



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 AUTOMOBILE ENGINEERING

B.E. – AUTOMOBILE ENGINEERING



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

DEPARTMENT OF AUTOMOBILE ENGINEERING

R 2019 – SUGGESTED CURRICULUM & SYLLABI

B.E – AUTOMOBILE ENGINEERING



Description / Semester	AICTE	SNSCT – AUTO Suggested	Credits Per Semester							
			Sem 1	Sem 2	Sem 3	Sem 4	Sem 5	Sem 6	Sem 7	Sem 8
Humanities, Social Science & Mandatory Courses (HSMC)	12	21	3	2	4	4	4	2	2	
Basic Science (BSC)	25	24	8	8	3	3			2	
Engineering Sciences (ESC)	24	19	8	9	2					
Professional Core (PCC)	48	59		3	14	18	17	7		
Professional Elective (PEC)	18	12					3	6	3	
Open Elective (OEC)	18	10						3	5	2
Employability Enhancement Courses / 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	27	25	20	14	14

Semester - I										
S. No	Course Code	Course Name	L	T	P	J	Contact Hours	Credit	Int/Ext	Category
Theory Course										
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	Basics of Electrical and Electronics Engineering	3	0	0	0	3	3	50/50	ESC
Theory Integrated Practical Course										
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	3	3	100/0	EEC
Practical Course										
7	19GEP101	Workshop Practice Laboratory	0	0	4	0	4	2	60/40	ESC
Mandatory Course										
8	19HST101	Induction Programme	3 Weeks					0	-	MC
9	19HST103	Indian Constitution	2	0	0	0	2	0	100/0	MC
Total			15	1	12	4	30	22		

Semester - II										
S. No	Course Code	Course Name	L	T	P	J	Contact Hours	Credit	Int/Ext	Category
Theory Course										
1	19AUT101	Material Science	3	0	0	0	4	3	60/40	PCC
2	19ITT101	Programming in C & Data Structures	3	0	0	0	3	3	50/50	ESC
3	19MET102	Engineering Mechanics	3	1	0	0	4	4	50/50	ESC
Theory Integrated Practical Course										
4	19PYB103	Physics for Engineers	3	0	2	0	5	4	60/40	BSC
5	19MAB102	Integral Calculus and Laplace Transforms	3	0	2	0	5	4	60/40	BSC
Practical Course										
6	19AUP101	Mini Project I	0	0	0	2	2	1	100/0	EEC
7	19ENP101	Professional Communication	0	0	4	0	4	2	60/40	HSMC
8	19ITP101	Programming in C & Data Structures Laboratory	0	0	4	0	4	2	60/40	ESC
Mandatory Course										
9	19HST102	Environmental Sciences	2	0	0	0	2	0	100/0	MC
Total			17	1	12	2	33	23		

Semester - III										
S. No	Course Code	Course Name	L	T	P	J	Contact Hours	Credit	Int/Ext	Category
Theory Course										
1	19MAT201	Transforms and Partial Differential Equations	3	0	0	0	3	3	50/50	BSC
2	19AUT201	Thermal Science & Engineering	3	0	0	0	3	3	50/50	PCC
3	19AUT202	Hybrid Electric and Fuel Cell Vehicles	3	0	0	0	3	3	50/50	PCC
4	19GET275	VQAR - I	2	0	0	0	2	2	100/0	HSMC
Theory Integrated Practical Course										
5	19AUB201	Auto Components Manufacturing	3	0	2	0	5	4	60/40	PCC
6	19AUB202	Automotive Systems	3	0	2	0	5	4	60/40	PCC
Practical Course										
7	19ITP202	Python Programming	0	0	4	0	4	2	60/40	ESC
8	19AUP201	Mini Project II	0	0	0	2	2	1	100/0	EEC
9	19GEP275	Personality Development	1	0	2	0	3	2	100/0	HSMC
Total			18	0	10	2	30	24		

Semester - IV										
S. No	Course Code	Course Name	L	T	P	J	Contact Hours	Credit	Int/Ext	Category
Theory Course										
1	19MAT202	Statistics and Numerical Methods	3	0	0	0	3	3	50/50	BSC
2	19AUT203	Mechanics of Automobile Systems	3	0	0	0	3	3	50/50	PCC
3	19AUT205	Internet of Things in Automotive Safety	2	0	0	0	2	2	50/50	PCC
4	19MET204	Strength of Materials	3	0	0	0	3	3	50/50	PCC
5	19GET276	VQAR - II	2	0	0	0	2	2	100/0	HSMC
Theory Integrated Practical Courses										
6	19AUB203	Automotive Engines and Emission Control	3	0	2	0	5	4	60/40	PCC
7	19AUB204	Automotive Electrical & Electronics Engineering	3	0	2	0	5	4	60/40	PCC
8		Language Elective	1	0	2	0	3	2	100/0	HSMC
Practical Course										
9	19AUP202	Internship-I	Two Weeks					2	100/0	EEC
10	19AUP203	Fluid Power Controls Laboratory	0	0	4	0	4	2	60/40	PCC
Total			20	0	10	0	30	27		

