ELECTRICAL MOTORS**9**

Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motor, universal motor, servo motor, stepper motor and reluctance motor, PMDC, BLDC Motor.

UNIT III SPEED CONTROL AND STARTING**9**

Speed control of D.C series and shunt motors- speed control of single and three phase induction motors –starting methods of D.C. motor and three phase induction motors –electrical braking, Control of Special Electrical Machines-PMDC and BLDC Motor: Characteristics – Open Loop and Closed Loop Control – Control Strategies

UNIT IV SOLID STATE SPEED CONTROL OF D.C DRIVES**9**

Power electronic devices, Controlled rectifiers and choppers, Speed control of DC series and shunt motors using controlled rectifiers and DC choppers -Application of DC Servo drives in mechatronics

UNIT V SOLID STATE SPEED CONTROL OF A.C DRIVES**9**

Inverters and voltage regulators, Speed control of three phase induction motor – Voltage control, voltage / frequency control and slip power recovery scheme using inverters and AC voltage regulators – applications

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**TEXT BOOKS**

- 1 D.P.Kothari and I.J.Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill publishing company Ltd, second edition, 2007 (Reprint)
2. S.K.Pillai, “ A First Course on Electrical Drives” New age publishing Ltd, 1989.

REFERENCES

- 1 Metha. V.K. & Rohit Metha, "Principle of Electrical Engineering", S.Chand & Co 2006.
- 2 Vedam Subramaniam. "Electric Drives", Tata McGraw Hill , New Delhi ,2007.
- 3 P.S Bimbhra, “Power Electronics”, Khanna Publishers, Pvt Ltd, 2004
- 4 Dubey.G.K. “Fundamental Electrical Drives” 2nd Edition, Narosa Publications, 2002
- 5 Bhattacharya S.K. & Brijinder Singh , "Control of Electrical Machines", New Age International Publishers, 2002.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Apply the concept of selection of different electrical motors for drives.
- CO2** Understand the principle of operation of AC and DC motors.
- CO3** Recognize the conventional method of speed control for DC and AC motors.
- CO4** Employ the implementation of solid state speed control for DC motors.
- CO5** Employ the implementation of solid state speed control for AC motors

UNIT I INTRODUCTION TO LIFE**6**

Characteristics of living organisms - Basic classification - cell theory - structure of prokaryotic and eukaryotic cell - Introduction to biomolecules: definition - general classification and important functions of carbohydrates – lipids – proteins - nucleic acids vitamins and enzymes - genes and chromosome.

UNIT II BIODIVERSITY**6**

Plant System: basic concepts of plant growth – nutrition - photosynthesis and nitrogen fixation– Animal System: elementary study of digestive–respiratory–circulatory- excretory systems and their functions. Microbial System: history - types of microbes - economic importance and control of microbes.

UNIT III GENETICS AND IMMUNE SYSTEM**6**

Evolution: theories of evolution - Mendel's cell division – mitosis and meiosis - evidence of the laws of inheritance - variation and speciation - nucleic acids as a genetic material - central dogma immunity – antigens – antibody – immune response.

UNIT IV HUMAN DISEASES**6**

Definition - causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis.

UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION**6**

Transgenic plants and animals - stem cell and tissue engineering – bioreactors – biopharming – recombinant vaccines – cloning - drug discovery - biological neural networks - bioremediation – biofertilizer – biocontrol – biofilters – biosensors – biopolymers – bioenergy – biomaterials – biochips - basic biomedical instrumentation.

L : 30 T: 0 P: 0 J: 0 Total: 30 PERIODS**TEXT BOOKS**

- 1 A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
- 2 Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
- 3 Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

REFERENCES

- 1 Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- 2 Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
- 3 Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the fundamentals of living things, their classification, cell structure and biochemical constituents.
- CO2** Apply the concept of plant, animal and microbial systems and growth in real life situations.
- CO3** Comprehend genetics and the immune system.
- CO4** Know the cause, symptoms, diagnosis and treatment of common diseases.
- CO5** Give a basic knowledge of the applications of biological systems in relevant industries.

19GET276	VQAR-II	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	2	0	0	0	2
UNIT I	QUANTITATIVE ABILITY III				6	
	Time, speed & distance-Average speed- Relative speed- Train problems- Boats and streams- Races, Chain rule, Time and work -Pipes and cisterns					
UNIT II	QUANTITATIVE ABILITY IV				4	
	Permutation & Combination, Probability, Mensuration					
UNIT III	VERBAL REASONING II				7	
	Machine Input and Output, Coded Inequalities, syllogisms, Problems on Cubes, Data sufficiency. Critical Reasoning -Statement and Argument, Statement and Assumption, Statement and Conclusion, Cause and effect, Course of action.					
UNIT IV	NON- VERBAL REASONING				5	
	Figure series, Odd man out, Mirror Image, Water image, Embedded Image, Cubes and Dices, Insert the Missing Characters, Analytical reasoning.					
UNIT V	LINGUISTICS SKILLS III				8	
	Sentences - Simple, Compound, Complex & Mixed sentences, Sentence Rearrangement, Idioms & Phrases, Reading Comprehension at higher level, Word Substitution, Synonyms & Antonyms, Error Spotting.					

L :30 T: 0 P: 0 J: 0 T: 30 PERIODS

TEXT BOOKS

- 1 Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.
- 2 M.K.Panday, "Analytical Reasoning", Magical Series.
- 3 BS Sijwali- Indu Sijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.
- 4 S.P.Bakshi, "Objective English" Arihant Publications.

REFERENCES

- 1 R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
- 2 R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited.
- 3 R.S.Agarwal, "A modern approach to Verbal & Non-verbal reasoning", S.Chand & Company Pvt Limited.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Learn the time and distance for solving application orientated concepts in quantitative aptitude
- CO2** Apply the financial ability for solving application orientated concepts in quantitative aptitude
- CO3** Analyze the verbal reasoning and the critical reasoning in quantitative aptitude.
- CO4** Analyze the non-verbal reasoning in verbal aptitude applications
- CO5** Apply appropriate LSRW skills

19MCB203 MICROPROCESSOR, MICROCONTROLLER & INTERFACING

L T P J C
3 0 2 0 4

UNIT I ARCHITECTURE OF 8085 MICROPROCESSOR 9+6

Functional Block Diagram - Registers, ALU, Bus systems - Timing and control signals - Machine cycles and timing diagrams - Interrupts - Programming of 8085 - Instruction formats - Addressing modes – Instruction set - Assembly language programs.

Programs for Arithmetic operations in 8085 [16-bit addition, subtraction and 8-bit multiplication, division].

UNIT II ARCHITECTURE OF 8086 MICROPROCESSOR 9+6

Intel 8086 Internal Architecture - 8086 addressing modes- Instruction set – Assembler Directives - 8086 assembly language Programming - Interrupts.

Program for Sorting in 8086, Program for String manipulation operations using 8086.

UNIT III PERIPHERAL INTERFACING 9+6

Interfacing requirements - Memory mapped I/O, I/O mapped I/O, 8255 PPI, 8279 keyboard and display controller, 8257 DMA controller, 8251 USART - Interrupt controller 8259 –Serial I/O standards RS232C, RS422A and IEEE 488.

Parallel Communication between two Microprocessors Kits using 8255, Serial Communication between two Microprocessors Kits using 8251.

UNIT IV MICROCONTROLLERS 9+6

Functional block diagram of 8051 - Instruction format and addressing modes – Timer – I/O ports – Serial communication - Inter facing -keyboard, LCD,ADC &DAC.

Programs for Arithmetic and Logical operations using 8051 microcontrollers.

UNIT V INTERFACING MICROCONTROLLER 9+6

Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation.

Stepper Motor control and DC Motor Speed control with 8051.

L : 45 T: 0 P: 30 J: 0 Total: 75 PERIODS

TEXT BOOKS

- 1 Soumitra Kumar Mandal, “Microprocessors and Microcontrollers”, Tata McGraw Hill Education Private Limited, Fourth reprint 2012.
2. Krishna Kant, “Microprocessors and Microcontrollers”, Prentice Hall of India, 2013.

REFERENCES

- 1 Ramesh S. Gaonkar ,”Microprocessor– Architecture, Programming and Applications with the 8085”,Penram International Publisher,5thEd.,2006
- 2 Douglas V.Hall, “Microprocessors and Inter facing : Programming and Hardware”, Second Edition, Tata Mc Graw Hill, 2006
- 3 Kenneth J.Ayala,“The 8051 microcontroller Architecture, Programming and Applications”, Second Edition ,Penram international.
- 4 Mohamed Ali Mazidi, Janice GillispieMazidi, “The 8051 Microcontroller and EmbeddedSystems: Using Assembly and C”, Second Edition, Pearson Education / Prentice Hall of India,2007
- 5 A.K.Ray& K.M. Bhurchandi, “Advanced Microprocessor and Peripherals – Architecture, Programming and Inter facing”, Tata Mc Graw Hill, 2006

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the architecture of 8085 microprocessor
- CO2** Understand the architecture of 8086 microprocessor.
- CO3** Learn about the need for interfacing requirements, memory mapping and interrupts
- CO4** Basic of microcontrollers
- CO5** Design a system design using microcontroller and microprocessor

UNIT I STRESS STRAIN DEFORMATION OF SOLIDS**9+6**

Rigid and Deformable bodies -Strength, Stiffness and Stability - Stresses; Tensile, Compressive and Shear - Deformation of simple and compound bars under axial load - Elastic constants and their relationship - Stresses in Stepped shafts and varying section

To determine the Tension test on mild steel rod

UNIT II BEAMS -SHEAR FORCE, BENDING MOMENT AND THEORY OF BENDING**9+6**

Types of beams: Supports and Loads - Shear force and Bending Moment in beams - Cantilever simply supported and Overhanging beams -Point of contra Flexure - Stresses in beams: Bending and shear stress

To conduct the experiment on the deflection test on the beam

UNIT III TORSION AND SPRINGS**9+6**

Analysis of torsion of circular bars - Shear stress distribution - Bars of Solid and hollow circular section - Stepped shaft - Twist and torsion stiffness - Compound shafts - Fixed and simply supported shafts - Application to close - coiled helical springs - Maximum shear stress inspring section including Wahl Factor - Deflection of helical coil springs under axial loads - Design of helical coils springs - stresses in helical coils springs under torsion loads. Strain energy in Torsion

To determine the Torsion test on mild steel

To find the shear stress on Compression test on helical spring

UNIT IV DEFLECTION OF BEAMS AND BUCKLING OF COLUMNS**9+6**

Elastic curve of Neutral axis of the beam under normal loads - Evaluation of beam deflection and slope: Double integration method, Macaulay Method - Columns- End conditions - equivalent length of a column -Euler equation -Slenderness ratio -Rankine formula for columns.

Hardness test on metals (Brinell Hardness Tests)

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS**9+6**

Biaxial state of stresses - Thin cylindrical and spherical shells - Deformation in thin cylindrical and spherical shells -Biaxial stresses at a point - Stresses on inclined plane -Principal Planes Hoop stress and stresses - Mohr's circle for biaxial stresses - Maximum shear stress.

Analyze the beam and supports using ANSYS

L : 45 T: 0 P: 30 J: 0 Total: 75 PERIODS

TEXT BOOKS

- 1 Popov E.P, "Engineering Mechanics of Solids", Prentice - Hall of India, New Delhi, 2012.
2. R.K.Rajput, "Strength of Materials", S.Chand and Company Ltd., New Delhi 2015,

REFERENCES

- 1 R.S.Khurmi, "Strength of Materials", S.Chand and Company Ltd. New Delhi 2015.
- 2 Ryder G.H, "Strength of Materials, Macmillan India Ltd". Third Edition, 2010
- 3 Kazimi S.M.A, "Solid Mechanics", Tata McGraw - Hill Publishing Co., New Delhi, 2006.
- 4 Singh D.K "Mechanics of Solids" Pearson Education 2014.
- 5 Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books, 2012.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Describe the fundamentals about the simple stresses, strains and deformation in components due to external loads.
- CO2** Draw the shear force and bending moment diagrams for various beams.
- CO3** Explain the effect of torsion on shaft and springs.
- CO4** Determine the deflection of the beams and buckling of columns.
- CO5** Evaluate the stresses in cylindrical and spherical components.

UNIT I INTRODUCTION**3+6**

Importance of Hindi Language- Devanagari Alphabet (Read/Write) – Numbers (Read & Write) - Vowels & their abbreviated forms-consonants-Conjuncts- Parts of speech- Gender

UNIT II WORDS**3+6**

Pronoun-Adjective-Verb-Tenses-Voice- Secondary verbs- Indeclinable- Cardinal numerals- Daily life words

UNIT III CLASSIFIED SENTENCES**3+6**

Expressions- Useful Expressions- Imperative sentences-Past tense- Present tense-Future tense- Interrogative sentences and negative sentences

UNIT IV SITUATIONAL SENTENCES**3+6**

Situational Sentences: At home-Shopping- Craftsman-Food & Drink- Hotel & Restaurant- Post office/Telephone/Bank- While Travelling- Health & Hygiene- Weather-Time.

UNIT V CONVERSATION**3+6**

Conversation between friends- About money- On the bus- Asking the way- Making a Trunk Call- About a Trips- The villager and the urban- The doctor & the patient- Self Introduction

L :15 T: 0 P: 30 J: 0 T: 45 PERIODS**REFERENCE BOOKS**

- 1 Hindi for beginners by Sunita Narainmathur “ Tuttle Publisher”
- 2 Learn hindi through English in 30 Days by Krishna gopalvikal “ Diamond Pocket books”

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Know about the language Hindi and parts of speech
CO2 Understand the verbs and tenses of Hindi language
CO3 Experience the expression and classified sentences in Hindi Language.
CO4 Practice the Hindi speaking at suitable situations.
CO5 Converse in Hindi with your friends & neighbors.

EXERCISES PROCEDURE FOR PRACTICALS

S.No	Exercises	Assessment (Mandatory)	
		Based on Report Submission	Based on Exercises/Presentation
1	Alphabets –Read & Write	5	5
2	Numbers-Read & Write	5	5
3	Vowels-Read & Write	5	5
4	Consonant Conjuncts		10
5	Parts of Speech & Gender		10
6	Verbs, tenses & Daily Life words		10
7	Verbs, tenses & Daily Life words		10
8	Tenses-Past Present & Future		10
9	Interrogative & negative sentences		10
10	Conversation practices 1 (Different cases to different batch)		10
11	Conversation practices 2 (Different cases to different batch)		10
12	Conversation practices 3 (Different cases to different batch)		10

UNIT I SELF INTRODUCTION AND BASIC CONVERSATION, JAPANESE SCRIPTS AND NUMBERS 3+6

Introduction to Japanese Syllables (phonetic alphabet), greetings & Self-introduction, Identifying things, point objects and listening to their names, Listen to things and places etc. Creating shopping lists. Numbers. Three Different types of Japanese Scripts : Hiragana, Katakana, Kanji.

UNIT II TIME, DAY, MONTH AND YEARS, TRAVEL , WORK ENVIRONMENT, PARTICLES 3+6

Introduction to Time, day of the week, simple inquiries on telephone, Means of transport, Basic conversations of everyday life., Office Environment, Japanese Particles

UNIT III LOCATION AND OBJECTS ALONG WITH EXPRESSIONS , PRESENT / PAST FORMS 3+6

Frame questions in Japanese. Vocabulary of giving and receiving objects, Stating impressions/things surrounding us, Expressing likes and dislikes, good/bad, possessions, Talking about the country, town and the environment

UNIT IV COUNTERS , DIRECTIONS, COLORS, FAMILY & RELATIONSHIP 3+6

Quantity, number of people, time, period etc., Stating thoughts and impressions, Conveying movement (e.g. go / come). Colors, Family and Relationship.

UNIT V BASIC AND DAY TO DAY CONVERSATIONS WITH MULTIPLE SCENARIOS 3+6

Conversational practices: Between Friends, Customer and Seller, & Business Conversation.

L :15 T: 0 P: 30 J: 0 T: 45 PERIODS

REFERENCE BOOKS

1. MINNA NO NIHONGO 1-1 Translation & Grammatical notes in English elementary
2. SHIN NIHONGO NO KISO 1 (Grammatical Notes in English)

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Know about the language Japanese and parts of speech
CO2 Understand the Japanese language on time and travel
CO3 Experience the Conversation about location and expression.
CO4 Practice Conversation about family and relationship
CO5 Converse in Japanese in day to day conversations

EXERCISES PROCEDURE FOR PRACTICALS

S.No	Exercises	Assessment (Mandatory)	
		Based on Report Submission	Based on Exercises/Presentation
1	Alphabets –Read & Write	5	5
2	Numbers-Read & Write	5	5
3	Vowels-Read & Write	5	5
4	Consonant Conjuncts		10
5	Parts of Speech & Gender		10
6	Verbs, tenses & Daily Life words		10
7	Verbs, tenses & Daily Life words		10
8	Tenses-Past Present & Future		10
9	Interrogative & negative sentences		10
10	Conversation practices 1 (Different cases to different batch)		10
11	Conversation practices 2 (Different cases to different batch)		10
12	Conversation practices 3 (Different cases to different batch)		10

UNIT I INTRODUCTION**8**

Introduction to German Language- Alphabets-Greetings and goodbye - Introduce yourself and others - numbers -how to give your telephone number and email address -Speak about countries- languages - words.-Vowels-Read & Write-Tenses.