Semester – V										
S. No	Course Code	Course Name	L	T	P	J	Contact Hrs / Week	Credit	Int/Ext	Category
Theory Course										
1	19AUT301	Automotive Embedded Systems	2	0	0	0	2	2	50/50	PCC
2	19AUT302	Vehicle Dynamics and Structures	3	0	0	0	3	3	50/50	PCC
3	19AUT303	Additive Manufacturing and its applications	2	0	0	0	2	2	50/50	PCC
4		Professional Elective – I	3	0	0	0	3	3	50/50	PEC
5		Career Course I	4	0	0	0	4	4	-	HSMC
		Career Course II								
Theory Integrated Practical Course										
7	19AUB301	Automotive Fuels and Lubricants	3	0	2	0	4	4	60/40	PCC
8	19AUB302	Automotive Component Design	3	0	2	0	4	4	60/40	PCC
Practical Course										
9	19AUP301	Mini Project III	0	0	0	2	2	1	100/0	EEC
10	19AUP302	Sensors & Interfacing Laboratory	0	0	4	0	2	2	60/40	PCC
Total			20	0	8	2	26	25		

Semester - VI										
S. No	Course Code	Course Name	L	T	P	J	Contact Hours	Credit	Int/Ext	Category
Theory Course										
1		Professional Elective – II	3	0	0	0	3	3	50/50	PEC
2		Professional Elective – III	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 Course										
5	19AUB303	Finite Element Methods and Analysis	3	0	2	0	5	4	60/40	PCC
6	19AUB304	Vehicle Maintenance& Reconditioning	2	0	2	0	4	3	60/40	PCC
Practical Course										
7	19AUP303	Internship-II	2 Weeks					2	100/0	EEC
Mandatory Course										
8	19HST105	Essense of Indian Traditional Knowledge	2	0	0	0	2	0	100/0	MC
Total			18	0	4	0	22	20		
Semester - VII										

S. No	Course Code	Course Name	L	T	P	J	Contact Hours	Credit	Int/Ext	Category
Theory Course										
1	19GET277	Biology for Engineers	2	0	0	0	2	2	50/50	BSC
2	19GET201	Professional Ethics and Human Values	2	0	0	0	2	2	100/0	HSMC
3		Professional Elective – IV	3	0	0	0	3	3	50/50	PEC
4		Open Elective – II	3	0	0	0	3	3	50/50	OEC
5		Open Elective – III*	2	0	0	0	2	2	50/50	OEC
Practical Course										
6	19AUP401	Project – I	0	0	0	4	4	2	60/40	EEC
Total			12	0	0	4	16	14		
*Offered for own department students										
Semester - VIII										
S. No	Course Code	Course Name	L	T	P	J	Contact Hours	Credit	Int/Ext	Category
1		Open Elective – IV* Online Mooc / NPTEL	2	0	0	0	2	2	50/50	OEC
Practical Course										
2	19AUP402	Project – II	0	0	0	24	24	12	60/40	EEC
Total			2	0	0	24	26	14		

***Offered for own department students**

HSMC - Humanities, Social science and Management Courses

Course Code	Course Title	L	T	P	J	C	Sem
19ENB101	Communicative English	2	0	2	0	3	I
19ENP101	Professional Communication	0	0	4	0	2	II
19GET275	VQAR - I	2	0	0	0	2	III
19GEP275	Personality Development	1	0	2	0	2	III
19GET276	VQAR - II	2	0	0	0	2	IV
Language Electives							
19GEB202	Hindi	1	0	2	0	2	IV
19GEB203	Japanese						
19GEB204	German						
19GEB205	French						
	Career Courses					6	V & VI
19GET201	Professional Ethics and Human Values	2	0	0	0	2	VI
TOTAL						21	

Career Courses

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

BSC - Basic Science Courses

S.No	Course Code	Course Title	L	T	P	J	C	Sem
1.	19MAT101	Linear Algebra and Calculus	3	1	0	0	4	I
2.	19CHB101	Chemistry for Engineers	3	0	2	0	4	I
3.	19PYB103	Physics for Engineers	3	0	2	0	4	II
4.	19MAB102	Integral Calculus and Laplace Transforms	3	0	2	0	4	II
5.	19MAT201	Transforms and Partial Differential Equations	3	0	0	0	3	III
6.	19MAT202	Statistics and Numerical Methods	3	0	0	0	3	IV
7.	19GET277	Biology for Engineers	2	0	0	0	2	VII
		TOTAL						24