UNIT II CONVERSATIONS WITH FRIENDS COLLEAGUE**6**

Speaking about hobbies - fixing meetings and appointments - name days of the week - about work. Speak about Professions and working hours

UNIT III CONVERSATION ABOUT CITY**7**

Name places and buildings - Ask questions about places - Assigning texts to a picture story - Enquire about things - Name means of transport - ask for directions and describe a way -understand texts with international words - learn articles

UNIT IV CONVERSATION ABOUT FOOD AND SHOPPING**6**

Speak about food - plan for shopping - conversations while shopping - conversations while eating - Understand texts with W questions -Organize and learn words

UNIT V CONVERSATION ABOUT TIME WITH FRIENDS**3**

Understanding and saying the time -Specify times - to talk about family -To plan something together n to talk about birthdays - Understand and write an invitation -to Order and pay in the restaurant n to talk about an event

L :15 T: 0 P: 30 J: 0 T: 45 PERIODS**TEXT BOOKS**

- 1 Netzwerk Deutsch alsfremdsprache A1.1 Kursbuch
- 2 Netzwerk Deutsch alsfremdsprache A1.1 Arbeitsbuch

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** Know about the language German and parts of speech
CO2 Understand the Conversations with Friends Colleagues
CO3 Experience the Conversation about city
CO4 Practice Conversation about food and shopping
CO5 Converse in German about time with friends

EXERCISES PROCEDURE FOR PRACTICALS

S.No	Exercises	Assessment (Mandatory)	
		Based on Report Submission	Based on Exercises/Presentation
1	Alphabets –Read & Write	5	5
2	Numbers-Read & Write	5	5
3	Vowels-Read & Write	5	5
4	Consonant Conjuncts		10
5	Parts of Speech & Gender		10
6	Verbs, tenses & Daily Life words		10
7	Verbs, tenses & Daily Life words		10
8	Tenses-Past Present & Future		10
9	Interrogative & negative sentences		10
10	Conversation practices 1 (Different cases to different batch)		10
11	Conversation practices 2 (Different cases to different batch)		10
12	Conversation practices 3 (Different cases to different batch)		10

UNIT I INTRODUCTION**3+6**

Introduction to the French Language- Alphabets -Consonants-Greetings and goodbye –Daily life words- Introduce yourself and others - numbers -how to give your telephone number and email address -Speak about countries- languages - words.-Vowels-Read & Write-Tenses

UNIT II CONVERSATIONS WITH FRIENDS COLLEAGUES**3+6**

Speaking about hobbies - fixing meetings and appointments - name days of the week - about work. Speak about Professions and working hours

UNIT III CONVERSATION ABOUT CITY**3+6**

Name places and buildings - Ask questions about places - Assigning texts to a picture story - Enquire about things - Name means of transport - ask for directions and describe a way -understand texts with international words - learn articles

UNIT IV CONVERSATION ABOUT FOOD AND SHOPPING**3+6**

Speak about food - plan for shopping - conversations while shopping - conversations while eating -Understand texts with W questions -Organize and learn words.

UNIT V CONVERSATION ABOUT TIME WITH FRIENDS**3 +6**

Understanding and saying the time -Specify times - to talk about family -To plan something together n to talk about birthdays - Understand and write an invitation -to Order and pay in the restaurant n to talk about an event.

L: 15 T: 0 P: 30 J: 0 T: 45 PERIODS**REFERENCE BOOKS**

- 1 G.Mauger Cours DE Langue De Civilisation Francaises
- 2 Annie Heminway, Complete French all in one Premium Second Edition, Tata McGraw Hill Education.
- 3 Diamond French-Apreons Le Francois New Saraswathi House (India)Private Limited
- 4 A.Monnerie Beinvenue En France. Documentation Marrie Franchise Boulet

COURSE OUTCOMES

At the end of the course, students should be able to

CO1: To know about the French language and parts of speech.

CO2: To understand the Conversations with Friends Colleagues

CO3: To experience the Conversation about the city

CO4: To Practice Conversation about food and shopping.

CO5: To converse in French about time with friends

EXERCISES PROCEDURE FOR PRACTICALS

S.No	Exercises	Assessment (Mandatory)	
		Based on Report Submission	Based on Exercises/Presentation
1	Alphabets –Read & Write	5	5
2	Numbers-Read & Write	5	5
3	Vowels-Read & Write	5	5
4	Consonant Conjuncts		10
5	Parts of Speech & Gender		10
6	Verbs, tenses & Daily Life words		10
7	Verbs, tenses & Daily Life words		10
8	Tenses-Past Present & Future		10
9	Interrogative & negative sentences		10
10	Conversation practices 1 (Different cases to different batch)		10
11	Conversation practices 2 (Different cases to different batch)		10
12	Conversation practices 3 (Different cases to different batch)		10

1. The Internship is provided for the students to update themselves with the recent Technologies and professional skills for better prospects in the future.
2. Internship in industry subjected to permissions from Government and concern Industry subject to the conditions of following the SOP issued by the concern and written consent of the student and parents.
3. Student is supposed to produce joining letter and relieving letter once the internship is over in case of offline internship in any industry.
4. Online internship in industry / other agencies.
5. Seminar by student under mentorship of a faculty.
6. A detailed report shall be submitted based on his Internship and shall be done by only one student.
7. A Mini Project- on some suitable topic related to the branch of study. It can be small fabrication / experimental results/ simulations / Programmes/ application development etc., depending on the branch of the student. Preferably a single student should do it.

Student has to prepare detailed report and submit to his/her college.

8. A copy of report can be kept in the departments for record.
9. Each student must be assigned a faculty as a mentor from the college and an Industry expert as co-mentor.
10. The evaluation of the work done by students will be carried by the internal and external examiner.
11. External examiner will evaluate for 80 marks and internal examiner will evaluate for 20 marks.
12. The presentation by student in the presence of all students is desirable.
13. Student should produce successful completion certificate in case of offline / online internship in industry

2 Weeks

SEMESTER V

19MCT301

MACHINE DESIGN

L	T	P	J	C
4	0	0	0	4

UNIT I INTRODUCTION TO THE DESIGN PROCESS

12

Factor influencing machine design, selection of materials based on mechanical properties – Direct, bending and torsion stress equations – Impact and shock loading – Calculation of principle stresses for various load combinations, eccentric bending – Factor of safety – Theories of failure – Stress concentration – Fatigue strength and the S-N diagram – Soderberg, Goodman and Gerber relations.

UNIT II DESIGN OF SHAFTS AND COUPLINGS

12

Design of solid and hollow shafts based on strength and rigidity– Design of keys and key ways – Design of rigid and flexible couplings

UNIT III DESIGN OF GEARS

12

Review of gear fundamentals – Interference - Gear forces - Dimensions of a spur gear pair- Dimensions of helical gear pair- Design of spur and helical gears – Nomenclature of worm and bevel gears (Theoretical treatment only)

UNIT IV DESIGN OF SPRINGS AND PIN JOINTS

12

Design of helical and leaf springs under constant and varying loads – Design of knuckle and cotter joints.

UNIT V DESIGN OF BEARINGS

12

Selection of bearings – Sliding contact and rolling contact types – Cubic mean load – Design of journal bearing – McKee's equation – Lubrication in journal bearings – Calculation of bearing dimensions – Design of ball bearings.

L : 60 T: 0 P: 0 J: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 Bhandari V, "Design of Machine Elements", 4rd Edition, Tata McGraw-Hill Book Co, New Delhi, 2016
2. Prabhu T J, "Design of Transmission Systems", private publication, 1999

REFERENCES

- 1 Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003
- 2 Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 7th Edition, Wiley, 2016
- 3 Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", 3rd Edition Tata McGraw-Hill BookCo.(Schaums Outline), New Delhi, 2010
- 4 Bernard Hamrock, Steven Schmid,Bo Jacobson, "Fundamentals of Machine Elements",2nd Edition, Tata McGraw-Hill Book Co, New Delhi, 2006
- 5 Orthwein W, "Machine Component Design", 3rd Edition Jaico Publishing Co, New Delhi, 2003

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Apply engineering analysis principles and methods to the proper analysis of a variety of common mechanical system components.
- CO2** Select the proper dimensions for the Shafts, Keys and Coupling.
- CO3** Analyse and design belt drives, knuckle and cotter joints with respect to static and dynamic loads
- CO4** Interpret the different Parameter involved in the Energy absorbing Material
- CO5** Design of Bearings based on different Load Combination

UNIT I INTRODUCTION TO CNC MACHINE TOOLS**6**

Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines– turning center, machining center-5 Axis and 6 Axis machining centre, types of control systems– -ATC-Turret Mechanism.

UNIT II STRUCTURE OF CNC MACHINE TOOL**6**

CNC Machine building, structural details, configuration and design, guide ways –Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion–Screw and nut, recirculating ball screw.

UNIT III DRIVES AND CONTROLS**6**

Spindle drives–DC shunt motor, 3-phase AC induction motor, feed drives–stepper motor, servo principle, DC and AC servomotors, Open loop and closed loop control, Axis measuring system–synchro, synchro-resolver, gratings

UNIT IV CNC PROGRAMMING**6**

Coordinate system, structure of a part program, G&M Codes, manual part programming, tool length compensation, cutter radius and tool nose radius compensation, indexing, subroutines, Canned cycle- Turning, grooving, thread cutting, Milling- Pocket cutting-drilling, APT Language

UNIT V MAINTENANCE AND DIAGNOSTICS**6**

Economics of CNC, maintenance of CNC Factors influencing selection of CNC Machines – Cost of operation of CNC Machines –Practical aspects of introducing CNC machines in industries – Maintenance features of CNC Machines – Preventive Maintenance, other maintenance requirements

L : 30 T: 0 P: 0 J: 0 Total: 30 PERIODS**TEXT BOOKS**

- 1 YoreurKoren, “Computer Control of Manufacturing Systems”, Pitman, London, 1987.
2. Mike Mattson, “CNC Programming Thomson Learning, 2003.

REFERENCES

- 1 HMT, "Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005
- 2 Warren S.Seamers, “Computer Numeric Control”, Fourth Edition – Thomson Delmar, 2002.
- 3 James Madison, “CNC Machining Hand Book”, Industrial Press Inc., 1996
- 4 Ken Evans, John Polywka& Stanley Gabrel, “Programming of CNC Machines”, Second Edition – Industrial Press Inc, New York, 2002
- 5 Peter Smid, “CNC Programming Hand book”, Industrial Press Inc., 2000

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Provide knowledge on principle, constructional features, programming, tooling and work holding devices in CNC machine tool.
- CO2** Understand the physical structure of machine components.
- CO3** Explain drives and controllers used in CNC machine tools.
- CO4** Generate the code/Program for various CNC turning and Milling component
- CO5** Understand the tooling and maintenance of CNC machines

19CST251	OBJECT ORIENTED PROGRAMMING USING C++	L	T	P	J	C
	(Common to ECE, EEE &MCT)	3	0	0	0	3

UNIT I INTRODUCTION 9

Need for object oriented programming – Procedural Languages vs. Object oriented approach – Characteristics Object oriented programming – C++ Programming Basics: Basic Program Construction – Output Using cout – Input with cin – Data types – Variables and Constants – Operators – Control Statements-Manipulators-Type conversion.

UNIT II OBJECTS AND CLASSES 9

Simple Class – C++ Objects as Physical Objects – C++ Object as Data types – Constructors and Destructors – Object as Function Arguments – Returning Objects from Functions – Structures and Classes – Arrays and Strings.

UNIT III OPERATOR OVERLOADING AND INHERITANCE 9

Need of operator overloading – Overloading Unary Operators – Overloading binary Operators – Overloading Special Operators – Data Conversion – Inheritance: Derived Class and Base Class – Derived Class Constructors – Overriding Member Functions-Class Hierarchies – Public and Private Inheritance – Levels of Inheritance – Multiple Inheritance.

UNIT IV POLYMORPHISM AND FILE STREAMS 9

Virtual Function – Friend Function – Static Function-Assignment and Copy Initialization – Streams – String I/O – Character I/O – Object I/O – I/O with Multiple Objects – File Pointers – Disk I/O with Member Functions – Error Handling in File I/O.

UNIT V TEMPLATES AND EXCEPTION HANDLING 9

Templates: Introduction – Function Templates – Overloading Function Templates – Class Templates – Exception Handling – Syntax, multiple exceptions, exceptions with arguments

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Robert Lafore, Object Oriented Programming in-C++, Galgotia Publication, 2009.
- 2 Deitel&Deitel, “C++ How to program”, Prentice Hall,2005.

REFERENCES

- 1 D.S.Malik, “C++ Programming”, Thomson, 2007.
- 2 K.R.Venugopal, Rajkumar and T.Ravishankar, “Mastering C++”, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2006.
- 3 E.Balagurusamy, “Object Oriented Programming with C++”, Sixth Edition, McGraw Hill Education, 2013.
- 4 Joyce Farrell, “Object-Oriented Programming Using C++”, Fourth Edition,2008.
- 5 Subhash K U, “Object Oriented Programming With C++”, First Edition, Pearson Education,2010.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Determine the needs of object oriented programming.
- CO2** Differentiate the functionalities of object oriented approach and procedural languages
- CO3** Demonstrate the concept of operator overloading and inheritance.
- CO4** Demonstrate the concepts of polymorphism and file streams.
- CO5** Design of Templates and Exception Handling.

UNIT I INTRODUCTION TO PLC**6+6**

Introduction – Principles of operation – Parts of PLC & hardware components – I/O section – Discrete and Analog Module – CPU processor and memory module – PLC Programming devices and Languages – Function Block Diagram – Interlocking and latching concepts

Study of Programmer Logic Controller

Construction of Ladder programming for Boolean operations & Math operations using PLC

UNIT II PLC INSTRUCTIONS & I/O DEVICES**6+6**

Timers, Delay And Retentive Timers – Counters – Data Manipulating Program – Data Handling: Control and Math Instructions – Sequencer and Shift Register– Electromagnetic Control Relays and Motor Starters – Latching Relays – Manually Operated Switches and Proximity Switches – Analog I/O devices

Sequential operation of pneumatic cylinders using PLC

Linear actuation with timer, counter and speed control using PLC

UNIT III NETWORKING AND APPLICATIONS OF PLC**6+6**

Network Topologies - Communication Modes HART Networks and OSI models - Fieldbus, Modbus, Profibus - Device net - System Operation and Troubleshooting

Applications of PLC - Automatic control of warehouse door – Conveyor belt motor control - Automatic car washing machine - Bottle filling systems, PLC in process control

Traffic light controller using PLC

Speed control of DC motor using PLC

UNIT IV SUPERVISORY CONTROL AND DATA ACQUISITION**6+6**

HMI and its functions, Elements and Architecture of SCADA - Hardware, Software: Development, Runtime mode functions - Tools: Tag database - Recipe database - Alarm Logging-Trends: Real Time, Historical Trends - Security and User Access Management-Management Information System - Report Function.

Interfacing PLC real time tag with HMI and SCADA

UNIT V DISTRIBUTED CONTROL SYSTEM**6+6**

Evolution of DCS - Types of Architecture - Local Control Unit - Communication Facilities - Operator and Engineering Interfaces - Operator Displays - Process Interfacing issues – Real time applications.

Study of DCS for thermal power plant

L : 30 T: 0 P: 30 J: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010
2. Stuart A Boyer, “SCADA supervisory control and data acquisition”

REFERENCES

- 1 K. L.S. Sharma, Overview of Industrial Process Automation, Elsevier, 2011 Batten G. L., “Programmable Controllers”, McGraw Hill Inc., Second Edition
- 2 Pradeep Kumar & Srivashtava, Programmable Logic Controller- BPB Publications.
- 3 Hughes .T, “Programmable Logic Controllers”, ISA Press, 1989
- 4 Gordan Clark, Deem Reynders, “Practical Modem SCADA Protocols”
- 5 Lucas M.P, Distributed control systems, Van Nostrand Reinhold Company, Newyork, 1986

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Acquire an adequate knowledge about various functions of PLC and its interfacing
- CO2** Understanding the concepts of various instructions in PLC programming language
- CO3** Write the PLC programs for the various sequential control applications
- CO4** Understand the basic of Supervisory Control and Data Acquisition (SCADA)
- CO5** Obtain the knowledge on evolution and architecture of DCS

UNIT I POWER SEMICONDUCTOR DEVICES**6+6**

Classification of Power Semiconductor devices, Construction and working principle of SCR, TRIAC, BJT, MOSFET, IGBT- Triggering and commutation circuit for SCR- Driver and snubber circuits

VI Characteristics of SCR, TRIAC, MOSFET, IGBT**UNIT II PHASE-CONTROLLED CONVERTERS****6+6**

Single phase half & fully controlled converters, Three phase half & fully controlled converters, Inversion mode of converter -performance parameters-Effect of source inductance-Dual converters-Battery charging circuit

Single phase half controlled & fully controlled converter**UNIT III DC TO DC CONVERTER****6+6**

Classifications of DC to DC converters- step-down and step-up DC to DC Converter -control strategies- Switched mode regulators- Buck, boost, buck- boost converter, Introduction to SMPS

AC and DC Voltage controller using SCR & Chopper**UNIT IV INVERTERS & AC TO AC CONVERTERS****6+6**

Single phase and three phase voltage source inverters (both 120° mode and 180° mode) -Voltage control methods -PWM techniques-Current Source Inverter, Single phase AC voltage controllers- Multistage sequence control - Single phase and three phase cycloconverters.

Speed control of Single phase and three phase PWM inverter**UNIT V INDUSTRIAL APPLICATION FOR MECHATRONICS****6+6**

Introduction to UPS, Solid state Relays, Electronic Timer, Motor Drive Application: AC, DC Motor Control, Servo Motor Control, Stepper Motor Control; Induction heating, Switching Circuits for BLDC Motor and SRM

Speed control of Reluctance motor using solid state drive.**L : 30 T: 0 P:30 J: 0 Total: 60 PERIODS****TEXT BOOKS**

- 1 P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003
2. M.H.Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI , Third Edition, New Delhi, 2004

REFERENCES

- 1 M.D. Singh and K.B. Khanchandani, "Power Electronics," McGraw Hill India, 2013.
- 2 Joseph Vithayathil, "Power Electronics, Principles and Applications" McGraw Hill Series, 6th Reprint, 2013.
- 3 Ned Mohan, Undeland, Robbins, "Power Electronics: Converters, Design and Applications", WILEY India Edition
- 4 Muhammad H. Rashid, Power Electronics - Circuits, Devices and Applications, Prentice Hall of India Learning. Ltd., New Delhi, 2013
- 5 M. D. Singh and K. B. Khanchandani, Power Electronics, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the characteristics of power electronics devices.
CO2 Know the concept of AC-DC conversion systems
CO3 Design various DC-DC converters
CO4 Understand the working of DC-AC converters & AC-AC converters
CO5 Apply power electronics converters for Mechatronics Application

LIST OF EXPERIMENTS**1. DRAWING STANDARDS**

Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys and fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc.