ESC - Engineering Science Courses

S.No	Course Code	Course Title	L	T	P	J	C	Sem
1.	19MET101	Engineering Drawing	1	0	4	0	3	I
2.	19EET101	Basics of Electrical and Electronics Engineering	3	0	0	0	3	I
3.	19GEP101	Workshop Practice Laboratory	0	0	4	0	2	I
4.	19ITT101	Programming in C & Data Structures	3	0	0	0	3	II
5.	19MET102	Engineering Mechanics	3	1	0	0	4	II
6.	19ITP101	Programming in C & Data Structures Lab	0	0	4	0	2	II
7.	19ITP202	Python Programming	0	0	4	0	2	III
		TOTAL						19

PCC - Professional Core Courses

S.No	Course Code	Course Title	L	T	P	J	C	Sem
1.	19AUT101	Material Science	3	0	0	0	3	II
2.	19AUT201	Thermal Science & Engineering	3	0	0	0	3	III
3.	19AUT202	Hybrid Electric and Fuel Cell Vehicles	3	0	0	0	3	III
4.	19AUB201	Auto Components Manufacturing	3	0	2	0	4	III
5.	19AUB202	Automotive Systems	3	0	2	0	4	III
6.	19AUT203	Mechanics of Automobile Systems	3	0	0	0	3	IV
7.	19AUT205	Internet of Things in Automotive Safety	2	0	0	0	2	IV
8.	19MET204	Strength of Materials	3	0	0	0	3	IV
9.	19AUB203	Automotive Engines and Emission Control	3	0	2	0	4	IV
10.	19AUB204	Automotive Electrical & Electronics Engineering	3	0	2	0	4	IV
11.	19AUP203	Fluid Power Controls Laboratory	0	0	4	0	2	IV
12.	19AUT301	Automotive Embedded Systems	2	0	0	0	2	V
13.	19AUT302	Vehicle Dynamics and Structures	3	0	0	0	3	V
14.	19AUT303	Additive Manufacturing and its applications	2	0	0	0	2	V
15.	19AUB301	Automotive Fuels and Lubricants	3	0	2	0	4	V
16.	19AUB302	Automotive Component Design	3	0	2	0	4	V
17.	19AUP302	Sensors & Interfacing Laboratory	0	0	4	0	2	V
18.	19AUB303	Finite Element Methods and Analysis	3	0	2	0	4	VI
19.	19AUB304	Vehicle Maintenance & Reconditioning	2	0	2	0	3	VI
		TOTAL						59

PEC - Professional Elective Courses

S.No	Course Code	Courses Offered	L	T	P	J	C	Sem
Professional Elective – I								
1	19AUE301	Two and Three Wheeler Technology	3	0	0	0	3	V
2	19AUE302	Automotive Safety and Infotronics	3	0	0	0	3	V
3	19AUE303	Automotive Vibration and Noise control	3	0	0	0	3	V
4	19AUE304	Automotive Control Systems	3	0	0	0	3	V
5	19AUE305	Automotive Computational Fluid Dynamics	3	0	0	0	3	V
Professional Elective – II								
6	19AUE306	Automotive Aerodynamics and Acoustics	3	0	0	0	3	VI
7	19AUE307	Vehicle Air-Conditioning	3	0	0	0	3	VI
8	19AUE308	Special Vehicles	3	0	0	0	3	VI
9	19AUE309	Rubber Technology for Automobiles	3	0	0	0	3	VI
10	19AUE310	Supercharging and Scavenging	3	0	0	0	3	VI
Professional Elective – III								
11	19AUE311	Composite Materials for Automobile	3	0	0	0	3	VI
12	19AUE312	Fleet Management	3	0	0	0	3	VI
13	19MEE301	Engineering Economics and Cost Analysis	3	0	0	0	3	VI
14	19MEE304	Total Quality Management	3	0	0	0	3	VI
15	19MEE312	Principles of Management	3	0	0	0	3	VI
Professional Elective – IV								
16	19AUE401	Tractor and Farm Equipments	3	0	0	0	3	VII
17	19AUE402	Intelligent Vehicle Technology	3	0	0	0	3	VII
18	19AUE403	Electric Vehicle Technology	3	0	0	0	3	VII
19	19AUE404	Data Analytics in Lean Six Sigma (MooC)	3	0	0	0	3	VII
20	19AUE405	Industrial safety for Automobile	3	0	0	0	3	VII

OEC - Open Elective Courses Offered to Other Programmes

S.No	Course Code	Courses Offered	L	T	P	J	C
1	19AUO301	Basics of Electric Vehicle Technology	3	0	0	0	3
2	19AUO302	Recent Trends in Automobiles	3	0	0	0	3
3	19AUO303	Road Safety and Traffic Rules	3	0	0	0	3

OEC - Open Elective Courses Offered To Parent Programme

S.No	Course Code	Courses Offered	L	T	P	J	C
1	19AUZ401	Robotics & Automation (MOOC)	2	0	0	0	2
2	19AUZ402	Industry 4.0 (MOOC)	2	0	0	0	2
3	19AUZ403	Augmented Reality & Virtual Reality (MOOC)	2	0	0	0	2
4	19AUZ404	Driverless Vehicles (MOOC)	2	0	0	0	2
5	19AUO401	Lean Manufacturing	2	0	0	0	2
6	19AUO402	Alternative Fuels for IC Engines	2	0	0	0	2