2. 3D GEOMETRIC MODELLING**2.1 Introduction**

3D Modeling software such as SOLIDEDGE/AUTOCAD/PRO-E

2.2 Real Components Drawing:

Simple components are given, such as Bolts & Nut, Hacksaw frame, Brake shoe, etc... and made to draw their views and to draw assembly drawing

2.3 Creation of 3D assembly model of following machine elements using 3D Modelling software

- Flange Coupling
- Plummer Block
- Screw Jack
- Lathe Tailstock
- Universal Joint
- Machine Vice

3. Analysis**3.1 Introduction**

Simulation and analysis software ANSYS

3.2 Analysis Exercise:

- Simulation and analysis of a truss
- Simulation and analysis of a cantilever beam with load
- Simulation and analysis of a cantilever beam with UDL

Thermal analysis of a copper plate

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

Pentium IV computer or better hardware, with suitable graphics facility -30
Software (SOLIDEDGE/AUTOCAD/PRO-E) for Drafting, Modeling and Analysis.
Laser Printer or Plotter to print / plot drawings -02

L : 45 T: 0 P: 0 J: 0 C: 0 Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Ability to define basic sketching commands and commands in the software tool
- CO2** Built the knowledge in terms of pictorial views into orthographic projections of simple machine parts with or without section
- CO3** Create solid models of objects; objects in basic shapes, composite bodies, custom built machine parts, building modules etc.
- CO4** Ability to develop 3D modelling with industrial component using Indian Standard
- CO5** Ability to analyse the models of the component using analysis software

LIST OF EXPERIMENTS

1. Define a class to represent a bank account to include the following members.
Data Members: Name of the depositors, Account number, Type of account, Balance amount in the account.
Member functions:
 To initialize values to data members,
 To deposit an amount,
 To withdraw an account after checking the balance,
 To display the name and the balance.
Note: Try to use all types of constructors.
2. Apply function overloading and operator overloading to the given problems.
3. Implement the concept of default argument function.
4. Implement the concept of array of objects.
5. Apprehend a class with dynamic objects and use constructors and destructors.
6. Execute the concept of Inheritance.
7. Illustrate the use of static data member and static member functions by keeping track of number of instances of object that are created and alive.
8. Implement friend functions and friend classes to add the private data member of two different classes.
9. Exercise the file handling concepts Copy the content of one file to another file by removing unnecessary spaces between words.
10. Realize the following concepts:
 (i) Class templates and Function templates
 (ii) Exception Handling
11. Design Experiments
12. Application Oriented Experiments: Mini Project

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS**Hardware**

PC – 30 nos.

- Processor – 2.0 GHz or higher with RAM – 256 MB or higher
- Hard disk – 20 GB or higher
- OS- Windows 2000/ Windows XP/ NT

Software

Turbo C (freeware) – to be installed in all PC's.

L: 0 T:0 P:60 J:0**TOTAL:60 PERIODS****COURSE OUTCOMES**

At the end of the course students should be able to

- CO1: To understand the usage of class and objects.
 CO2: To implement the concepts of inheritance and operator overloading.
 CO3: To solve cases applying concept of one- and two-dimensional arrays
 CO3: To demonstrate the concept of operator overloading and inheritance.
 CO4: To demonstrate the concepts of polymorphism and file streams.
 CO5: To design of Templates and Exception Handling.

Guidelines

1. The scope of the project work is to enable the students in convenient groups (not more than 4 members) involving theoretical and experimental studies through Design Thinking approach.
2. The aim of the project work is to deepen comprehension of principles by applying them to a new problem based on the courses such as Microprocessor, Microcontroller and Interfacing, embedded systems, Solid Mechanics, Machine Design, CNC Technology, Integrated Automation, Industrial Electronics, IoT, fluid power systems by the students in the third year of study but not limited to.
3. Project periods shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
4. Create a model/fabricate a model/conduct experiment/simulate mechanical system/implement the same. Analyze data, evaluate the results and conclude the appropriate solution, suggestion for feature work.
5. The continuous assessment shall be made according to the regulation which is tabulated below.
6. The progress of the project is evaluated based on a minimum of two reviews.
7. The review committee may be constituted by the Head of the Department
8. Each student shall finally produce a comprehensive report covering background information, empathy, problem statement, project work details, result and conclusion.
9. This final report shall be typewritten form as specified in the guidelines.

L : 0 T: 0 P: 0 J: 30 Total: 30 PERIODS

SEMESTER VI

19MCT303	IOT FOR FLUID POWER SYSTEMS	L	T	P	J	C
		3	0	0	0	3
UNIT I	FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS					6
Introduction to Fluid power-Advantages and Applications-Fluid power systems– Types of fluids- Properties of fluids–Basics of Hydraulics–Pascal’s Law-Principles of flow– Friction loss- Work, Power and Torque. Problems Sources of Hydraulic power: Pumping Theory–Pump Classification Construction, working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary-Fixed and Variable displacement pumps- Problems based on Fluid Power System.						
UNIT II	FLUID POWER ACTUATORS AND VALVES					6
Actuators: Cylinders– Types and construction, Application, Hydraulic cushioning- Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves-Types, Construction and Operation- Servo and Proportional valves -Applications–Types of actuation. Accessories: Reservoirs, Pressure Switches- Applications-Fluid Power ANSI Symbols– Problems						
UNIT III	HYDRAULIC & PNEUMATIC SYSTEMS					6
Accumulators, Intensifiers, Industrial hydraulic circuits-Regenerative, Pump Unloading, Double- pump, Pressure Intensifier, Reciprocation, Synchronization, Fail-safe, Speed control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical Hydraulic servo systems.- Hydro-Pneumo Circuit simulation in Fluidsim.						
UNIT IV	INTRODUCTION TO IoT					6
Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device						
UNIT V	IoT BASED FLUID POWER AUTOMATION					6
Press and Fork lift control using IoT - Fluid powered Assembling, Feeding, Metalworking, materials handling and plastics working application with IoT.						
		L : 45	T: 0	P: 0	J: 0	Total: 45 PERIODS

TEXT BOOKS

- 1 Anthony Esposito, “Fluid Power with Applications”, Pearson Education, Seventh Edition, 2009.
2. Mandler, B., Barja, J., MitreCampista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publication

REFERENCES

- 1 Andrew Parr, “Hydraulics and Pneumatics”, Jaico Publishing House, 2005.
- 2 Majumdar S R, “Pneumatic Systems – Principle and Maintenance”, Tata Mc-Graw Hill, 2006.
- 3 Majumdar, S.R., “Oil Hydraulics Systems, Principles and Maintenance”, Tata McGraw Hill, 2001.
- 4 Internet of Things: A Hands-On Approach Paperback – 2015, by ArsheepBahga, Vijay Madiseti.
- 5 IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by Pearson Paperback – 16 Aug 2017, by Hanes David, Salgueiro Gonzalo, Grossetete Patrick, Barton Rob

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Explain basic working principle and constructional features of hydraulics and pneumatics system.
- CO2** Understanding the actuating Techniques
- CO3** Design of pneumatics & hydraulics circuits.
- CO4** Understand the Concept of IoT.
- CO5** Design a fluid power system with IoT.

UNIT I SENSOR BASED MEASUREMENT SYSTEM**6+6**

Basics of Measurement– Units and Standard– Generalized Measurement System– Errors in Measurements– Error Analysis– Calibration techniques– Sensors vs Transducer– Classification of transducers– Static and Dynamic characteristics of transducers– Generalized Performance of Zero Order, First and Second Order Systems– Emerging fields of sensor technologies.

Measurement of Temperature using Thermocouple and Thermistor

Measurement of Temperature using RTD

UNIT II ELECTROMECHANICAL SENSORS**6+6**

Resistive transducers– Potentiometer– RTD– Thermistor– Thermocouple– Strain gauges– use in displacement, temperature, force measurement– Inductive transducer–LVDT– RVDT–use in displacement– Capacitive transducer– Ultrasonic Transducer.

Measurement of Displacement using Potentiometer and LVDT

Measurement of Strain using Strain Gauge

UNIT III SELF GENERATING SENSORS**6+6**

Thermoelectric Sensors- Thermocouple- Piezoelectric Sensors- Piezoelectric effect- Pyroelectric Sensors- Photovoltaic Sensor- Electrochemical Sensor.

Measurement of Displacement using Capacitive Transducer

Measurement of Torque using torque measuring device

UNIT IV SMART SENSORS**6+6**

Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors – Applications- Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring.

Experiment on smart sensor using Arduino

Experiment on Analog to Digital Converters and Digital Comparator

UNIT V SIGNAL CONDITIONING & DATA ACQUISITION**6+6**

Amplification– Attenuation- Quantization- Filtering– Sample and Hold circuits– Data Acquisition: Single channel and multi-channel data acquisition– Data logging- Applications and Case study of DAQs

Experiment on Voltage to Frequency and Frequency to Voltage Converter

Study on the application of data acquisition system for industrial purposes

L : 30 T: 0 P:30 J: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 A.K. Sawney and Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 14th edition, Dhanpat Rai & Co, New Delhi, 2017.
- 2 Ramon Pallas-Areny and John G Webster, Sensors and Signal Conditioning, 2012, 2nd ed., Wiley India Pvt. Ltd.

REFERENCES

- 1 Patranabis. D, “Sensors and Transducers”, PHI, New Delhi, 2nd Edition, 2003
- 2 David G. Alciatore and Michael B. Hstand, “Introduction to Mechatronics and Measurement systems”, Tata McGraw-Hill, 2nd Edition, 2008.
- 3 Thomas G. Bekwith and Lewis Buck.N, “Mechanical Measurements, Oxford and IBH publishing Co. Pvt. Ltd.
- 4 Gupta.I.C, “A Text book of Engineering Metrology”, Dhanpat Rai and Sons, 2006.
- 5 D. Roy Choudry, Sheil Jain, ‘Linear Integrated Circuits’, New Age International Pvt. Ltd., 2000.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Familiar with various measurements, calibration techniques and types of transducers.
- CO2** Summarize the working and construction of sensors measuring various physical parameters.
- CO3** Describe the working of self-generating sensor
- CO4** Study the basic principles of various smart sensors
- CO5** Outline operations of signal conditioning and various data acquisition systems.

19MCB304	ROBOTICS AND MACHINE VISION SYSTEM	L	T	P	J	C
		2	0	2	0	3
UNIT I	BASICS OF ROBOTICS					6+6

Introduction - Basic components of robot wrist configurations, motion - roll - Pitch - Yaw - Laws of robotics - classification of robot - work space - accuracy - resolution - repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives, gear drives, belt drives

Study of different types of robots based on configuration and application.

Study of different type of links and joints used in robots

UNIT II	ROBOT END EFFECTORS	6+6
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Robot End effectors: Introduction - types of End effectors - Mechanical gripper - types of gripper mechanism - gripper force analysis - other types of grippers- special purpose grippers.

Verification of transformation (Position and orientation) with respect to gripper and world coordinate system.

Determination of maximum and minimum position of links.

UNIT III	ROBOT MECHANICS	6+6
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Robot kinematics: Introduction- Matrix representation - rigid motion & homogeneous transformation - forward & inverse kinematics - trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics - Lagrange - Euler formulation- Newton-Euler formulation, Denavith - Hartenberg method

Estimation of accuracy, repeatability and resolution.

Simulation of Kinematics path using anyone robo software

UNIT IV	MACHINE VISION AND ITS APPLICATIONS	6+6
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Human vision, Computer vision, Lighting Techniques, Machine vision: image acquisition, digital images - sampling and quantization - levels of computation - Feature extraction - windowing technique - segmentation - Thresholding - edge detection -Texture Analysis, binary morphology - grey morphology

Line Follower Robot

Line follower robot with path detection (2 or more sensor)

UNIT V	ROBOT PROGRAMMING	6+6
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Robot programming: Methods of Robot Programming - Characteristics of task level languages, lead through programming methods Robot Languages - Classification of robot language - Computer control and robot software - Basic introduction to VAL Programming & Robotic operating System (ROS)

Point to Point Path Programming

Continuous Path Programming

L : 30 T: 0 P: 30 J: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 M.P.Groover, M.Weiss, R.N.Nagal, N.G.Odrey, "Industrial Robotics - Technology, Programming and Applications" Tata McGraw-Hill Education Pvt Limited, 2008 (Unit I,II,III,V)
- 2 K.S.Fu, R.C.Gonzalez, CSG. Lee, —Robotics control, sensing, vision and Intelligence, McGraw Hill Education Pvt. Ltd., 2013. (Unit IV)

REFERENCES

- 1 John J Craig, —Introduction to Robotics, Pearson, 2009. (Unit I,II)
- 2 Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, Indian Reprint, 2010 (Unit III)
- 3 Carsten Steger, Markus Ulrich, Christian Wiedemann, - Machine Vision Algorithms and Application, WILEY-VCH, Weinheim, 2008. (Unit IV)
- 4 Aaron Martinez and Enrique Fernandez, —Learning ROS for Robotics Programming, PACKT Publishing, 2013. (Unit V)
- 5 Bruno Siciliano, Oussama Khatib, Springer Hand book of Robotics, Springer, 2008. (Unit I,II,III,IV,V)

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know the fundamentals of Robot.
- CO2** Recognize various robot components, parts and the End-effectors
- CO3** Comprehend Robot transformation system and its application to a robots kinematic and Dynamic structure
- CO4** Understand Image Processing and its application in Machine Vision System
- CO5** Understand the basics of robot programming and Robot Assembling

LIST OF EXPERIMENTS

1. Program to implement Arithmetic Operations in Scilab environment
2. Program to perform Arithmetic Operations using Complex Numbers
 - i) Program to Construct a Matrix in Scilab
 - ii) Program to do basic Matrix Operations, Matrix parameters and Matrix sorting
3. Program to perform Matrix Trigonometric, Relational and Logical Operations
4. Program to execute Control structures (if else, for and while and break and continue) using Sci Notes
5. Program to draw a Two-Dimensional single Plots and Multiple Plot
6. Program to charge and discharge a capacitor
7. Application Program to compare discharge of Tank and volume of Tank
8. Application Program to determine Nodal Voltage
9. Application program to find the structural stability of truss
10. Application to develop PID Controller
11. Simulation to control a DC Motor
12. Modeling and Simulation of Spring Mass Damper System
13. Modeling and Simulation of Object Detection for Robot

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

Mac Intel 64 bits processor	-36
2 GB RAM (1 GB minimum)	-36
500 MB hard disk space.	-36
Scilab Software – Version 6.1.1	-36

L : 45 T : 0 P : 0 J : 0 C : 0 Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Learn the basic commands in Scilab
- CO2** Develop programs in Scilab
- CO3** Implement the Mathematical and Matrix operations using scilab
- CO4** Evaluate, analyze and plot results using Scilab
- CO5** Apply the programming skill in developing various industrial applications

19HST105	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	2	0	0	0	0
UNIT I	ANCIENT INDIA & STATE POLITY				6	
State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions’ of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage.						
UNIT II	INDIAN LITERATURE, CULTURE, TRADITION, AND PRACTICES				6	
Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali,Prakrit And Sanskrit, Kautilya’sArthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature,Malayalam Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature						
UNIT III	INDIAN RELIGION, PHILOSOPHY, AND PRACTICES				6	
Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.						
UNIT IV	INDIAN KNOWLEDGE SYSTEM ON SCIENCES & TRADE				6	
Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India ,Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Trade in Ancient India						
UNIT V	INDIAN CULTURAL HERITAGE & ARTS				6	
Indian architect, engineering and architecture in ancient India, sculptures, seals, coins, pottery, puppetry, dance, music, theatre, drama, painting, martial arts traditions, fairs and festivals, current developments in arts and cultural, Indian’s cultural contribution to the world. Indian cinema, yoga.						
		L :30	T: 0	P: 0	J: 0	T: 30 PERIODS
REFERENCES						
1	V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014					
2	S. Baliyan, Indian Art and Culture, Oxford University Press, India					
3	Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan					
4	Romila Thapar, Readings In Early Indian History Oxford University Press , India					
5	Fritz of Capra, Tao of Physics					
6	Fritz of Capra, The wave of Life					
7	V N Jha (English Translation), Tarkasangraha of Annam Bhatta, International Chinmay Foundation,Velliarnad,Amaku,am					
8	Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta					
9	GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, VidyanidhiPrakasham, Delhi,2016					
10	RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, VidyanidhiPrakasham, Delhi, 2016					
11	R Sharma (English translation), ShodashangHridayam					
12	Basham, A.L., The Wonder that was India (34th impression), New Delhi, Rupa & co					
13	Sharma, R.S., Aspects of Political Ideas and Institutions in Ancient India(fourth edition), Delhi, Motilal Banarsidass,					
COURSE OUTCOMES :						
At the end of the course students should be able to						
CO1	To understand the Ancient India and State Polity					
CO2	Understand the Indian Literature, Culture, Tradition, and Practices					
CO3	Understand the Indian Religion, Philosophy, and Practices					
CO4	Understand the Indian Knowledge System on Sciences & Trade					
CO5	Understand the Indian Cultural Heritage & Arts					

1. The Internship is provided for the students to update themselves with the recent Technologies and professional skills for better prospects in the future.
2. Internship in industry subjected to permissions from Government and concern Industry subject to the conditions of following the SOP issued by the concern and written consent of the student and parents.
3. Student is supposed to produce joining letter and relieving letter once the internship is over in case of offline internship in any industry.
4. Online internship in industry / other agencies.
5. Seminar by student under mentorship of a faculty.
6. A detailed report shall be submitted based on his Internship and shall be done by only one student.
7. A Mini Project- on some suitable topic related to the branch of study. It can be small fabrication / experimental results/ simulations / Programmes/ application development etc., depending on the branch of the student. Preferably a single student should do it.

Student has to prepare detailed report and submit to his/her college.

8. A copy of report can be kept in the departments for record.
9. Each student must be assigned a faculty as a mentor from the college and an Industry expert as co-mentor.
10. The evaluation of the work done by students will be carried by the internal and external examiner.
11. External examiner will evaluate for 80 marks and internal examiner will evaluate for 20 marks.
12. The presentation by student in the presence of all students is desirable.
13. Student should produce successful completion certificate in case of offline / online internship in industry

2 Weeks

SEMESTER VII

19MCT401	DATA ANALYTICS IN AUTOMATION SYSTEMS	L	T	P	J	C
		2	0	0	0	2

UNIT I INTRODUCTION TO BIG DATA

6

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value

UNIT II DATA ANALYTICS

6

Introduction data analytics, visualization and data exploration, basic and intermediate analysis, linear and logistic regression, decision tree.

UNIT III HADOOP

6

Introduction to Hadoop – Hadoop scalability - Vertical Scalability, Horizontal Scalability - Anatomy of Hadoop

UNIT IV MANAGING HADOOP FILE

6

Installation and execution of Hadoop – Stand-alone mode, Pseudo Distributed Mode and Fully Distributed Mode - File Management - Create a directory in HDFS - List the contents, upload and download a file in HDFS - Copy, move and remove a file HDFS

UNIT V AUTOMATION DATA HANDLING

6

Weather Report POC - Map Reduce Program - Regression Modeling using R - Implementation of classification models using R - Implementation of clustering models using R - Execution Big Data using R programming

L: 30 T: 0 P:0 TOTAL: 30 PERIODS

TEXT BOOKS

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
2. Andrew Gelman and Jennifer Hill, "Data Analysis using Regression and multilevel / Hierarchical Models", Cambridge University Press, 2007.