EEC - Employment Enhancement Courses

S.No	Course Code	Courses Offered	L	T	P	J	C	Sem
1	19GEB101	Design Thinking and Innovation	1	0	0	4	3	I
2	19AUP101	Mini Project I	0	0	0	2	1	II
3	19AUP201	Mini Project II	0	0	0	2	1	III
4	19AUP202	Internship-I	Two Weeks				2	IV
5	19AUP301	Mini Project III	0	0	0	2	1	V
6	19AUP202	Internship-I	Two Weeks				2	VI
7	19AUP401	Project – I	0	0	0	4	2	VII
8	19AUP402	Project – II	0	0	0	24	12	VIII

MC - Mandatory Courses

Course Code	Course Title	L	T	P	J	C	Sem
19HST101	Induction Programme	2	0	0	0	0	I
19HST103	Indian Constitution	2	0	0	0	0	I
19HST102	Environmental Sciences	2	0	0	0	0	II
19HST105	Essence of Indian Traditional Knowledge	2	0	0	0	0	VI

OCC - One Credit Courses

Course Code	Course Title	L	T	P	J	C
19AUOC1	E-Vehicle design	2	0	0	0	0
19AUOC2	Heating, Ventilation and Air-Conditioning	2	0	0	0	0
19AUOC3	Geometrical Dimensioning and Tolerance	2	0	0	0	0

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
	(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 V K, 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

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

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

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

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

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 milk 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" , Dhanapat Rai 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 Curedale, 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

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
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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, New Delhi.
- 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

19AUT101	MATERIAL SCIENCE	L	T	P	J	C
		3	0	0	0	3
UNIT I	PHASE DIAGRAMS					9
Solid solutions - Hume Rothery's rules – the phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - micro structural change during cooling.						
UNIT II	FERROUS ALLOYS					9
The iron-carbon equilibrium diagram - phases, invariant reactions - microstructure of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's laws - phase transformations - T-T-T-diagram for eutectoid steel – pearlitic, bainitic and martensitic transformations - tempering of martensite – steels – stainless steels – cast irons.						
UNIT III	MECHANICAL PROPERTIES					9
Tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers micro hardness.						
UNIT IV	MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS					9
Ferromagnetism – domain theory – types of energy – hysteresis – hard and soft magnetic materials – ferrites - dielectric materials – types of polarization – Langevin-Debye equation – frequency effects on polarization - dielectric breakdown – insulating materials – Ferroelectric materials - superconducting materials and their properties.						
UNIT V	NEW MATERIALS					9
Ceramics – types and applications – composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics – metallic glasses: types , glass forming ability of alloys, melt spinning process, applications - shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy, applications – nanomaterials: preparation (bottom up and top down approaches), properties and applications – carbon nanotubes: types.						
		L :45	T: 0	P: 0	J: 0	Total:45 PERIODS

TEXT BOOKS

1. Balasubramaniam, R. "Callister's Materials Science and Engineering". Wiley India Pvt. Ltd., 2014.
2. Raghavan, V. "Physical Metallurgy: Principles and Practice". PHI Learning, 2015.
3. Raghavan, V. "Materials Science and Engineering: A First course". PHI Learning, 2015.

REFERENCES

1. Balasubramaniam, R. "Callister's Materials Science and Engineering". Wiley India Pvt. Ltd., 2014.
2. Raghavan, V. "Physical Metallurgy: Principles and Practice". PHI Learning, 2015.
3. Raghavan, V. "Materials Science and Engineering: A First course". PHI Learning, 2015.

COURSE OUTCOMES

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

- CO1** Gain basic knowledge of phase diagrams
- CO2** Understand the usage of ferrous alloys
- CO3** Recognize the basics of Mechanical properties
- CO4** understand various materials and their properties
- CO5** Identify the new materials

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 - Lamé'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 elastic bodies.						
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 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-Diffussion 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,Tata Mcgraw-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.

19MAB102	INTEGRAL CALCULUS & LAPLACE TRANSFORMS	L	T	P	J	C
	(Common to all B.E. / B. Tech. Courses)	3	0	2	0	4
UNIT I	MULTIPLE INTEGRALS					9
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.						
UNIT II	VECTOR CALCULUS					9
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.						
UNIT III	COMPLEX VARIABLES					9
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.						
UNIT IV	COMPLEX INTEGRATION					9
Cauchy's integral theorem – Cauchy's integral formula – Taylor's series – Zeros of an analytic function – singularities – Laurent's series – Residues – Cauchy Residue theorem.						
UNIT V	LAPLACE TRANSFORMS					9
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.						
List of SCILAB / MATLAB Programmes:						30
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.						
		L : 45	T: 0	P:30	J: 0	Total: 75 PERIODS

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, CBS Publishers, 2012.

REFERENCES

- 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.

COURSE OUTCOMES

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.

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 Engineering, Material science, Engineering mechanics, 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 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

COURSE OUTCOMES

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

CO1**CO2****CO3****CO4****CO5**

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 - Aruna Koneru—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

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.

19AUT201	THERMAL SCIENCE AND ENGINEERING	L	T	P	J	C
		3	0	0	0	3

UNIT I BASIC CONCEPT AND THERMODYNAMIC RELATIONS 9

Basic concepts - System and their types - Thermodynamic Equilibrium State - sign convention - Displacement work - Zeroth law of thermodynamics -concept of temperature - relationship between temperature scales - Formation of steam and its thermodynamic properties P-V, P-T, T-V, T-s, h-s diagrams. P-V-T surface - change in internal energy - enthalpy - entropy and Gibbs function-Properties of Ideal gas - Ideal and real gas comparison -Maxwell relations - Tds Equations - Difference and ratio of heat Capacities - Joule Thomson Coefficient

UNIT II FIRST AND SECOND LAW OF THERMODYNAMICS AND ITS APPLICATION 9

First law of thermodynamics –application to closed systems -Equation for steady flow processes and its application in Turbine, Nozzle, and Heat Exchanger. Second law of Thermodynamics - Statements of second law and its corollaries - Carnot cycle -Reversed Carnot cycle - Carnot theorem - Clausius equality –inequality – Application of II law.

UNIT III STEAM AND GAS POWER CYCLES 9

Ideal and actual Rankine cycles - Cycle Improvement Methods - Reheat and Regenerative Cycles.Otto cycle - Diesel cycle – Dual Cycle. - Air Standard Efficiency & Mean Effective Pressure - Problems.

UNIT IV CONDUCTION 9

Basic Concepts - General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall and Cylinders – Extended Surfaces.

UNIT V CONVECTION AND RADIATION 9

Basic Concepts – Convective Heat Transfer Coefficients – Types of Convection – Forced Convection – External Flow – Flow over Plates - Internal Flow – Laminar and Turbulent Flow– Free Convection – Flow over Vertical Plate. Basic Concepts, Laws of Radiation – Stefan Boltzmann Law, Kirchoff Law – Black Body Radiation –Grey body radiation - Shape Factor Algebra– Radiation Shields.

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

TEXT BOOKS

1. Nag.P.K., “Engineering Thermodynamics”, 5th Edition, Tata McGraw - Hill, New Delhi, 2013.
2. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 8th Edition, Tata McGraw Hill, 2014.
3. Rajput. R. K., “Thermal Engineering” S. Chand Publishers, 2017
4. Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill, 2010

REFERENCES

- 1 Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012.
- 2 Holman.J.P. "Thermodynamics", 3rd Edition, McGraw - Hill, 1995.
- 3 Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice - Hall of India Pvt. Ltd, 2006

4 Arora C.P, “Thermodynamics”, Tata McGraw - Hill, New Delhi, 2007.

5 Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2011

COURSE OUTCOMES

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

CO1 Identify and describe various concepts of thermodynamics

CO2 Describe the laws of thermodynamics and their application to a wide range of systems.

CO3 Identify and describe the various gas power cycles.

CO4 Infer the physical behavior of various modes of heat transfer like conduction, convection & radiation.

CO5 Understand the concept of black body, grey body, view factor & Radiation Shield

UNIT I HYBRID VEHICLES

9

History of hybrid vehicles, social and environmental importance of hybrid vehicles, impact of modern drive train on energy supplies. Hybrid Electric Drive-train configurations - basic concept of hybrid traction, architecture - merits and challenges, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNITII ENERGY STORAGE SYSTEMS

9

Requirements in Hybrid and Electric Vehicles, Types of batteries – lead acid batteries, nickel based batteries, and lithium based batteries - Battery Charging, Battery Characterization - capacity, discharge rate, state of charge, state of discharge, depth of Discharge, Technical characteristics, battery pack design, battery management system, Ultra capacitors.

UNIT III HEV PERFORMANCE

9

Maximum speed - Acceleration – Gradeability, HEV - mechanics, efficiency, driving cycles, regulations, sizing the propulsion motor and power electronics, Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV), Vehicle Simulation, Comparison of ICEV and HEV, Well-to-Wheel Analysis.

UNIT IV INTRODUCTION TO FUEL CELLS

9

Introduction – working and types of fuel cell – low, medium and high temperature fuel cells - Proton Exchange Membrane fuel cell, Solid Oxide fuel cell, Alkaline fuel cells, Molten carbonate fuel cell, Phosphoric acid fuel cell, liquid and methanol type fuel cells, Microbial fuel cell

UNIT V FUEL CELLS COMPONENTS FOR AUTOMOTIVE APPLICATIONS

9

Fuel cells for automotive applications, components of fuel cell - Membrane Electrode Assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates, materials for fuel cell-carbon fibre, Fuel cell based vehicle, technological advancements in fuel cell vehicle systems

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

TEXT BOOKS

1. “Electric and Hybrid Vehicles- Design Fundamentals” - Iqbal Husain, CRC Press, 2011.
2. “Electric and Hybrid – Electric Vehicles” - Ronald K Jurgen,, SAE International, 2011.