REFERENCES

1. Philipp K. Janert, "Data Analysis with Open Source Tools", O'Reilley, 2010.
2. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
3. Robert Nisbelt, John Elder, and Gary Miner, "Handbook of statistical analysis and data mining applications", Academic Press, 2009.
4. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. Vignesh Prajapati, Big Data Analytics with R and Hadoop, Packt Publishing-Kindle Edition, 2013

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the concept of big data.
- CO2** Acquire an adequate knowledge about Data Analytics
- CO3** Describe the High Availability Distributed Object Oriented Platform.
- CO4** Create and Manage Hadoop file in automation data handling.
- CO5** Analyze automation data by utilizing clustering and classification algorithms.

19MCT402	APPLIED MECHATRONICS ENGINEERING	L	T	P	J	C
		2	0	0	0	2

UNIT I INFOTRONICS

6

Driver assistance system: Introduction, driver support systems – driver information, Vehicle support systems – collision avoidance - seat belt tightening system, collision warning systems, child lock - Adaptive cruise control, adaptive noise control.

UNIT II AUTOTRONICS

6

Sensors: Knock sensor, Crash sensor, Speed sensor, Acceleration sensor and Micro sensor – X-by-wire systems - Electronic ignition system – fuel cell Electric vehicle - CNG Electric hybrid vehicle - Vision based autonomous road vehicles

UNIT III AVIONICS

6

Introduction to Avionics - Avionics sub-systems and design - Avionics system architecture– Data buses - Navigation systems - Flight control systems - Radar electronic warfare - Cockpit Display System

UNIT IV HOME AUTOMATION

6

Introduction – Fingerprint system – retinal scanning system – PIR sensors – Night Vision system – Zigbee technology – advanced wireless technology - Global Positioning System – Global System for Mobile Communication

UNIT V BIOTRONICS

6

Introduction to bioelectronics – Biosensors and Transducers - Measurement and recording: Cardiovascular systems, Respiratory mechanism - Measurement of pH value of blood, ESR measurements, hemoglobin measurement, GSR measurement – Biotelemetry.

L: 30 T:0 P: 0 TOTAL : 30 PERIODS

TEXT BOOKS

1. LjuboVlacic, Michel Parent and Fumio Harashima, “Intelligent Vehicle Technologies”, Butterworth-Heinemann publications, Oxford, 2011.
2. Robert Bosch, “Automotive Hand Book”, 5th Edition, SAE, 2000
3. Middleton, D.H., Ed., “Avionics Systems, Longman Scientific and Technical”, Longman Group UK Ltd., England, 1989.
4. Jigisha D. Pardesi, "Emerging Trends in Information Technology ", 1st Edition, NiraliPrakashan publication, 2007.
5. Khandpur R.S, “Hand-book of Biomedical Instrumentation”, Tata McGraw Hill, 2nd Edition, 2003.

REFERENCES

1. William B Riddens, “Understanding Automotive Electronics”, 5th edition, Butter worth Heinemann Woburn, 1998.
2. Automotive Technology”, Jack Erjavec, Robert Scharff, -Delmar Publications Inc 1992. [
3. Spitzer, C.R., “Digital Avionic Systems”, Prentice Hall, Englewood Cliffs, N.J., USA.,1987.
4. Electric and Hybrid-electric vehicles, Ronald K. Jurgen, SAE 2002.
5. Joseph DuBovy, “Introduction to biomedical electronics”, McGraw-Hill Ryerson, Limited, 1978.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Gain knowledge on advanced technology in applied mechatronics system.
- CO2** Able to design and analyses a real time mechatronics system with suitable controlling techniques.
- CO3** Understand the basic concepts of Mechatronics in various fields
- CO4** Work in various Mechatronics system
- CO5** Design and analyses a real time Mechatronics system with suitable controlling techniques

19GET201	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	J	C
		2	0	0	0	2
UNIT I	ENGINEERING ETHICS				6	
Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Uses of Ethical Theories.						
UNIT II	ENGINEERING AS SOCIAL EXPERIMENTATION				6	
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – Plagiarism – Case studies						
UNIT III	RESPONSIBILITIES AND RIGHTS				6	
Collegiality and loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.						
UNIT IV	UNIVERSAL HUMAN VALUES-INTRODUCTION				6	
Need, Basic Guidelines, Content and Process for Value Education – Understanding Harmony in the Human Being – Harmony in Myself! – Understanding Harmony in the Family and Society – Harmony in Human-Human Relationship						
UNIT V	UNIVERSAL HUMAN VALUES -HARMONY				6	
Understanding Harmony in the Nature and Existence – Whole existence as Co-existence Implications of the above Holistic Understanding of Harmony on Professional Ethics						
		L :30	T: 0	P: 0	J: 0	T:30 PERIODS

TEXT BOOKS

- 1 Mike W. Martin and Roland Schinzinger, Ethics in Engineering, Tata McGraw Hill, New Delhi, 2003
- 2 R.R Gaur, R Sangal, GP Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

REFERENCES

- 1 Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics, Prentice Hall of India, New Delhi, 2004.
- 2 Charles B. Fleddermann, — Engineering Ethics, Pearson Prentice Hall, New Jersey, 2004.
- 3 Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, — Engineering Ethics – Concepts and Cases, Cengage Learning, 2009.
- 4 Edmund G Seebauer and Robert L Barry, — Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Create an awareness on Human Values
- CO2** Understand moral issues and sense of Engineering Ethics
- CO3** Understand code of Ethics and Engineering as Experimentation
- CO4** Study the safety, responsibility and rights
- CO5** Visualize the global issues and code of conduct

1. The scope of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies.
2. Every project work shall have a guide who is the member of the faculty of the institution.
3. Shall consist of identification of the project after literature survey.
4. Students should present a review paper and submit it to the internal examiners.
5. Report should summarize the methodology to be adopted, work plan for the proposed project work.
6. The final report shall be type written form as specified in the guidelines.
7. The continuous assessment shall be made as prescribed in the regulations
8. Awarding Credit value is based on the performance of the above said criteria.
9. 25% of the project work and its methodologies are to be completed.

L: 0 T: 0 P:60 TOTAL: 60 PERIODS

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Apply the relevant knowledge and skills, which are acquired within the technical area, to a given problem.
- CO2** Apply the knowledge and demonstrate a project work
- CO3** Reflect on, evaluate, and critically assess one's own and others' scientific results
- CO4** Discriminate the research journals/Technical Papers.
- CO5** Publish their project work in a reputed journal / Conference Proceedings.

SEMESTER VIII

19MCP402

PROJECT-II

L	T	P	J	C
0	0	24	0	12

1. If the students want to continue the Project work as per the directions of Project-I, he can continue to enhance the Project-I. The students can also do a new project in Project-II
2. Project periods shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
3. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.
4. Create a model/fabricate a model/conduct experiment/simulate mechanical system/implement improved ideas for the project work carried in Phase-I. Analyze data, evaluate the results and conclude the appropriate solution, suggestion for future work.
5. The continuous assessment shall be made as prescribed in the regulations.
6. The progress of the project is evaluated based on a minimum of three reviews.
7. The review committee may be constituted by the Head of the Department
8. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.
9. This final report shall be typewritten form as specified in the guidelines.

COURSE OUTCOMES

At the end of the course students should be able to

CO 1: Propose solution to the problem based on literature survey and future trends.

CO 2: Perform analysis using appropriate tools/methods for the problem.

CO 3: Identify the process for fabrication / manufacturing.

CO 4: Conduct experiment and Summarize result

CO 5: Pertain the knowledge and demonstrate a project work using real life problems by publishing their project work in a reputed journal/ Conference Proceedings.

PROFESSIONAL ELECTIVE

19MEE312

PRINCIPLES OF MANAGEMENT

L	T	P	J	C
3	0	0	0	3

UNIT I INTRODUCTION TO MANAGEMENT

9

Management: Definition - Evolution of Management Studies –Nature, Functions, Levels and role of management - Basic Principles and Process of Management - Management vs. Administration – Taylor & Fayol's contribution to Management - Role of Managers - Current trends and issues in Management

UNIT II PLANNING

9

Planning: Basic types of planning – Characteristics of a good plan- Features - Planning process-Planning Tools and Techniques - Obstacles in planning - MBO, Policy - Policy formulation - Types of policies - Forecasting, Process, Importance – Decision making process.

UNIT III ORGANISING

9

Organization: Need - forms of organization - features of a good organization. Departmentation – manuals – delegation of authority and responsibility - centralization and decentralization. Career planning and management.

UNIT IV STAFFING & DIRECTING

9

Staffing: Meaning, Nature, Need, and Process. Directing - Characteristics, Importance and Techniques of directing - Coordination - Need for coordination leadership – types and theories of leadership

UNIT V CONTROLLING

9

Concept of Control – Importance of control- Essentials of control system - Process of control – Communication - Process of Communication - Types - Barriers - Management Information Systems - Reporting.

L: 45 T: 0 P: 0 TOTAL: 45 PERIODS

TEXT BOOKS

1. Harold Koontz, and Weihrich, 'Essential of Management' 8th Edition, Tata Mc Gra Hill Education, Delhi, (2010).
2. Tripathy.P.C and Reddy.P.N., 'Higher Principles of Management' Tata Mc-Graw Hill Publishing Company limited, New Delhi (2011).

REFERENCES

1. Stephen.P.Robbins, Mary coulter, NeharikaVohra 'Management', 10th Edition, TataMc-Graw Hill Publishing Company limited, New Delhi (2010).
2. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education (2011).
3. VSP Rao, V.Hari Krishna, 'Management, Excel Books (2010).
4. Dr.Kumkum Mukherjee, 'Principles of Management, 2nd Edition, Tata McGrawHill, (2009).
5. Charles W.L. Hill, Steven Lattimore McShane'Principles of Management, 2nd Edition, Tata McGrawHill, (2008).

COURSE OUTCOMES

At the end of the course the student will be able to

CO1 Discuss and communicate the management evolution and how it will affect future managers.

CO2 Explain how organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment.

CO3 Practice the process of management's four functions: planning, organizing, leading, and controlling.

CO4 Use appropriate methods of communication in the Business Environment.

CO5 Gather and analyze both qualitative and quantitative information to isolate issues and formulate best control methods

19MCE301	DESIGN OF MECHATRONICS SYSTEMS	L	T	P	J	C
		3	0	0	0	3
UNIT I	FUNDAMENTALS				9	
Key elements – Mechatronics Design process –Design Parameters – Traditional and Mechatronics designs – Advanced approaches in Mechatronics - Industrial design and ergonomics, safety.						
UNIT II	SYSTEM MODELLING				9	
Introduction-model categories-fields of application-model development-model verification- model validation-model simulation-design of mixed systems-electro mechanics design-model transformation-domain-independent description forms-simulator coupling.						
UNIT III	SYSTEM INTERFACING				9	
Introduction - Elements of data acquisition and control - Overview of I/O process, Analog signals, discrete signals, Data conversion process and Frequency signals, over framing.						
UNIT IV	CASE STUDIES ON MECHATRONIC SYSTEM				9	
Thermal cycle fatigue of a ceramic plate - pH control system - De-Icing Temperature Control System - Skip control of a CD player - Autofocus Camera, exposure control.						
UNIT V	ADVANCED APPLICATION IN MECHATRONICS				9	
Sensors for condition Monitoring – Mechatronic Control in Automated Manufacturing – Artificial intelligence, Fuzzy Logic Applications, Micro actuation – Micro robot – Micro pump – Applications of micro Mechatronics components						
		L : 45	T: 0	P: 0	J: 0	Total: 45 PERIODS

TEXT BOOKS

- 1 Smaili and F. Mrad, "Applied Mechatronics", Oxford University Press, 2007
2. Georg pelz, "Mechatronic Systems: Modelling and simulation" with HDLs, John wiley and sons Ltd, 2003

REFERENCES

- 1 Bishop, Robert H, "Mechatronics Hand book", CRC Press, 2002.2. Bradley, Dawson
- 2 N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991, First Indian print 2010.
- 3 De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint,2013
- 4 Bolton, -Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering-, 2nd Edition, Addison Wesley Longman Ltd., 1999
- 5 Devdasshetty, Richard A. Kolk, "Mechatronics System Design", 2nd Edition, Cengage Learning 2011.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Design simple mechatronics system.
- CO2** Demonstrate the mechatronics design process
- CO3** Understand the data acquisition system with application
- CO4** Get exposure to the applications of mechatronics system.
- CO5** To Realize the advanced application in mechatronics system.

UNIT I MANUFACTURING SYSTEMS AND MODELS**9**

Introduction to manufacturing models- types and principles of manufacturing system, manufacturing models - types and uses- physical models, mathematical models, model uses, model building.

UNIT II ASSEMBLY LINES**9**

Introduction- line balancing algorithms- COMSOL Random sequence generation, Ranked positional weight heuristics, optimal solutions- practical issues - mixed models – sequencing- unpaced lines- Shop scheduling with many products, Order release, flow shop sequencing – single and two machine flow shops- job shop scheduling.

UNIT III PROCESS MONITORING CONDITION MONITORING**9**

Principle, Sensors for Process Monitoring - online and off line quality control, Quality parameter design Direct monitoring of fault based on process signals. Condition monitoring of manufacturing systems- principles –sensors for monitoring force, vibration and noise. Selection of sensors and monitoring techniques. Acoustics emission sensors-principles and applications-online tool wear monitoring.

UNIT IV AUTOMATIC IDENTIFICATION TECHNIQUES**9**

MRP-MRP II-Shop floor control –Factory data collection systems – Automatic identification methods – Bar code technology, Two-Dimensional Bar Codes, Radio Frequency Identification, automated data collection system – Agile manufacturing- flexible manufacturing- Enterprise integration and factory information system.

UNIT V MACHINE LEARNING**9**

Machine Learning – Impacts of Machine learning - Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks - Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**TEXT BOOKS**

- 1 Rao P.N., “Manufacturing Technology, Metal cutting and Machine Tools”, Tata McGraw Hill, 2000.
- 2 Sabriesalomon, Sensors and Control Systems in Manufacturing, McGraw Hill int.edition,1994.

REFERENCES

- 1 Ronald G. Askin and Charles R. Standridge, “Modeling and analysis of manufacturing systems” John Wiley & Sons, Inc. 2000
- 2 Groover M.P., “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice-Hall of India Pvt. Ltd., New Delhi, 1996.
- 3 Jha, N.K., “Handbook of Flexible Manufacturing Systems”, Academic Press Inc., 1991
- 4 Intelligent Manufacturing Systems, Andrew Kusiak.,Prentice Hall
- 5 Artificial Neural Networks.YagnaNarayana,PHI,2006

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the Concept of condition monitoring and identification techniques.
- CO2** Apply various knowledge based techniques
- CO3** Learned about the different processing technologies in non-traditional process in manufacturing
- CO4** Design the Jigs, fixtures and dies for industrial applications.
- CO5** Adopt intelligent system

L	T	P	J	C
3	0	0	0	3
9				

UNIT I SYSTEM AND SYSTEM ENVIRONMENT

System and System Environment: Component of a system Continuous and discrete systems Models of a system modelling, simulation as a decision making tool.

UNIT II RANDOM NUMBER GENERATION

Random Number Generation: Midsquare- The midproduct method Constant multiplier method Additive Congruential method Test for random numbers: the Chi-square test the KoimogrovSmimov test Runs test Gap test- Generation of Pseudo techniques of generating pseudo random numbers.

UNIT III RANDOM VARIABLE GENERATION

Random Variable Generation: Inverse transform technique Exponential distribution Poisson distribution Uniform distribution Weibull distribution Empirical distribution Normal distribution Building and empirical distribution The Rejection method. Direct Transformation for normal distribution.

UNIT IV DATA ANALYSIS

Simulation of Systems: Simulation of continuous system Simulation of discrete system Simulation of an event occurrence using random number table. Simulation of component failures using Exponential and weibull models. Verification and validation of simulation models.

UNIT V SIMULATION LANGUAGES

Comparison and selection of GPSS, SIMSCRIPT, SLAM. Development of simulation models using Arena simulation package for queuing system, Production system, Inventory system, Maintenance system – An Electronic Assembly and testing system.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Banks J., Carson J.S. and Nelson B.L., “Discrete – Event System Simulation”, 3rd Edition, Pearson Education, Inc 2004
2. David Kelton.W .and Randall P. Sowdowski, “Simulation with Arena”, 2nd Edition , McGraw Hill, 2002

REFERENCES

- 1 Geoffrey Gorden, “System Simulation”, Prentice Hall of India, 2003
- 2 NarsinghDeo., “System Simulation with Digital Computer”, Prentice Hall of India, 2003.
- 3 David V Hutton, “Fundamentals of Finite Element Analysis”, McGraw Hill Int. Ed., New Delhi 2004.
- 4 Rao S S,”The Finite element Method in Engineering”, Pergammon Press, 2005
- 5 Rogers.D.F. and Adams.J.A., Mathematical Elements in Computer Graphics, 2nd Edition, Tata McGraw-Hill, New Delhi, 2003

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Summarize the working of system and system Environment.
- CO2** Design & Simulation of systems
- CO3** Outline operations of Random variable generation systems
- CO4** Simulation methods and tools for modelling and simulation of continuous, discrete and combined systems.
- CO5** Create simulation models of various types

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS**9**

Embedded system, Functional building block of embedded system, Characteristics of embedded system applications, Challenges in embedded system design, Embedded system design processes.

UNIT II ARCHITECTURE OF EMBEDDED SYSTEM**9**

Computer architecture taxonomy, CPUs – Programming input and output, Supervisor mode, Exceptions & Traps, Co - processors, Memory system mechanisms - CPU bus - Memory devices - I/O devices - Component interfacing - Assembly and linking - Basic compilation techniques – Program optimization.

UNIT III OS FOR EMBEDDED SYSTEMS**9**

Introduction to RTOS, Multiple tasks and multiple processes, Context switching, Operating system, Scheduling policies, Interprocess communication mechanisms. Introduction to μ C/ OS II.

UNIT IV PERFORMANCE ISSUES OF EMBEDDED SYSTEMS**9**

CPU Performance, CPU power consumption, Program level performance analysis, Analysis and optimization of program size, energy and power, Evaluating operating system performance, Power management and optimization strategies for processes, Multiprocessors – CPUs and accelerators, Multiprocessor performance analysis.

UNIT V IMPLEMENTATION AND APPLICATIONS**9**

Development and debugging, Manufacturing Testing, Program validation and Testing, Distributed embedded architecture, Networks for Embedded Systems - I2 C Bus, CAN Bus, Design examples: Cell phones, Digital Still Cameras, Elevator Controller.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**TEXT BOOKS**

- 1 Wayne Wolf, "Computers as Components: Principles of Embedded Computer Systems Design", The Morgan Kaufmann Series in Computer Architecture and Design, Elsevier Publications, 2008.
2. Rajkamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013.

REFERENCES

- 1 Shibu. K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill,2009.
- 2 Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013
- 3 Peckol, "Embedded system Design", John Wiley & Sons,2010 (UNIT IV and V)
- 4 Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning,2009
- 5 Rajib Mall "Real-Time systems: Theory and Practice" Pearson Education, 2007.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Outline the concepts of embedded systems.
- CO2** Explain the basic concepts of real time Operating system design.
- CO3** Use the system design techniques to develop software for embedded systems
- CO4** Differentiate between the general purpose operating system and the real time operating system.
- CO5** Model real-time applications using embedded-system concepts.

UNIT I INTRODUCTION**9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM – Industrial Examples of Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, and Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES**9**

Leadership - Strategic quality planning - Employee involvement and engagement initiatives in industries - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - Case studies on 5S and Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III STATISTICAL PROCESS CONTROL (SPC)**9**

Statistical fundamentals – Measures of central Tendency and Dispersion - Population and Sample, Control Charts for variables and attributes, Industrial Examples. Process capability. 5's Principles and Six Sigma Process – Case studies – New seven Management tools.

UNIT IV TQM TOOLS**9**

Benchmarking - Reason to benchmark, Best Practices and case studies of Benchmarking process - FMEA - Stages, Types. Quality Function Deployment (QFD) - House of Quality - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures in various industries.

UNIT V QUALITY SYSTEMS**9**

Need for ISO 9000 and Other Quality Systems - ISO 9001:2015 Quality System - Elements, Implementation of Quality System Documentation, Quality Auditing in industries - QS 9000 – BS-OHSAS 18001: 2007, ISO 20000, ISO 22000 IATF 16949: 2016, ISO 14001:2015, AS9100–Concept, Requirements and Benefits - Case studies.

L: 45 T:0 P:0 J:0 TOTAL: 45 PERIODS**TEXT BOOKS**

1. Dale H. Besterfield, "Total Quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2016.
2. Subburaj Ramasamy "Total Quality Management" Tata Mcgraw hill edition, 2015.

REFERENCES

1. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2010.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2016.
4. Dr S. Kumar, "Total Quality Management", Laxmi Publications Ltd., New Delhi 2006.
5. P. N. Muherjee, "Total Quality Management", Prentice Hall of India, New Delhi, 2015.

COURSE OUTCOMES

At the end of the course the student will be able to

CO1 State about the recent techniques followed in quality approach.

CO2 Improve Leadership Skills and raise the employee involvement.

CO3 Implement the Concepts of SPC Tools in Industrial Activity.

CO4 Examine the TQM Tools in Several Engineering fields.

CO5 Explain about the ISO and QS certification process and its need for the industries.

UNIT I INTRODUCTION

Brief review of Human physiology and anatomy – Cell and its structure – Action and Resting Potential- propagation of action potential – Sodium pump- electrodes for their measurement -ECG, EEG, EMG – machine description.

UNIT II TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION 9

Basic transducer principles Types – source of bioelectric potentials – resistive, inductive, capacitive, fiber-optic, photoelectric and chemical transducers – their description and feature applicable for biomedical instrumentation – Bio and Nano sensors and application

UNIT III RECORDING AND MONITORING SYSTEMS 9

Input Isolation, DC amplifier, power amplifier, and differential amplifier, carrier Amplifier. Oscillography – Galvanometric - X-Y, magnetic recorder, storage oscilloscopes – electron microscope – PMMC writing systems – Electro cardio graph – Digital Stethoscope - Oximeters.

UNIT IV MEDICAL IMAGING SYSTEMS AND THERAPEUTIC EQUIPMENTS 9

Electro cardio graph measurements – blood pressure measurement: by ultrasonic method – Plethysonography – blood flow measurement by electromagnetic flow meter cardiac output measurement by dilution method – phonocardiography – vector cardiography. Heart lung machine – artificial ventilator – Anaesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner – laser equipment and application – cardiac pacemaker – DC-Defibrillator – patient safety - electrical shock hazards.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9

Radiation therapy and planning – Diathermies – Surgical Diathermy – Telemetry principles – Biotelemetry, Telemedicine – Insulin Pumps – Radio pill – Endomicroscopy – Virtual Hospitals – Smart Medical Homes – Personalized e-health services – Biometrics - GRID and Cloud Computing in Medicine.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Khandpur R.S, “Handbook of Biomedical Instrumentation”, McGraw Hill Education, 3rd edition, 2014.
2. SiamakNajarian., “Mechatronics in Medicine – A Biomedical Engineering Approach”, McGraw Hill Education, 1st edition, 2011.

REFERENCES

- 1 Cromwell, Weibelland Pfeiffer, “Biomedical Instrumentation and Measurements” Prentice Hall of India, 2nd Edition, 1999.
- 2 Geddes L.A., and Baker, L.E., “Principles of Applied Bio-medical Instrumentation” John Wiley and Sons, 3rd Edition, 1995.
- 3 Tompkins W.J., “Biomedical Digital Signal Processing”, Prentice Hall of India, 1998.
- 4 Arumugam M., “Bio Medical Instrumentation”, Anuradha Agencies Pub., 2002.
- 5 Raja Rao C and Guha S.K., “Principles of Medical Electronics and Biomedical Instrumentation” Universities Press, 2013.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the human body electro- physiological parameters and recording of bio-potentials.
- CO2** Comprehend the transducers used to measure the non-electrical physiological parameters.
- CO3** Differentiate the working of recorders and monitoring methods used in medicine
- CO4** Able to identify the major functions of mechatronics equipment in medical field.
- CO5** Get exposed to the recent applications of mechatronics in medical field.

19MCE306	COMPUTER INTEGRATED MANUFACTURING	L	T	P	J	C
		3	0	0	0	3
UNIT I	INTRODUCTION					9

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerized elements of CIM system –Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

UNIT II	PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING	9
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Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.

UNIT III	CELLULAR MANUFACTURING	9
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Group Technology (GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.

UNIT IV	FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS)	9
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Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

UNIT V	JUST IN TIME (JIT)	9
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Basic concepts of JIT GLOBAL IMPLEMENTATION OF JIT: JIT in automotive industry, JIT in electronics, computer, telecommunication and instrumentation, JIT in process type industry, JIT in seasonal demand industry, other manufacturing industries, Case study.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2016.
2. Radhakrishnan P, Subramanyan S. and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi, 2007.

REFERENCES

- 1 Kant Vajpayee S, “Principles of Computer Integrated Manufacturing”, Prentice Hall India, 2003.
- 2 Gideon Halevi and Roland Weill, “Principles of Process Planning – A Logical Approach” Chapman & Hall, London, 2002.
- 3 P Rao, N Tewari &T.K. Kundra, “Computer Aided Manufacturing”, Tata McGraw Hill Publishing Company, 2010.
- 4 Yorem Koren, “Computer Integrated Manufacturing”, McGraw Hill, 2010.
- 5 P N Rao, “CAD/CAM Principles and Applications”, TMH Publications, 2012

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the concept and requirement of the integration of the design and manufacturing
- CO2** Understand the use of computers in process planning and control
- CO3** Appraise the concepts of cellular manufacturing
- CO4** Understand Flexible Manufacturing System in Industrial Activity and Robotics in FMS
- CO5** Understand the concept and implementation of JIT

19MCE307	ARTIFICIAL INTELLIGENCE FOR ROBOTICS	L	T	P	J	C
		3	0	0	0	3
UNIT I	INTRODUCTION TO AI					9

Introduction to AI - Production systems, Control strategies, Search strategies. Problem characteristics, Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents, Production system characteristics -Specialized productions system- Matching, Indexing and Heuristic functions -Hill Climbing

UNIT II	FUZZY LOGIC SYSTEMS	9
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Basic of fuzzy logic theory - crisp and fuzzy sets, Basic set operation like union - interaction - complement - T-norm - T-conorm - composition of fuzzy relations - fuzzy if-then rules - fuzzy reasoning - Neuro-Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference System (ANFIS) - ANFIS architecture - Hybrid Learning Algorithm.

UNIT III	NEURAL NETWORKS	9
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Back Propagation Network - generalized delta rule - Radial Basis Function Network - interpolation and approximation RBFNS - comparison between RBFN and BPN - Support Vector Machines: Optimal hyperplane for linearly separable patterns - optimal hyperplane for non-linearly separable patterns - Inverse Modeling.

UNIT IV	MOBILE ROBOT LOCALIZATION	9
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Introduction to localization – noise and aliasing – localization-based navigation – belief representation – map representation – probabilistic map-based localization – autonomous map building.

UNIT V	AI EXPERT SYSTEMS IN ROBOTICS	9
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ROBOT Expert systems – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving, Architecture of Robot expert systems, Roles of Robot expert system

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill- 2010. \
2. H.J. Zimmermann, “Fuzzy Set Theory and its Applications”, Springer. \

REFERENCES

- 1 Peter Jackson, “Introduction to Expert Systems”, 3rd Edition, Pearson Education, 2007.
- 2 Stuart Russel and Peter Norvig “AI – A Modern Approach”, 4th Edition, Pearson Education 2021.
- 3 Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2020.
- 4 Christopher M. Bishop, “Neural Networks for Pattern Recognition”, Oxford University Press. \
- 5 R. Siegwart, I. R. Nourbaksh, and D. Scaramuzza, “Introduction to Autonomous Mobile Robots”, Second Edition, MIT Press, 2011.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the basics of AI algorithms.
- CO2** Understand the fundamentals of Computational Intelligence models.
- CO3** Understand the concepts of neural networks and fuzzy neural networks.
- CO4** Devise the localization algorithm for AI robot.
- CO5** State the conclusions that the evaluation supports Artificial Intelligence.

UNIT I INTRODUCTION TO VIRTUAL REALITY & HAPTICS 9

Virtual reality concepts – virtual world and real world – Interface to virtual world (inputs and outputs) – Types of interaction – Applications. Definition - Importance of Touch - Tactile Proprioception - Tactual Stereo genesis – Kinesthetic Interfaces - Tactile Interfaces - Human Haptics - Overview of existing applications.

UNIT II DESIGN OF HAPTIC DEVICES 9

Virtual Reality Input and Virtual Reality Output parameters - Computing Architectures for VR - Haptic assembly architecture - Haptic Interface Design – Kinesthetic devices.

UNIT III KINEMATICS AND DYNAMICS 9

Homogeneous Transformation Matrices - Transformation Invariants – Force Computation – Force Smoothing and Mapping

UNIT IV GEOMETRIC MODELING 9

Virtual Object Shape - Object Visual Appearance – Position - Object Hierarchies – Physical Modeling: Collision Detection, Surface Deformation, Haptic Texturing.

UNIT V CASE STUDIES ON VIRTUAL REALITY 9

Case Study-Virtual Reality at NASA, Automatic stitching of panoramas in Virtual Reality, A virtual Study Use Case- NICE, An Educational Experience, GHOST (General Haptics Open Software Toolkit) software development toolkit, Side effects of using VR systems/ VR sickness.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Sherman, William R. and Alan B. Craig. Understanding Virtual Reality – Interface, Application, and Design, Morgan Kaufmann, 2002. (Unit I, II, III, IV, V)
2. John vince, Essential Virtual Reality Fast (2012), Springer. (Unit I, II, III, IV, V)

REFERENCES

- 1 Kelly S. Hale, Kay M. Stanney, Handbook of Virtual Environments: Design, Implementation, and Applications, 2014 by CRC Press. (Unit I, II, III)
- 2 Matjaz Mihelj, Jonezpodobnik, Haptics for virtual reality and tele operation (2012), Springer. (Unit III, IV).
- 3 Grigore Burdea, Philippe Coiffet, Virtual Reality Technology (2006), 2nd edition. Wiley India. (Unit I, II)
- 4 Virtual Reality by Steve Lavalley, online open book. (Unit I, II, III, IV, V)
- 5 George Mather, Foundations of Sensation and Perception: Psychology Press; 2 edition, 2009. (Unit I, V).

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Earn knowledge on haptic architecture.
- CO2** Have the knowledge on various types of haptic devices.
- CO3** Apply the knowledge of kinematics and dynamics in VR and Haptic devices.
- CO4** Understand the geometric modelling of various objects and textures.
- CO5** Case studies, tools and side effects in Virtual Reality

19MEE301	ENGINEERING ECONOMICS AND COST ANALYSIS	L	T	P	J	C
		3	0	0	0	3

UNIT I BASIC ECONOMICS 9

Definition of economics - nature and scope of economic science - nature and scope of managerial economics - basic terms and concepts - goods - utility - value - wealth - factors of production - land - its peculiarities - labour - economies of large and small scale - consumption - wants - its characteristics and classification - law of diminishing marginal utility

UNIT II DEMAND AND SCHEDULE 9

Demand - demand schedule - demand curve - law of demand - elasticity of demand - types of elasticity - factors determining elasticity - measurement - its significance - supply - supply schedule - supply curve - law of supply - elasticity of supply - market price and normal price - perfect competition - monopoly - monopolistic competition.

UNIT III ORGANISATION 9

Forms of business - proprietorship - partnership - joint stock company - cooperative organization - state enterprise - mixed economy - money and banking - banking - kinds - commercial banks - central banking functions - control of credit - monetary policy - credit instrument.

UNIT IV FINANCING 9

Types of financing - Short term borrowing - Long term borrowing - Internal generation of funds - External commercial borrowings - Assistance from government budgeting support Profit and Loss account - Funds flow statement - Case Study on Inflation

UNIT V COST AND BREAK-EVEN ANALYSIS 9

Types of costing - traditional costing approach - activity base costing - Fixed Cost variable cost - marginal cost - cost output relationship in the short run and in long run pricing practice - full cost pricing - marginal cost pricing - going rate pricing - bid pricing - pricing for a rate of return - appraising project profitability - internal rate of return - payback period - net present value. Break even analysis - basic assumptions - break even chart - managerial uses of break-even analysis.

L: 45 T: 0 P: 0 TOTAL: 45 PERIODS

TEXT BOOKS

1. John A.White, Kenneth E Case, David B Pratt, Principles of Engineering Economic Analysis, Fifth edition, Wiley India Edition., 2015
2. D.M.Mithani, Suresh Chandra Das, Engineering Economic and Costing, Himalaya publishing House, 2017

REFERENCES

1. Barthwal R.R., Industrial Economics - An Introductory Text Book, New Age, 2007
2. R.Paneerselvam, Engineering Economics, PHI Learning Private limited, 2013
3. R.Kesavan, C.Elanchezian, T.Sundar Selwyn, Engineering Economics and Financial Accounting, Lakshmi Publications (P) LTD, 2012
4. Tahir Hussain, Engineering Economics, University science Press, 2010
5. David Whitman, Ronald E. Terry, Fundamentals of Engineering Economics and Decision Analysis, Morgan & Claypool Publishers, 2012

COURSE OUTCOMES

At the end of the course the student will be able to

- Recognize about the fundamentals of economics
- Describe about the demand and schedule of the market
- Framework about the organization process
- Develop the financial statement
- Summarize the cost and break even analyses of the system

UNIT I INTRODUCTION TO PROCESS PLANNING

9

Introduction- methods of process planning-Drawing Interpretation-Material evaluation – steps in process selection-Production equipment and tooling selection, Problems in lack of product planning Quantity determination in batch production-Machine capacity, balancing

UNIT II PROCESS PLANNING ACTIVITIES

9

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning-Schedule production: Job-shop method, Gantt charts, the critical path method, and PERT case studies, Manufacturing lead time techniques for aligning completion times and due dates.

UNIT III PRODUCT DEVELOPMENT

9

Product Development process, product development - design aspects, functional aspects, marketing aspects, profit consideration. reverse engineering and redesign product development process, new product development, tear down method.

UNIT IV PRODUCT SPECIFICATIONS

9

Establishing the product specifications– Target specifications – Refining specifications, concept generation-Clarify the problem – Search internally – Search externally – Explore systematically - Reflect on the Results and the Process.

UNIT V PRODUCT IMPROVEMENT

9

Reliability, failure identification techniques, Poka-Yoke, Design for the environment, design for maintainability, product safety, liability and design, design for packaging, factorial analysis-ANOVA, factorial experiments,

L: 45 T:0 P:0 TOTAL: 45 PERIODS**TEXT BOOKS**

1. Peter Scaloni, “Process planning, Design/Manufacture interface”, Elsevier science technology Books, 2002.
2. Alexis Leon, “Enterprise Resource Planning”, Tata McGraw Hill, New Delhi,2008.

REFERENCES

1. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, John Wiley, 9th Edition, 1998.
2. Concurrent Engg. /Integrated Product Development. Kemnneth Crow, DRMAssociates, 26/3, ViaOlivera, Palos Verdes, CA 90274 (310) 377 569, WorkshopBook
3. “Effective Product Design and Development”, Stephen Rosenthal, Business OneOrwin Homewood, 1992, ISBN, 1-55623-603-434
4. David S Linthicum, “B2B Application Integration”, Addison Wesley,2001
5. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002

COURSE OUTCOMES

At the end of the course students should be able to

Apply knowledge on the concepts of product specification.

Know the concept of product architecture.

Describe the principles of industrial design and prototyping.

Examine the concept of product development and customer needs.

Understand the concept of product improvement, safety, and packing.

UNIT I INTRODUCTION**9**

Evolution of electronics in automobiles – emission laws – Euro standards – Equivalent Bharat Standards. Adaptive Lighting System-Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

UNIT II IGNITION AND INJECTION SYSTEMS**9**

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fueling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – MPFI technology – Diesel fuel injection-DTSI Technology.

UNIT III SENSOR AND ACTUATORS**9**

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall Effect, Throttle angle, temperature, exhaust gas oxygen sensors, Brake Fluid Pressure Sensor, Engine Torque Sensor – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV ENGINE CONTROL SYSTEMS**9**

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. Vehicle networking solutions: CAN standard, FlexRay – Diagnostics systems in modern automobiles-OBD-I and OBD-II system - Basic Study on BS Vehicles.

UNIT V CHASSIS AND SAFETY SYSTEMS**9**

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars. Keyless entry – Tyre pressure warning-Noise control – Reverse sensing / parking aid – Car navigation system – Telematics - Global Positioning System - SOS Tracking Device.