REFERENCES

- 1 "Electric Vehicle Technology Explained" - James Larminie, John Lowry, Wiley, 2012.
- 2 "Fuel Cell Technology Handbook- SAE International" –GregorHoogers, CRC Press ISBN 0-8493-0877-1-2003.
- 3 "Fuel Cells for automotive applications", professional engineering publishing UK. ISBN 1- 86058 4233, 2004.

COURSE OUTCOMES

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

- | | |
|------------|--|
| CO1 | Impart the knowledge about different configuration of hybrid vehicles |
| CO2 | Describe the various energy storage systems for hybrid & electric vehicles |
| CO3 | Design batteries and analyze the performance of Hybrid electric vehicles |
| CO4 | Be familiar with the various components of the fuel cells |
| CO5 | Choose materials for fuel cells related to automobile applications |

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 SKILLS I					6
Parts of Speech- Noun, Verb, Participle, Articles, Pronoun, Preposition, Adverb, Conjunction. Logical sequence of words, Tense & Voice, Comparison.						
UNIT V	LINGUISTICS SKILLS II					3
Comprehension - Comprehend and understand a paragraph, Paragraph writing.						
		L :30	T: 0	P: 0	J: 0	T: 30 PERIODS

19AUB201	AUTO COMPONENTS MANUFACTURING	L	T	P	J	C
		3	0	2	0	4

UNIT I ENGINE COMPONENTS 9+6

Casting of Engine block - conventional and expendable pattern, Casting of cylinder heads, Cylinder liners, Crankshaft, Connecting rod and Gudgeon pins-forging and casting, machining and heat treatment. Casting of Piston - gravity casting, squeeze casting, machining and finishing and piston ring manufacturing. Upset forging of valves - heat treatment and surface improvement. Engine bearing manufacturing

Experiments:

1. Prepare the component using the following operations- Facing, Turning, Step turning, Taper turning and Knurling
2. Prepare the component using the following operations- Facing, Turning and Thread cutting (Single start only)

UNIT II TRANSMISSION COMPONENTS - I 9+6

Manufacturing of friction plates using conventional blanking and fine blanking. Manufacture of composite friction lining, composite moulding of phenol formaldehyde lining. Casting of gear box casing, Precision forging of gears, gear hobbing, shaping, powder metallurgy, orbital forming of spur, helical, and bevel gears, hypoid gears, heat treatment and finishing

Experiments:

1. Prepare the component using the Surface Milling operations
2. Prepare the component using the Gear Cutting operations

UNIT III TRANSMISSION COMPONENTS-II 9+6

Propeller shaft – Continuous Casting, extrusion, heat treatment and surface hardening, Composite propeller shaft manufacturing. Forging of rear axles, casting of rear axle casing, Manufacturing of wheels and brake drums.

Experiments:

1. Prepare the component using the following operations- Drilling, Tapping and Reaming.

UNIT IV BODY COMPONENTS 9+6

Introduction- Thermoforming and Hydro forming, Press forming of body panels. Welding of body panels - resistance welding, Spot welding, Seam welding. Injection moulding – Introduction, instrument panel, bumpers, Reinforced Reaction injection moulding. Manufacture of metal and polymer panels. Adhesives and sealants Manufacturing of Springs ,Wrap forming of coil springs, leaf springs, Composite leaf springs

Experiments:

1. Prepare the mould using the following patterns:
 - a. Single piece pattern
 - b. Split pattern
 - c. Pattern with self core
2. Pattern with core box

UNIT V SURFACE COATINGS 9+6

Chemical Vapour deposition, Physical Vapour deposition, sol-gel processing Spraying, Plating, Painting in paint booth.

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

TEXT BOOKS

1. Heldt P M, High Speed Combustion Engines, Oxford IBH publishing Co., Calcutta, 1996
2. Kalpakjian, Manufacturing Engineering and Technology, Pearson Education, 2005.

REFERENCES

- 1 B.P. Bhardwaj, The Complete Book on Production of Automobile Components and Allied Products, NIIR Project Consultancy Services, 2014.
- 2 Degarmo E P, Materials and process in Manufacturing, Macmillan Publishing Co, 1997.
- 3 John A S, Introduction to Manufacturing Processes, Tata McGraw -Hill, 2012.
- 4 Kalpakjian, Manufacturing Processes For Engineering Materials, Pearson Education, 2009.
- 5 Philip F O and JairoMunuz, Manufacturing Processes and Systems, John Wiley and Sons, New York, 1998.