L: 45 T:0 P:0 TOTAL: 45 PERIODS**TEXT BOOKS**

1. Ribbens, "Understanding Automotive Electronics", 7th Edition, Elsevier, Indian Reprint, 2013
2. Robert Bosch, Automotive Electronics Handbook, John Wiley and Sons

REFERENCES

1. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2000.
2. Barry Hollembeak, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, 2001
3. Richard K. Dupuy "Fuel System and Emission controls", Check Chart Publication, 2000.
4. Ronald. K. Jurgon, "Automotive Electronics Handbook", McGraw-Hill, 1999
5. Newton, Steeds and Garet, "Motor Vehicles", Butterworth Publishers, 1989

COURSE OUTCOMES

At the end of the course student should be able to:

- Understand the fundamentals of automotive system.
- Apply electronics into automobile systems
- Use advanced sensors and actuators in the upgrading of automobiles.
- Identify the different control systems in automotive and their control
- Formulate and solve real time engineering problems

UNIT I INTRODUCTION**9**

An Introduction to sensors and Transducers, History and definitions, Smart Sensing, AI sensing, Need of sensors in Robotics.

UNIT II SENSORS FOR INDUSTRIAL ROBOT**9**

Position sensors – optical, non-optical, Velocity sensors, Accelerometers, Proximity Sensors – Contact, non-contact, Range Sensing, touch and Slip Sensors, Force and Torque Sensors

UNIT III SENSORS FOR HUMANOID ROBOTS**9**

Different sensing variables – smell, Heat or Temperature, Humidity, Light, Speech or Voice recognition Systems, Telepresence and related technologies.

UNIT IV HYDRAULIC ACTUATORS**9**

Robotics Actuator- Hydraulic rotary and linear actuators. Hydraulic components in robots, Power Pistons-Linear, Rotary pistons, Drive Motors-Flapper motor, geared motor- Electrohydraulic circuits.

UNIT V ELECTRIC AND SERVO SYSTEMS FOR ROBOT CONTROL**9**

Control Techniques- DC Motor, AC motor, stepper motors, General aspects of robot control, hydraulic position servo, computer-controlled servo system for robot applications, selection of robot drive systems.

L: 45 T: 0 P:0 TOTAL: 45 PERIODS**TEXT BOOKS**

1. SabrieSoloman, “Sensors and Control Systems in Manufacturing”, McGraw-Hill Professional Publishing, 2nd Edition, 2009.
2. Richard D. Klafter, Thomas.A, ChriElewski, Michael Negin, “Robotics Engineering an Integrated Approach”, Phi Learning., 2009.

REFERENCES

1. Julian W Gardner, “Micro Sensor MEMS and Smart Devices”, John Wiley & Sons, 2001.
2. Paul W Chapman, “Smart Sensors”, an Independent Learning Module Series, 1996.
3. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, “Industrial Robotics, Technology programming and Applications”, Tata McGraw-Hill Education, 2012.
4. Robert J. Schilling, “Fundamentals of Robotics Analysis and Control”, PHI Learning., 2009.
5. John J. Craig, “Introduction to Robotics Mechanics and Control”, Third Edition, Pearson, 2008.

COURSE OUTCOMES

At the end of the course the student will be able to

Know the basics concepts of Sensors.

Acquire knowledge on sensors for Industrial Robot.

Describe the principles of sensors for Humanoid Robot.

Examine the concept of Hydraulic and Pneumatic Actuators.

Understand the concept of Electric and Servo Systems for Robot Control.

UNIT I PRODUCTION OPERATIONS AND AUTOMATION STRATEGIES 9

Automation – Definition, levels, need, strategies principles. Types of production, functions in manufacturing, plant layout – types, organization and information processing in manufacturing, Types of flow lines, Flexible manufacturing, FMC, Building blocks of FMS, FMS layout, FMS planning

UNIT II GROUP TECHNOLOGY 9

Automated manufacturing systems: Components, classification, overview, group technology and cellular manufacturing, parts classification and coding– OPITZ and MI CLASS system, product flow analysis, cellular manufacturing, advantages, disadvantages and application considerations in GT

UNIT III INTEGRATED MANUFACTURING SYSTEMS 9

Definition - application - features - types of manufacturing systems-machine tools-materials handling system computer control system - DNC systems manufacturing cell. Flexible manufacturing systems (FMS) - the FMS concept-transfer systems - head changing FMS- variable mission manufacturing system - CAD/CAM system-Rapid prototyping - Artificial Intelligence and Expert system in CIM.

UNIT IV MATERIAL HANDLING AND AS/RS SYSTEMS 9

Material handling: Introduction, material handling systems, principles and design, material transport system: transfer mechanisms, uses of various types of handling systems including AGV and its various guiding technologies. Automated material handling systems – AGV, Transfer mechanism - Buffer storage – Analysis of transfer lines, Robots in material handling, Automated storage and Retrieval Systems (AS/RS) – carousel storage – Automatic data capture – bar code technology, Automated assembly systems.

UNIT V MANUFACTURING SUPPORT & APPLICATIONS 9

Process planning and concurrent engineering- process planning, CAPP, CE and design for manufacturing, advanced manufacturing planning, production planning and control system, master production schedule, MRP. Capacity planning, shop floor control, inventory control, MRP-II, J.I.T production systems, Kanban System, Business Process Re-engineering (BPR), 5S, lean and agile manufacturing.

L: 45 T:0 P:0 TOTAL: 45 PERIODS**TEXT BOOKS**

1. Groover, M.P. “Automation, Production Systems and Computer Integrated Manufacturing”, 4th edition Prentice Hall of India, New Delhi, 2015.
2. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi, 1998

REFERENCES

1. Rao .P.N., Computer Aided Manufacturing, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2001.
2. Kant Vajpayee .S, Principles of Computer Integrated Manufacturing, Prentice Hall of India Pvt. Ltd., 1995.
3. Radhakrishnan .P, Subramaniam .S, CAD/CAM/CIM, New Age International Limited, 1994.
4. Viswanathan .N, Navahari .Y “Performance Modeling of Automated Manufacturing Systems”, Prentice Hall of India Pvt. Ltd., 1998.
5. Jha, N and K. “Handbook of Flexible Manufacturing Systems”, Academic Press, Orlando, 2006.

COURSE OUTCOMES

At the end of the course students should be able to

- Understand the various automations in the production system.
- Able to learn techniques and the importance of group technology.
- Understand the concept of cellular manufacturing systems.
- Familiar with fundamentals of ASRS.
- Understand the methodologies in the production support system.

OPEN ELECTIVE

UNIT I ROBOTICS BASICS

Robot-Basic concepts, Need, Law, History, Anatomy, specification. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision and accuracy of robot. Robot kinematics, robot dynamics, Euler equation

UNIT II SENSORS FOR ROBOTICS

9

Sensors in robot – Touch sensors - Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensors -Light sensors, Pressure sensors.

UNIT III ACTUATORS FOR ROBOTICS

9

End effectors-Classification, Types of Mechanical actuation, gripper force analysis, Robot drive system-Types, Position and velocity feedback devices-Robot joints and links-Types, Motion interpolation

UNIT IV INDUSTRIAL ROBOTS AND APPLICATIONS

9

Robot work cell design and control – Safety measures in Robot – Robot cell layouts – Multiple robots and machine interference – Robot cycle time analysis – Industrial applications of robots.

UNIT V ROBOT PROGRAMMING & HUMANOID ROBOTS

9

Introduction, Program, V rep programming – Need of Humanoid robots – Sensors: Proprioceptive sensors - Exteroceptive sensors – Actuators for Humanoid Robots - planning and control – DoF – ZMP – Applications.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

1. Deb.S.R, "Robotics Technology and Flexible Automation", Tata McGraw - Hill Publishing Company Limited, 2010. (Unit- I,II,III,IV,V)
2. Mikell. P. Groover, 'Industrial Robotics Technology', Programming and Applications, McGraw Hill Co, 2008. (Unit- I,II,III,IV,V)

REFERENCES

1. Klafter.R.D, Chmielewski.T.A, and Noggin's., "Robot Engineering : An Integrated Approach", Prentice Hall of India Pvt. Ltd.,1994. (Unit- I,II,III,IV)
2. Fu.K.S, Gonzalez.R.C&Lee.C.S.G, "Robotics control, sensing, vision and intelligence", McGraw Hill Book co, 1987. (Unit- I,II,III,IV,V)
3. Craig.J.J, "Introduction to Robotics mechanics and control", Addison- Wesley, 1999. (Unit- I,II,III,IV,V)
4. Ray Asfahl.C, "Robots and Manufacturing Automation", John Wiley & Sons Inc., 1985 (Unit- I,II,III,IV,V)
5. Kozyrey, Yu. "Industrial Robotics", MIR Publishers Moscow, 1985. (Unit- I)

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the Robot fundamentals
- CO2** Identify Robots various components parts and the robotic internal and external sensors
- CO3** Know robot transformation system and its application to a robot's kinematic structure.
- CO4** Understand the application of robot work cell
- CO5** Apply the Robot programming and working of Humanoid robots.

UNIT I INTRODUCTION TO MEMS AND MICROFABRICATION 9

MEMS Roadmap - MEMS markets - MEMS foundries - Benefits of Miniaturization - Benefits of Scaling. Microfabrication: Basic Fabrication Processes – oxidation - film deposition – lithography – etching - ion implantation – diffusion - Cleanroom technology.

UNIT II MICROMACHINING TECHNIQUES 9

Surface Micromachining: Basic process flow – release – stiction – material choices - residual stress - Electroplating. Bulk Micromachining: wet etch-based - dissolved wafer process - SOI MEMS – Scream – MEMS – RIE – DRIE.

UNIT III MEMS DEVICES 9

Pressure sensors- Accelerometers - Gyroscopes- RF MEMS Switch- Temperature sensors - Humidity sensors. Micro actuators: Electrostatic – piezoelectric – SMA – Thermoelectric – electromagnetic actuators

UNIT IV POLYMERS AND OPTICAL MEMS 9

Polymers in MEMS– Polyimide – SU-8 – Liquid Crystal Polymer (LCP) – PDMS – PMMA – Perylene – Fluorocarbon - Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS - Case studies- MEMS scanners and retinal scanning display, Digital Micromirror devices.

UNIT V MICROSYSTEM PACKAGING AND APPLICATION 9

Overview of packaging - Selection of packaging materials - Levels of Microsystem packaging - Interface in Microsystem packaging - Essential packaging technologies - Assembly of micro systems - Applications of MEMS in Aerospace, Healthcare, Industrial products and telecommunication.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Tai - Rai Hsu, "*MEMS and Microsystems: Design and Manufacturing*", Tata MC Graw Hill, Edition 2002.
2. Stephen D.Senturia, "*Microsystems Design*", Springer, 2001

REFERENCES

- 1 Mark Madou, Fundamentals of Microfabrication, CRC Press, New York, 2002, eBook Published 8th Oct 2018.
- 2 Chang Liu, Foundations of MEMS, Pearson Education India, 2012
- 3 K.J.Vinoy, Vijay.K.Varadan, "RF MEMS and their Applications" John Wiley & Sons Reprint@2003
- 4 NadimMaluf, KirtWillams, An Introduction to Microelectromechanical Systems Engineering Artech House Publishers, London, Second Edition, 2004
- 5 Julian W. Gardner, Microsensors – Principles and Applications, Wiley, 1994

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the concepts of MEMS systems
- CO2** Gain knowledge of materials used for micromachining techniques
- CO3** Know of basic approaches for designing various sensors
- CO4** Acquire knowledge with polymers and an optical MEMS
- CO5** Apply the knowledge in packaging and different applications of MEMS

UNIT I PLC IN INDUSTRIAL AUTOMATION**9**

Programmable Logic Controllers, Parts of a PLC, Principles of Operation, PLC Hardware Components - The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, Central Processing Unit (CPU) – PLC Programming Methods – Ladder Logic.

UNIT II HMI AND SCADA**9**

Human machine Interface – Need – Advantages - Types of HMI – HMI real time application for industry process Evolution – Water Level Monitoring in HMI - SCADA architectures –MTU – RTU – Operator Interface – Displays – Engineering Interface.

UNIT III ADVANCED INDUSTRIAL AUTOMATION & ITS APPLICATIONS**9**

Industrial Revolution - Evolution of process control operations - Remote transmission, logging and data historian - DCS - Types of Architecture. APPLICATION OF DCS - DCS Applications in power plants, Iron and steel plants, Chemical plants, Cement plants, paper and pulp industries.

UNIT IV HOME AND OFFICE AUTOMATION**9**

Introduction – Basic components - Fingerprint based door opening system –PIR sensors based lighting systems – Global Positioning System for tracking devices – GSM based home and office equipment's control – Light ON/OFF control using IoT.

UNIT V STREET AUTOMATION**9**

Introduction – basic street automation components - Smart city - IoT based street automation - Human detection-based lighting system – Density based traffic control system – street water automation using PLC – Parking automation system – Automatic gate control Mechanism.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**TEXT BOOKS**

- 1 Frank D. Petruzella, "Programmable Logic Controllers", Glencoe McGraw Hill Second Edition, 2013(Unit- I,II,III,IV,V)
- 2 Michael Lucas, "Distributed Control Systems", Van Nostrand Reinhold Co.,1986 (Unit- V)

REFERENCES

- 1 McMillan.G.K, "Process/ Industrial instrument and handbook", McGraw-Hill, New York, 1999 (Unit- I,II,III)
- 2 Popovic D. and Bhatkar.V.P, "Distributed Computer Control for industrial automation", Marcel Dekkar Inc., 1990(Unit- IV,V)
- 3 Kant, Krishna "Computer - Based Industrial Control", PHI Learning. 2004(Unit - IV,V)
- 4 Stenerson Jon Stenerson, "Industrial Automation and Process Control", PHI Learning. 2008.(Unit- I,II,III,IV,V)
- 5 Z. Binder and R. Perret"Components and Instruments for Distributed Control , Systems", Elsevier Ltd. 2009 (Unit- III,IV,V)

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Acquire an adequate knowledge about basic functions of PLC.
- CO2** Understanding the concepts of HMI and SCADA.
- CO3** Know the function and advantages of DCS.
- CO4** Automate office with simple components.
- CO5** Know the need of street automation.

UNIT I FOUNDATIONS OF HMI

The Human: History of User Interface Designing, I/O channels, Hardware, Software and Operating environments, The Psychopathology of everyday Things, Psychology of everyday actions, Reasoning and problem solving. The computer: Devices, Memory, processing and networks. Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms

UNIT II DESIGN & SOFTWARE PROCESS**9**

Mistakes performed while designing a computer system, Human interaction with computers, importance of human characteristics, human consideration, Human interaction speeds. Interactive Design basics, process, scenarios, navigation, Iteration and prototyping. HMI in software process: software life cycle, usability engineering, Prototyping in practice, design rationale. Design rules: principles, standards, guidelines, rules. Recognize the goals, Goal directed design process. Evaluation Techniques: Universal Design.

UNIT III GRAPHICAL USER INTERFACE**9**

The graphical User Interface: Popularity of graphics, the concept of direct manipulation, graphical systems, Characteristics. Web user Interface: Interface popularity, characteristics. The merging of graphical Business systems and the Web. Principles of user interface design

UNIT IV SCREEN DESIGNING**9**

Design goals, Screen planning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design

UNIT V INTERFACE DESIGN FOR MOBILE DEVICES**9**

Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**TEXT BOOKS**

- 1 Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, 3rd Edition, Pearson Education, 2004. (Unit- I,II,III,IV,V)
2. Wilbert O. Galitz, The Essential Guide to User Interface Design, Wiley publication. (Unit- II,III,IV,V)

REFERENCES

- 1 Alan Cooper, Robert Reimann, David Cronin, About Face3: Essentials of Interaction design, Wiley publication. (Unit- III, IV, V)
- 2 Jeff Johnson, Designing with the mind in mind, Morgan Kaufmann Publication. (Unit- III)
- 3 Donald A. Normann, Design of everyday things, Basic Books; Reprint edition 2002. (Unit- III)
- 4 Brian Fling, Mobile Design and Development, First Edition, O'Reilly Media Inc., 2009. (Unit- V)

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Identify User Interface (UI) design principles.
- CO2** Analysis of effective user-friendly interfaces.
- CO3** Apply Interactive Design process in real world applications.
- CO4** Evaluate UI design and justify.
- CO5** Create applications for social and technical tasks.

19MCO305	MOBILE ROBOTICS	L	T	P	J	C
		3	0	0	0	3
UNIT I	INTRODUCTION TO ROBOT LOCOMOTION				9	
Types of locomotion, hopping robots, legged robots, wheeled robots, stability, maneuverability, controllability						
UNIT II	MOBILE ROBOT KINEMATICS AND DYNAMICS				9	
Forward and inverse kinematics, holonomic and nonholonomic constraints, kinematic models of simple car and legged robots, dynamics simulation of mobile robots						
UNIT III	PERCEPTION				9	
Proprioceptive/Exteroceptive and passive/active sensors, performance measures of sensors, sensors for mobile robots like global positioning system (GPS), Doppler effect-based sensors, vision based sensors, uncertainty in sensing, filtering						
UNIT IV	LOCALIZATION				9	
Odometric position estimation, belief representation, probabilistic mapping, Markov localization, Bayesian localization, Kalman localization, positioning beacon system						
UNIT V	INTRODUCTION TO PLANNING AND NAVIGATION				9	
Path planning algorithms based on A-star, Dijkstra, Voronoi diagrams, probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), Markov Decision Processes (MDP), stochastic dynamic programming (SDP)						
		L : 45	T: 0	P: 0	J: 0	Total: 45 PERIODS
TEXT BOOKS						
1	R. Siegwart, I. R. Nourbakhsh, “Introduction to Autonomous Mobile Robots”, The MIT Press, 2011					
2.	H. Choset, K. M. Lynch, S. Hutchinson, G. Kantor, W. Burgard, L. E. Kavraki, and S. Thrun, Principles of Robot Motion: Theory, Algorithms and Implementations, PHI Ltd., 2005.					
REFERENCES						
1	Peter Corke , Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer Tracts in Advanced Robotics, 2011					
2	Thrun, S., Burgard,W., and Fox, D., Probabilistic Robotics. MIT Press, Cambridge, MA, 2005					
3	S. M. LaValle, “Planning Algorithms”, Cambridge University Press, 2006					
4	Melgar, E. R., Diez, C. C., Arduino and Kinect Projects: Design, Build, Blow Their Minds, 2012					
5	H. Choset, K. M. Lynch, S. Hutchinson, G. Kantor, W. Burgard, L. E. Kavraki, and S. Thrun, Principles of Robot Motion: Theory, Algorithms and Implementations, PHI Ltd., 2005					
COURSE OUTCOMES						
At the end of the course student should be able to:						
CO1	Acquire an adequate knowledge about the Robot Locomotion					
CO2	Understanding the various concepts of kinematics and dynamic in the Mobile robot					
CO3	To understand the various perception of Sensors in mobile Robotics					
CO4	Understand the basic concepts of various localization					
CO5	Interface the mobile robots through planning and Navigation					

CAREER COURSES

19GEP375	TECHNICAL INTERVIEWING	L	T	P	J	C
		0	0	4	0	2

UNIT I C - PROGRAMMING 12

Basic Programming: Data Types, Iteration, Recursion, Decision, Procedure, functions and scope. Data Structures: Arrays, Linked Lists, Trees, Graphs, Stacks, Queues, Hash Tables, Heaps. OOPs: Polymorphism, Abstraction, Encapsulation Miscellaneous, Searching and Sorting, Complexity Theory.

UNIT II DATA STRUCTURE CONCEPT USING C/C++/JAVA/PYTHON 12

Basics-Distinction between nanoparticles and bulk materials-Top down and Bottom up approach- -Sol gel method-Chemical vapour deposition- -Types (Nano clusters, Nano rods, Nanotubes and Nanowires)-Application of nanomaterials.

UNIT III ADVANCED DESIGN AND ANALYSIS TECHNIQUES USING C/C++/JAVA/PYTHON 12

Greedy Algorithms: Activity-selection problem fractional knapsack. Minimum Spanning Trees:Kruskal, Prim. String Matching: The naive string-matching algorithm.Divide and Conquer: Sorting algorithms Binary Search. Computational Geometry: Line-segment properties Intersection of line segment.

UNIT IV DEPARTMENT SPECIFIC DOMAIN-1 12

Geometric Dimensioning and Tolerances – Material Selection, Material testing,Stress strain , Power transmission, Balancing, Drives, CAM.

UNIT V DEPARTMENT SPECIFIC DOMAIN-2 12

Vehicle Structures, Steering system, transmission, suspension and breaking system, Friction- Electrical and Hybrid Vehicles, Conventional engines- Fuels and lubricants- Fuel cells.

L :0 T: 0 P: 60 J: 0 T:60 PERIODS

REFERENCES

- 1 Kernighan, B.W and Ritchie,D.M, —The C Programming language, Second Edition, Pearson Education, 2006
- 2 Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 1997.
- 3 Data structures, Algorithms, and applications in C++, SartajSahni, Universities Press, 2nd Edition, 2005.
- 4 Data Abstraction and Problem Solving with Java: Walls and Mirrors by Frank M. Carrano and Janet J. Prichard
- 5 AnanyLevitin, “Introduction to the Design and Analysis of Algorithms”, 3rd Edition, Pearson Education, 2012.
- 6 Spotts M F, "Dimensioning and Tolerance for Quantity Production", Prentice Hall Inc., 1983.
- 7 Kirpal Singh, “Automobile Engineering Vol. I & II”, Standard Publishers Distributors 2007
- 8 Mehrdad Ehsani, Yimin Gao, Stefano Longo, Kambiz Ebrahimi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles”, CRC Press, 2018

COURSE OUTCOMES :

At the end of the course students should be able to Apply the technical competencies to the real life problems

- CO 1** Implement concepts using C/C++/ Java/ Python.
- CO 2** Apply suitable concept of Data structures and implement the programs
- CO 3** Analyze algorithms and calculate its complexity
- CO 4** Write SQL commands and excel in Normalization techniques.
- CO 5** Excel in Layers of Computer Networks and Scheduling in Operating systems

19GEB375	PERSONNEL PSYCHOLOGY	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	1	0	2	0	2

UNIT I	FRAMEWORK OF PERSONNEL PSYCHOLOGY	3+6
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Nature and scope of personnel psychology-Functions of personnel psychologist-Importance of human Resource Management- Role in Providing for Equal Employment Opportunity-Objectives of personnel management.

UNIT II	JOB ANALYSIS	3+6
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Introduction to Job analysis-Job Descriptions- Job Specifications-Sources of Job Information-Position Analysis Questionnaire - Fleishman Job Analysis System -Importance of Job Analysis-Self-Managing Work Teams - Flexible Work Schedules - Job sharing-Selection & Interview Process- Psychometric Test.

UNIT III	PERFORMANCE ANALYSIS	3+6
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Methods for Measuring Performance: Making Comparisons-Rating Individuals -Rating Behaviors - Behaviorally anchored rating scale -Behavioral observation scale.

Measuring Results: Management by objectives (MBO)-Total Quality Management, Sources of Performance Information-Managers-Peers- Subordinates- Self.

UNIT IV	RESUME BUILDING	3+6
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Introduction- SWOT- Online learning -Preparing to Write, Writing a Winning Resume, Choosing a Resume Format, Writing a Winning Cover Letter, Professional objective and Educational section, - Canva Resume. Video Resume.

UNIT V	JOB SEARCH & NETWORKING	3+6
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Introduction to Job search-Job search platforms- Social Media Job Search- Introduction to job analysis- Job Evaluation- Self Screening-Importance of Networking-Types of Networking - Networking platforms.

L :15 T: 0 P: 30 J: 0 T: 45 PERIODS

REFERENCES

- 1 Dr.Nishi Goyal “Industrial Psychology” Krishna’s Educational Publisher.
2 Dr.S.S Khanka, Human Resource Management, S.Chand Publications
3 Parul Singh ’Writing Effective resume for effective resume for job applications” Fortune Institute of
International Business”
4 Andrea R Nirenberg” Essentials of Business networking” Tips, Tools and Tactics you can use,
Pearson Education
5 Miriam Salpter “Social Networking for career success “Learning express, New York
6 Joshua Waldman, Job searching with social media, John Wiley & Sons, Inc

COURSE OUTCOMES :

At the end of the course students should be able to

- | | |
|------------|--|
| CO1 | To know about the framework of Personnel Phycology |
| CO2 | To understand the job analysis for Job search |
| CO3 | To understand the performance analysis in job |
| CO4 | To know about resume building qualities |
| CO5 | To experience the job search and networking |

List of Exercises

S.No	Name of the Exercises
1	Mock Interview
2	Portfolio creation
3	Psychometric test
4	Video Resume
5	Cover letter and thank you letter
6	Attending business career fair
7	Empathy on Job Analysis/Search
8	Business card creation
9	Networking –Online/offline
10	Online Image & Branding
11	Exercises in career portals

UNIT I QUANTITATIVE ABILITY III

3+6

Algebra, Power, Surds and Indices, Inverse, Logarithms, Equations, Progressions, Functions and Graphs, Perimeter, Geometry, Coordinate Geometry, Direction Sense, Logical Connectives, Venn Diagrams

UNIT II QUANTITATIVE ABILITY IV

3+6

Puzzles, Physics, Base conversion, Trigonometry, Divisibility, Series, Simple Equations, Simplification, Quadratic Equations

UNIT III VERBAL REASONING II

3+6

Sentence correction and completion, Para-Jumbles, Cloze Passage, Vocabulary, Voices & Forms of Speech, Multidimensional arrangement

UNIT IV NON- VERBAL REASONING

3+6

The Embedded figure, Logical Games, Incomplete Pattern, Missing letters, Data arrangement, Mathematical orders, Inferred meaning

UNIT V LINGUISTICS SKILLS III

3+6

Sentence improvement, Subject-Verb agreement, Speech & voices, Preposition & Conjunctions, Selection words, Comprehension ordering

L :15 T: 0 P: 30 J: 0 T:45 PERIODS

TEXT BOOKS

- 1 Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.

REFERENCES

- 1 R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication.
2 M.K.Panday, “Analytical Reasoning”, Magical Series.
3 BS Sijwali- InduSijwali, A New Approach to “Reasoning Verbal, Non-Verbal & Analytical”,
Arihant Publications.
4 S.P.Bakshi, “Objective English” Arihant Publications.(Unit V)
5 R.S.Agarwal, “Quantitative Aptitude for Competitive Examinations”, S.Chand& Company
Pvt Limited.
6 R.S.Agarwal, “A modern approach to Verbal & Non-verbal reasoning”, S.Chand& Company
Pvt Limited.

COURSE OUTCOMES :

At the end of the course students should be able to

- | | |
|------------|---|
| C01 | Understand the time and distance for solving application oriented concepts in quantitative aptitude |
| C02 | Know the financial ability for solving application oriented concepts in quantitative aptitude |
| C03 | Analyze the verbal reasoning and the critical reasoning in quantitative aptitude |
| C04 | Understand the non-verbal reasoning in verbal aptitude applications |
| C05 | Apply the appropriate LSRW skills |

19GEB376	ENTREPRENEURSHIP & BUSINESS	L	T	P	J	C
	MODEL CANVAS					
	(Common to All B.E. / B. Tech. Courses)	2	0	4	0	4

UNIT I INTRODUCTION 6+8

Meaning and concept of entrepreneurship, role of entrepreneurship in economic development, agencies in entrepreneurship management and future of entrepreneurship, types of entrepreneurs, skills/ traits required to be an entrepreneur, Creative and Design Thinking, the entrepreneurial decision process, skill gap analysis, and role models, mentors and support system, entrepreneurial success stories.-Business Storytelling

UNIT II BUSINESS MODEL CANVAS 6+36

Idea generation by design thinking, Idea Validation, Business Model Canvas- Value Proposition, Customer Segments, Channels and Partners, Revenue Model and Streams, Key Resources, Activities, and Costs Customer Relationships and Customer.

UNIT III BUSINESS MODEL TO BUSINESS PLAN 6+4

Translate Business Model into a Business Plan, Visioning for venture, Take product or service to market, Deliver an investor pitch to a panel of investors, Identify possible sources of funding for your venture – customers, friends and family, Angels, VCs, Bank Loans and key elements of raising money for a new venture.

UNIT IV BUSINESS LICENSES AND PERMITS 6+4

Business Licenses and permits Business Licenses, business permits, choosing a form of business organization, sole proprietorship, partnership, corporations, Limited Liability Company.

UNIT V TOOLS FOR ENTREPRENEURS 6+8

Agile Entrepreneurship, Business Process Management & Automation, Taking Business to Digital World via Digital Marketing & eCommerce, HRM and Keeping it lean with Freelancers

L :30 T: 0 P: 60 J: 0 T: 90 PERIODS

REFERENCES

- 1 Donald F Kuratko, “Entrepreneurship – Theory, Process and Practice”, 9th Edition, Cengage Learning, 2014.
- 2 Khanka. S.S., “Entrepreneurial Development” S.Chand& Co. Ltd., Ram Nagar, New Delhi, 2013.
- 3 Osterwalder, A. and Y. Pigneur. 2010. Business Model Generation. John Wiley & Sons. Hoboken, NJ
- 4 Levin, Jack S. Structuring Venture Capital, Private Equity, and Entrepreneurial Transactions. Aspen Publishers, 2009
- 5 Sole proprietorship, partnership, corporations, Limited Liability Company - Kapoor.N.D, ‘Elements of Mercantile Law’, 30th Edition, Sultan Chand &Co., 2015
- 6 The art of digital marketing, definitive guide by Ian Dodson, Wiley.
- 7 Marlon Dumas “Fundamentals of business process management” second edition, springer.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Understand the need for entrepreneurship and its characteristics
- CO2** Apply the ideas in to business model canvas
- CO3** Know the funding partner & investor for entrepreneurship
- CO4** Apply for business licenses and permits for their company/startup
- CO5** Apply the various tools for entrepreneurship/startup

19GET376	ECONOMICS, FINANCE & ACCOUNTING	L	T	P	J	C
	TRACK 2 (ENTREPRENEURSHIP)	1	0	0	0	1
UNIT I	Managerial Economics					3

Introduction to Engineering Economics – Scope of Engineering Economics - Break Even Analysis - Elementary economic analysis- Demand and Supply

UNIT II	Financial Accounting	3
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Introduction to Financial Accounting-Book Keeping-Journal-Ledger- Trial Balance- Trading Account- Profit and Loss Account- Balance sheet statement - Working capital management

UNIT III	Cost Accounting	3
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Introduction to Cost Accounting- Elements of cost- Types of cost -Cost Accounting systems: Job costing- Process costing

UNIT IV	Budget	3
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Introduction to budgeting- Characteristics of a sound budget-Fixed budget-Production. Budget- Sales budget-Flexible budgets- Zero base budgeting and budgetary control-ROI

UNIT V	Purchase Management	3
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Role of Purchase department-Vendor selection- Purchase- Documents related to Purchase: Invoice Generation-Material Inward & Outward-Introduction to ERP & SAP

L :15 T: 0 P: 0 J: 0 T:15 PERIODS

REFERENCES

- 1 R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication.
- 2 M.K.Panday, “Analytical Reasoning”, Magical Series.
- 3 BS Sijwali- InduSijwali, A New Approach to “Reasoning Verbal, Non-Verbal & Analytical”, Arihant Publications.
- 4 S.P.Bakshi, “Objective English” Arihant Publications.(Unit V)
- 5 R.S.Agarwal, “Quantitative Aptitude for Competitive Examinations”, S.Chand& Company Pvt Limited.
- 6 R.S.Agarwal, “A modern approach to Verbal & Non-verbal reasoning”, S.Chand& Company Pvt Limited.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Understand about Managerial economics for Entrepreneurship
- CO2** Learn about Financial accounting for Entrepreneurship
- CO3** Know about Cost accounting for Entrepreneurship
- CO4** Understand Budget for Entrepreneurship
- CO5** Apply the Purchase Management for Entrepreneurship

List of Exercises

S.No	Exercises
1	Business Model Analysis 1
2	Business Model Analysis 2
3	Idea Generation & Validation
4	BMC Value Proposition Pitch
5	BMC- Customer Segments Pitch
6	BMC- Channels Pitch
7	BMC- Revenue Model and Streams Pitch
8	BMC- Key Resources & Key Activities Pitch
9	BMC- Key Partners & Cost Structure Pitch
10	BMC- Customer Relationships Pitch
11	Final BMC Pitch
12	Report on Investors/Funding agency
13	Report on Business License & Permits
14	Digital Marketing Exercises
15	Case study on Business Process Automation

UNIT I INTRODUCTION**3**

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge - Trade Secret - IPR in India– IPR in abroad

UNIT II PATENTS**3**

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

UNIT III COPYRIGHT**3**

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

UNIT IV TRADEMARK**3**

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

UNIT V OTHER FORMS OF IP**3**

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection

Geographical Indication (GI): meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection

L :15 T: 0 P: 0 J: 0 T:15 PERIODS**TEXT BOOKS**

- 1 Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
- 2 Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

REFERENCES

- 1 Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets, Cengage Learning, Third Edition, 2012.
- 2 Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
- 3 Prabuddha Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, McGraw Hill Education, 2011
- 4 Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: LexisNexis.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Know about Intellectual property rights and classification.
- CO2** Understand about Patents, Registration & Procedure and other information
- CO3** Learn about Copyrights, Registration & Procedure and other information
- CO4** Understand about Trademark, Registration & Procedure and other information
- CO5** Know about other forms of IP, Registration & Procedure and other information

19GEB377	ADVANCED VERBAL QUANTITATIVE APTITUDE REASONING	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	2	0	2	0	3
UNIT I	QUANTITATIVE ABILITY III					6+6
	Algebra, Power, Surds and Indices, Inverse, Logarithms, Equations, Progressions, Functions and Graphs, Perimeter, Geometry, Coordinate Geometry, Direction Sense, Logical Connectives, Venn Diagrams					
UNIT II	QUANTITATIVE ABILITY IV					6+6
	Puzzles, Physics, Base conversion, Trigonometry, Divisibility, Series, Simple Equations, Simplification, Quadratic Equations					
UNIT III	VERBAL REASONING II					6+6
	Sentence correction and completion, Para-Jumbles, Cloze Passage, Vocabulary, Voices & Forms of Speech, Multi dimensional arrangement					
UNIT IV	NON- VERBAL REASONING					6+6
	The Embedded figure, Logical Games, Incomplete Pattern, Missing letters, Data arrangement, Mathematical orders, Inferred meaning					
UNIT V	LINGUISTICS SKILLS III					6+6
	Agile Entrepreneurship, Business Process Management & Automation, Taking Business to Digital World via Digital Marketing & e Commerce, HRM and Keeping it lean with Freelancers					

L :30 T: 0 P: 30 J: 0 T: 60 PERIODS

TEXT BOOKS

- 1 Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.

REFERENCES

- 1 R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
- 2 M.K.Panday, "Analytical Reasoning", Magical Series.
- 3 BS Sijwali- InduSijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.
- 4 S.P.Bakshi, "Objective English" Arihant Publications.
- 5 R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand& Company Pvt Limited
- 6 R.S.Agarwal, "A modern approach to Verbal & Non-verbal reasoning", S.Chand& Company Pvt Limited.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Apply the time and distance for solving application orientated concepts in quantitative aptitude
- CO2** Apply the financial ability for solving application orientated concepts in quantitative aptitude
- CO3** Analyze the verbal reasoning and the critical reasoning in quantitative aptitude
- CO4** Analyze the non-verbal reasoning in verbal aptitude applications
- CO5** Apply appropriate LSRW skills

List of Exercises

S.No	Exercises
1	Assessment 1 from Quantitative Ability III
2	Assessment 2 from Quantitative Ability III
3	Assessment 3 from Quantitative Ability III
4	Assessment 1 from Quantitative Ability IV
5	Assessment 2 from Quantitative Ability IV
6	Assessment 3 from Quantitative Ability IV
7	Assessment 1 from Verbal Reasoning II
8	Assessment 2 from Verbal Reasoning II
9	Assessment 3 from Verbal Reasoning II
10	Assessment 1 from Non Verbal Reasoning II
11	Assessment 2 from Non Verbal Reasoning II
12	Assessment 3 from Non Verbal Reasoning II
13	Assessment 1 from Linguistics Skills III
14	Assessment 2 from Linguistics Skills III
15	Assessment 3 from Linguistics Skills III

19GEB377	ADVANCED VERBAL QUANTITATIVE APTITUDE REASONING	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	2	0	2	0	3
UNIT I	QUANTITATIVE ABILITY III					6+6
	Algebra, Power, Surds and Indices, Inverse, Logarithms, Equations, Progressions, Functions and Graphs, Perimeter, Geometry, Coordinate Geometry, Direction Sense, Logical Connectives, Venn Diagrams					
UNIT II	QUANTITATIVE ABILITY IV					6+6
	Puzzles, Physics, Base conversion, Trigonometry, Divisibility, Series, Simple Equations, Simplification, Quadratic Equations					
UNIT III	VERBAL REASONING II					6+6
	Sentence correction and completion, Para-Jumbles, Cloze Passage, Vocabulary, Voices & Forms of Speech, Multi dimensional arrangement					
UNIT IV	NON- VERBAL REASONING					6+6
	The Embedded figure, Logical Games, Incomplete Pattern, Missing letters, Data arrangement, Mathematical orders, Inferred meaning					
UNIT V	LINGUISTICS SKILLS III					6+6
	Agile Entrepreneurship, Business Process Management & Automation, Taking Business to Digital World via Digital Marketing & e Commerce, HRM and Keeping it lean with Freelancers					

L :30 T: 0 P: 30 J: 0 T: 60 PERIODS

TEXT BOOKS

- 1 Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.