COURSE OUTCOMES

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

- CO1** understand properties and behavior of engineering materials
- CO2** know how to use information sources to select materials for automobile uses
- CO3** acquire knowledge in manufacturing of different automobile components
- CO4** have clear understanding about the machining of engine components
- CO5** perform and analyze the various heat treatment and surface treatment process

UNIT I VEHICLE STRUCTURE**9+6**

Brief history, introduction to automobile, layout of an automobile, Role and requirement of a chassis frame. Types of chassis – Light, medium and heavy duty vehicle chassis, ladder chassis, integral body. Design features of a body – Types of bodies, coach built convertibles. Body accessories, bumpers.

Experiments:

1. Measurement of Heavy duty vehicle frame
2. Measurement of Light duty vehicle frame

UNIT II STEERING SYSTEM**9+6**

Desirable characteristics, principle of steering, steering linkage layouts for rigid axle suspension and independent suspension systems, reversible and irreversible steering. Steering gearbox – Purpose, types of steering gearboxes. Front wheel alignment and steering geometry, centre point steering. Power steering – Purpose, basic principle, types of power steering.

Experiments:

1. Dismantling and Assembling of Rack & Pinion Steering System
2. Dismantling and Assembling of Recirculating ball steering system
3. Dismantling and Assembling of Motorized power Steering

UNIT III TRANSMISSION SYSTEMS**9+6**

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints. Construction - Differential, rear axle. Types -Full Floating, Three Quarter Floating and Semi Floating Axles - Multi-axle vehicles, Hotchkiss Drive.

Experiments:

1. Dismantling and Assembling of Coil Spring & Diaphragm spring clutches
2. Dismantling and Assembling of Sliding mesh, Constant mesh & Synchromesh gear box
3. Dismantling and Assembling of Front Axle-Rzeppa joint assembly
4. Dismantling and Assembling of Rear Axle
5. Dismantling and Assembling of Differential Mechanism

UNIT IV SUSPENSION SYSTEM**9+6**

Desirable characteristics. Types of suspension systems – Rigid axle suspension and independent suspension systems. Types of suspension springs – Leaf springs, coil springs, torsion bar springs, air springs, rubber springs, hydro elastic springs. Linked suspension system. Shock absorbers – Role of shock absorber – Types of shock absorbers, construction and working of telescopic shock absorber.

Experiments:

1. Dismantling and Assembling of Multi-Cylinder Petrol Engine
2. Dismantling and Assembling of Multi-Cylinder Diesel Engine
3. Dismantling and Assembling of petrol and diesel engine fuel system
4. Dismantling and Assembling of two-wheeler - two stroke and four stroke engines.

UNIT V BRAKING SYSTEM**9+6**

Need, characteristics of good braking system, principle of working of a braking system, wheel locking and stopping distance. Types of brakes – Drum brakes, disc brakes. Types of brake actuating systems – Mechanical brakes, hydraulic brakes, power brakes, servo brakes. Wheels and Rims, Types of Tyres and their constructional details

Experiments:

1. Dismantling and Assembling of Air Braking System

TEXT BOOKS

1. Kirpal Singh, “Automobile Engineering”, Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 1997.
2. K.K.Ramalingam, “Fundamentals of Automobile Engineering”, Scitech Publications (India) Private Limited, Chennai, 2013

REFERENCES

- 1 Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.
- 2 Joseph Heitner, “Automotive Mechanics”, Second Edition, East-West Press, 1999.
- 3 Giri. N.K., “Automotive Mechanics”, Khanna Publishers, New Delhi, 2005
- 4 R. K. Rajput , “A Text Book of Automobile Engineering”, Laksmi Publications (P) Ltd, New Delhi, 2007
- 5 Giancarlo Genta and L. Morello, “The Automotive Chassis: Volume 1: Components Design”, Springer Science & Business Media, 2008

COURSE OUTCOMES

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

- CO1** Identify the vehicle based on its structure.
- CO2** familiarize the layout and design features of an automobile
- CO3** Understanding on different types of steering system, transmission systems and axles.
- CO4** get the exposure to the suspension system
- CO5** Understanding on tyres and braking 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.
4. 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)
5. 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
6. 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

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 Mechanics of Automobile Systems, IoT in Automobile, Strength of Materials, Automotive Engines and Emission Control, Automotive Electrical and Electronics Engineering 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 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

COURSE OUTCOMES

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

CO1**CO2****CO3****CO4****CO5**

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: Prentice Hall.

REFERENCES

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

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Evaluate the quality of personality for self-development in career perspective.
- CO2** Apply the body languages in his professional interview modes.
- CO3** Apply the communication and leadership styles in the public speaking.
- CO4** Apply the social imaging qualities in their presentation skill.
- CO5** Demonstrate the personality development in mock interview.