REFERENCES

- 1 R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
- 2 M.K.Panday, "Analytical Reasoning", Magical Series.
- 3 BS Sijwali- InduSijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.
- 4 S.P.Bakshi, "Objective English" Arihant Publications.
- 5 R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand& Company Pvt Limited
- 6 R.S.Agarwal, "A modern approach to Verbal & Non-verbal reasoning", S.Chand& Company Pvt Limited.

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** Apply the time and distance for solving application orientated concepts in quantitative aptitude
- CO2** Apply the financial ability for solving application orientated concepts in quantitative aptitude
- CO3** Analyze the verbal reasoning and the critical reasoning in quantitative aptitude
- CO4** Analyze the non-verbal reasoning in verbal aptitude applications
- CO5** Apply appropriate LSRW skills

List of Exercises

S.No	Name of the Exercises
1	Assessment 1 from Quantitative Ability III
2	Assessment 2 from Quantitative Ability III
3	Assessment 3 from Quantitative Ability III
4	Assessment 1 from Quantitative Ability IV
5	Assessment 2 from Quantitative Ability IV
6	Assessment 3 from Quantitative Ability IV
7	Assessment 1 from Verbal Reasoning II
8	Assessment 2 from Verbal Reasoning II
9	Assessment 3 from Verbal Reasoning II
10	Assessment 1 from Non Verbal Reasoning II
11	Assessment 2 from Non Verbal Reasoning II
12	Assessment 3 from Non Verbal Reasoning II
13	Assessment 1 from Linguistics Skills III
14	Assessment 2 from Linguistics Skills III
15	Assessment 3 from Linguistics Skills III

19GET375	NETWORKING	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	1	0	0	0	1
UNIT I	INTRODUCTION				3	
	Networking, Benefits, Quality vs Quantity in Networking, Networking for new opportunities, Networking for Professional Partnership, Local and In-person networking					
UNIT II	DIGITAL NETWORKING				3	
	Tools for Online Networking – Linkedin, Facebook, Twitter, Google+, LMS, Open Learning Networks					
UNIT III	EMPATHIZING				3	
	Art of Listening, Empathy, Listening Models, Networking etiquette, Digital Storytelling, Lead Generation					
UNIT IV	COMMUNICATION				3	
	Interpersonal Skills, Personality and Emotional Intelligence, Business Communication, Copyrights, Networking Plan					
UNIT V	DIGITAL FOOTPRINTS				3	
	Introverts & Extroverts, Maintain Your Connections, Long-Term Networking Strategies, Case Studies-Scholarship for higher education in various countries –Case study					
		L :15	T: 0	P: 0	J: 0	T: 15 PERIODS

REFERENCES

- 1 Andrea R Nirenberg "Essentials of Business networking" Tips, Tools and Tactics you can use, Pearson Education
- 2 Miriam Salpter "Social Networking for career success "Learning express, Newyork
- 3 Andrea R Nirenberg "Network like you means it" handbook for business and personal networking.
- 4 S.P.Bakshi, "Objective English" Arihant Publications.
- 5 Peter W Cardon "Business Communication" Tata Mcgraw Hill Publications, Third edition
- 6 Elizabeth A Segal "Social Empathy-Art of understanding others" Columbia University press, New York

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Understand the networking and its significance
- CO2** Apply the digital tools for networking with overseas professors.
- CO3** Empathize the need and prepare themselves for overseas education
- CO4** Apply the communication skills for the overseas education
- CO5** Apply the networking strategies for scholarship in overseas education

19GEB380	HIGHER STUDIES IN ABROAD & INDIA	L	T	P	J	C
		1	0	2	0	2

UNIT I OVERVIEW OF HIGHER STUDIES 3+6

Higher education in India & Examinations- Higher Education in abroad:Introduction-Admission process- Identification & Procedure - SOP-LOR-Desirable Characteristics - Introduction to Proficiency test

UNIT II SELECTION & SCHOLARSHIP 3+6

Top Universities in world- Cost of overseas education- Funding & Scholarships-Case studies
Higher Education in USA, UK, France, Singapore, Germany, Norway, Sweden, Australia & Netherland

UNIT III GRE & GMAT 3+6

GRE & GMAT: Importance of GRE & GMAT- Syllabus- Assessment pattern- Analytical reasoning- Quants-Verbal-Integrated Reasoning-Analytical writing assessment

UNIT IV TOEFL & IELTS 3+6

Importance of TOEFL & IELTS - Syllabus-Assessment Pattern-Reading-Speaking -Writing

UNIT V GATE 3+6

Importance of GATE- Syllabus -Assessment Pattern- Weightages in the different domain-General Aptitude- Candidate selected subject

L :15 T: 0 P: 30 J: 0 T:45 PERIODS

REFERENCES

- 1 B.S.Warrier “Studying Abroad” Tata Mcgraw Hill Education Private Limited, New Delhi
- 2 Dr.T.P.Sethumadhavan “Study abroad” iRank publishers , India
- 3 General Aptitude & Engineering Mathematics 2022 , Pearson Education

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** To know about the Indian constitution and Government services
- CO2** To understand about the civil services post and selection process
- CO3** To understand about the RRB & Public sector banks post and selection process
- CO4** To understand about the central and state public sector companies post and selection process
- CO5** To experience the resume building and networking

19GEB378	FOUNDATION COURSE ON COMPETITIVE EXAMS	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	2	0	4	0	4
UNIT I	QUANTITATIVE ABILITY III					6+12
Algebra, Power, Surds and Indices, Inverse, Logarithms, Equations, Progressions, Functions and Graphs, Perimeter, Geometry, Coordinate Geometry, Direction Sense, Logical Connectives, Venn Diagrams, Puzzles, Physics, Base conversion, Trigonometry, Divisibility, Series, Simple Equations, Simplification, Quadratic Equations						
UNIT II	VERBAL REASONING II					6+12
Sentence correction and completion, Para-Jumbles, Cloze Passage, Vocabulary, Voices & Forms of Speech, Multi dimensional arrangement						
UNIT III	NON- VERBAL REASONING II					6+12
The Embedded figure, Logical Games, Incomplete Pattern, Missing letters, Data arrangement, Mathematical orders, Inferred meaning						
UNIT IV	GENERAL AWARENESS FOR CIVIL SERVICE EXAMS					6+12
Current events of National & International importance, History of India & Indian National Movement, Indian & World Geography – Physical, Social, Economic Geography of India & the World, Indian Polity & Governance – Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, Economic & Social Development – Sustainable Development, Poverty, Inclusion, Demographics, Social Sector Initiatives, Environmental ecology, Bio-diversity & climate change, General Science.						
UNIT V	GENERAL AWARENESS FOR BANKING SECTORS					6+12
Current Affairs (National and International), Major Financial/Economic News, Budget and Five Year Plans, Who's Who, Sports, Books and Authors, Awards and Honors, Science – Inventions and Discoveries, Abbreviations, Important Days, International and National Organizations						
L :30 T: 0 P: 60 J: 0 T: 90 PERIODS						

REFERENCES

- 1 R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
- 2 R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand& Company Pvt Limited
- 3 BS Sijwali- InduSijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.
- 4 R.S.Agarwal, "A modern approach to Verbal & Non-verbal reasoning", S.Chand& Company Pvt Limited.
- 5 NIOS course books for classes XI and XII on - Ancient India, Medieval India, Modern India, National Movement & Contemporary World and Culture of India.
- 6 The Story of Civilization, Part 2 by Arjun Dev, NCERT
Certificate Physical & Human Geography (Oxford) by Goh Cheng Leong
General Knowledge 2019 (English, Paperback, Pandey Manohar)

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Apply the quantitative ability for competitive exams.
- CO2** Know the verbal reasoning for competitive exams
- CO3** Understand the non-verbal reasoning for competitive exams.
- CO4** Apply the general awareness in the civil service exams
- CO5** Understand the general awareness in the banking exams

List of Exercises

S.No	Name of the Exercises
1	Assessment 1 from Quantitative Ability III
2	Assessment 2 from Quantitative Ability III
3	Assessment 3 from Quantitative Ability III
4	Assessment 1 from Verbal Reasoning II
5	Assessment 2 from Verbal Reasoning II
6	Assessment 3 from Verbal Reasoning II
7	Assessment 1 from Non Verbal Reasoning II
8	Assessment 2 from Non Verbal Reasoning II
9	Assessment 3 from Non Verbal Reasoning II
10	Assessment 1 from General Awareness for Civil Service
11	Assessment 2 from General Awareness for Civil Service
12	Assessment 3 from General Awareness for Civil Service
13	Assessment 1 from General Awareness for Banking
14	Assessment 2 from General Awareness for Banking
15	Assessment 3 from General Awareness for Banking

19GEB378	FOUNDATION COURSE ON COMPETITIVE EXAMS	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	2	0	4	0	4
UNIT I	QUANTITATIVE ABILITY III					6+12
	Algebra, Power, Surds and Indices, Inverse, Logarithms, Equations, Progressions, Functions and Graphs, Perimeter, Geometry, Coordinate Geometry, Direction Sense, Logical Connectives, Venn Diagrams, Puzzles, Physics, Base conversion, Trigonometry, Divisibility, Series, Simple Equations, Simplification, Quadratic Equations					
UNIT II	VERBAL REASONING II					6+12
	Sentence correction and completion, Para-Jumbles, Cloze Passage, Vocabulary, Voices & Forms of Speech, Multi dimensional arrangement					
UNIT III	NON- VERBAL REASONING II					6+12
	The Embedded figure, Logical Games, Incomplete Pattern, Missing letters, Data arrangement, Mathematical orders, Inferred meaning					
UNIT IV	GENERAL AWARENESS FOR CIVIL SERVICE EXAMS					6+12
	Current events of National & International importance, History of India & Indian National Movement, Indian & World Geography – Physical, Social, Economic Geography of India & the World, Indian Polity & Governance – Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, Economic & Social Development – Sustainable Development, Poverty, Inclusion, Demographics, Social Sector Initiatives, Environmental ecology, Bio-diversity & climate change, General Science.					
UNIT V	GENERAL AWARENESS FOR BANKING SECTORS					6+12
	Current Affairs (National and International), Major Financial/Economic News, Budget and Five Year Plans, Who's Who, Sports, Books and Authors, Awards and Honors, Science – Inventions and Discoveries, Abbreviations, Important Days, International and National Organizations					
	L :30 T: 0 P: 60 J: 0 T: 90 PERIODS					
REFERENCES						
1	R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.					
2	R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand& Company Pvt Limited					
3	BS Sijwali- InduSijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.					
4	R.S.Agarwal, "A modern approach to Verbal & Non-verbal reasoning", S.Chand& Company Pvt Limited.					
5	NIOS course books for classes XI and XII on - Ancient India, Medieval India, Modern India, National Movement & Contemporary World and Culture of India.					
6	The Story of Civilization, Part 2 by Arjun Dev, NCERT Certificate Physical & Human Geography (Oxford) by Goh Cheng Leong General Knowledge 2019 (English, Paperback, Pandey Manohar)					
COURSE OUTCOMES :						
At the end of the course students should be able to						
CO1	Apply the quantitative ability for competitive exams.					
CO2	Know the verbal reasoning for competitive exams					
CO3	Understand the non-verbal reasoning for competitive exams.					
CO4	Apply the general awareness in the civil service exams					
CO5	Understand the general awareness in the banking exams					

List of Exercises

S.No	Name of the Exercises
1	Assessment 1 from Quantitative Ability III
2	Assessment 2 from Quantitative Ability III
3	Assessment 3 from Quantitative Ability III
4	Assessment 1 from Verbal Reasoning II
5	Assessment 2 from Verbal Reasoning II
6	Assessment 3 from Verbal Reasoning II
7	Assessment 1 from Non Verbal Reasoning II
8	Assessment 2 from Non Verbal Reasoning II
9	Assessment 3 from Non Verbal Reasoning II
10	Assessment 1 from General Awareness for Civil Service
11	Assessment 2 from General Awareness for Civil Service
12	Assessment 3 from General Awareness for Civil Service
13	Assessment 1 from General Awareness for Banking
14	Assessment 2 from General Awareness for Banking
15	Assessment 3 from General Awareness for Banking

19GEB381	PERSONNEL PSYCHOLOGY FOR	L	T	P	J	C
	GOVERNMENT JOBS					
	(Common to All B.E. / B. Tech. Courses)	1	0	2	0	2

UNIT I GOVERNMENT JOBS 3+6

Hierarchical structure of Indian Government- Preamble to Constitution of India-7th pays commission- Classification of Government Services-Classification of Groups-Pay Band, Pay & Emoluments- Educational Qualifications.

UNIT II CIVIL SERVICES 3+6

Post & Selection Process: general group A services- technical group A services- uniformed group A services-group B services-group C services.

UNIT III RRB & PUBLIC SECTOR BANK 3+6

Railway Recruitment Board: Introduction to RRB-classification of RRB- ost& Selection Process

Public Sector Bank: Introduction to public sector banks- Post & Selection Process: RBI-SBI-IBPS- other public sector banks

UNIT IV CENTRAL/STATE PUBLIC SECTOR COMPANIES 3+6

Public sector classification- Post & selection process:: maharatna - navratna - miniratna- Non GATE- public sector insurance companies- central universities- other government jobs

UNIT V RESUME BUILDING & NETWORKING 3+6

Introduction- SWOT- Online learning -Writing a Winning Resume, Choosing a Resume Format - Canva Resume- Video Resume.- Importance of networking -Networking platforms

L :15 T: 0 P: 30 J: 0 T: 45 PERIODS

REFERENCES

- 1 KP. Shashidharan “ Know How to get government Jobs”Jaico Publishing home
- 2 Dipak Anand IAS “How to Succeed in Civil Services” Ocean books private limited
- 3 VVK Subburaj “Railway Recruitment Board Exams, Technical Cadre” Sura Books Private Limited
- 4 Banking Awareness by Disha Publication, 4th Edition
- 5 Rajesh Varma, “Fast Track Objective Arithmetic”, Arihant Publications.
- 6 Parul Singh 'Writing Effective resume for effective resume for job application ns.”Fortune Institute of International Business”
- 7 Andrea R Nirenberg ”Essentials of Business networking” Tips, Tools and Tactics you can use, Pearson Education
- 8 Miriam Salpeter “Social Networking for career success “Learning express, Newyork

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** To know about the Indian constitution and Government services
- CO2** To understand about the civil services post and selection process
- CO3** To understand about the RRB & Public sector banks post and selection process
- CO4** To understand about the central and state public sector companies post and selection process
- CO5** To experience the resume building and networking

List of Exercises

S.No	Name of the Exercises
1	Assessment for Group A Services
2	Assessment for Group B Services
3	Assessment for Group C Services
4	Assessment for Uniformed Services
5	Assessment 1 for RRB
6	Assessment 2 for RRB
7	Assessment 1 for Banking Exams
8	Assessment 2 for Banking Exams
7	Assessment for Public sector company 1
8	Assessment for Public sector company 2
9	Resume Preparation for Government Jobs
10	Video Resume for Government Jobs
11	Networking Exercises using Linked In

UNIT I BASIC ECONOMICS

Definition of economics - nature and scope of economic science - nature and scope of managerial economics - basic terms and concepts - goods - utility - value - wealth - factors of production - land - its peculiarities - labour - economies of large and small scale - consumption - wants - its characteristics and classification - law of diminishing marginal utility

UNIT II DEMAND AND SCHEDULE

9

Demand - demand schedule - demand curve - law of demand - elasticity of demand - types of elasticity - factors determining elasticity - measurement - its significance - supply - supply schedule - supply curve - law of supply - elasticity of supply - market price and normal price - perfect competition - monopoly - monopolistic competition.

UNIT III ORGANISATION

9

Forms of business - proprietorship - partnership - joint stock company - cooperative organization - state enterprise - mixed economy - money and banking - banking - kinds - commercial banks - central banking functions - control of credit - monetary policy - credit instrument.

UNIT IV FINANCING

9

Types of financing - Short term borrowing - Long term borrowing - Internal generation of funds - External commercial borrowings - Assistance from government budgeting support Profit and Loss account - Funds flow statement - Case Study on Inflation

UNIT V COST AND BREAK-EVEN ANALYSIS

9

Types of costing - traditional costing approach - activity base costing - Fixed Cost variable cost - marginal cost - cost output relationship in the short run and in long run pricing practice - full cost pricing - marginal cost pricing - going rate pricing - bid pricing - pricing for a rate of return - appraising project profitability - internal rate of return - payback period - net present value. Break even analysis - basic assumptions - break even chart - managerial uses of break-even analysis.

L: 45 T: 0 P: 0 J: 0 TOTAL: 45 PERIODS**TEXT BOOKS**

1. John A.White, Kenneth E Case, David B Pratt, Principles of Engineering Economic Analysis, Fifth edition, Wiley India Edition., 2015
2. D.M.Mithani, Suresh Chandra Das, Engineering Economic and Costing, Himalaya publishing House, 2017

REFERENCES

1. Barthwal R.R., Industrial Economics - An Introductory Text Book, New Age, 2007
2. R.Paneerselvam, Engineering Economics, PHI Learning Private limited, 2013
3. R.Kesavan, C.Elanchezhian, T.Sundar Selwyn, Engineering Economics and Financial Accounting, Lakshmi Publications (P) LTD, 2012
4. Tahir Hussain, Engineering Economics, University science Press, 2010
5. David Whitman, Ronald E. Terry, Fundamentals of Engineering Economics and Decision Analysis, Morgan & Claypool Publishers, 2012

COURSE OUTCOMES

At the end of the course the student will be able to

- CO1** Recognize about the fundamentals of economics
- CO2** Describe about the demand and schedule of the market
- CO3** Framework about the organization process
- CO4** Develop the financial statement
- CO5** Summarize the cost and break even analyses of the system