SEMESTER IV

19MAT202	STATISTICS AND NUMERICAL METHODS	L	T	P	J	C
	(Common to Agri, Auto, Food Technology, Mech)	3	0	0	0	3
UNIT I	TESTING OF HYPOTHESIS					9
Sampling distributions – Statistical hypothesis – Tests for single mean and Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.						
UNIT II	DESIGNS OF EXPERIMENTS					9
Completely randomized design – Randomized block design – Latin square design-Applications of ANOVA.						
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					9
	NUMERICAL INTEGRATION					
Lagrange's interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3 rd rule.						
UNIT V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL					9
	EQUATIONS					
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 Johnson, R.A. and Gupta, C.B., Miller and Freund's, "Probability and statistics for Engineers", Pearson Education Asia, 8th Edition, 2011.
2. Grewal, B.S and Grewal, J.S, "Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2012.

REFERENCES

- 1 Spiegel M.R , Schiller J and Srinivasan R.A , "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, 3rd Edition, 2011.
- 2 Chapra S.C and Canale R.P. "Numerical Methods for Engineers", 6th Edition, Tata McGraw Hill Edition, 2014.
- 3 Gerald C.F. and Wheatley P.O. "Applied Numerical Analysis", 8th Edition, Pearson Education, Asia, New Delhi, 2014
- 4 Walpole R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
- 5 Kandasamy P, Thilagavathy K and Gunavathy K., "Numerical Methods", 3rd Edition, S. Chand & Company Pvt. Ltd, 2013.

COURSE OUTCOMES

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

- CO1** Apply the statistical concepts and tools for engineering applications and to use different types of research methodology techniques for decision making under uncertainty.
- CO2** Perform the ANOVA calculation which is needed for engineering research and project management.
- 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 behaviour through solution of ODEs modeling the system.

19AUT203	MECHANICS OF AUTOMOBILE SYSTEMS	L	T	P	J	C
		3	0	0	0	3
UNIT I	BASICS OF MECHANISMS AND KINEMATICS					9
Mechanism – Basic terminology and definitions, degree of freedom, mobility. Grashoff's law. Kinematic inversions - 4-bar chain, slider crank chain. Determination of velocity and acceleration of simple mechanisms using relative velocity method.						
UNIT II	STATIC AND DYNAMIC FORCE ANALYSIS					9
Applied and Constrained Forces – Free body diagrams –superposition principle – 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 –dynamic Force Analysis in simple machine members						
UNIT III	MECHANISM OF CAMS					9
Fundamentals of cam, Classifications, displacement diagrams, uniform velocity, simple harmonic paths. Layout of plate cam profiles for different types of followers - knife - edged, roller, design, derivatives of follower motion.						
UNIT IV	GEARING AND FRICTION DRIVES					9
Gear – Types and profile – nomenclature of spur & helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and epicyclic gear trains. Sliding and Rolling Friction angle – friction in threads – Belt and rope drives						
UNIT V	BALANCING					9
Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses - Balancing of single and multicylinder engines. Governors – Spring loaded and dead weight 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 Dukkupati, 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, NewDelhi, 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** determine the phenomenon of direction of rotation, speed and torque systems for simple, compound and planetary gear
- CO5** Describe the methods of balancing the moving parts of the machines.

19AUT205	INTERNET OF THINGS IN AUTOMOTIVE SAFETY	L	T	P	J	C
		2	0	0	0	2
UNIT I	INTRODUCTION					6
Introduction to IoT – Future and Market Potential of IoT – Industry 4.0 – IoT Model – IoT Protocol Architecture – IoT Technology – Functional Block of IoT						
UNIT II	IOT COMMUNICATION AND LEVELS					6
IoT Communication Models – IoT Communication API - Levels of IoT System – Domain Specific IoT and Applications						
UNIT III						6
IoT Servers – Internet of Things Device Design Methodology – Role of IoT in Automotive Industries – Introduction to Arduino – Introduction to NodeMCU – Introduction to GPRS						
UNIT IV						6
Digital Sensor – Analog Sensor – Serial Communication with RF Modem – Interfacing of ESP8266 with Analog Sensor – NodeMCU and Serial Communication						
UNIT V						6
Biometric Car Door Opening System – Accident Monitoring System – Engine oil and Coolant Level Monitoring System – Fleet and Driver Management System – Smart Road Communication System for Mobile Vehicles						

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

TEXT BOOKS

1. Internet of Things in Automotive Industries and Road Safety by RaghuveerChimata, Anita Gehlot, Rajesh Singh, Bhupendra Singh, P. S. Ranjith - 2018

REFERENCES

- 1 ArshdeepBahga, Vijay Madiseti, —Internet of Things – A hands-on approach, Universities Press, 2015
- 2 Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011

COURSE OUTCOMES

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

- CO1** Understand the concept of IoT and industry 4.0
- CO2** Understand the levels of IoT and communication
- CO3** Apply the concept of IoT in automobiles.
- CO4** Interface arduino with various I/O devices
- CO5** Apply the concept of IoT in automotive safety equipments and features.

UNIT I STRESS, STRAIN DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains – Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

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

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.

UNIT III TORSION AND SPRINGS 9

Torsion formulation stresses and deformation in circular and hollow shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs.

UNIT IV DEFLECTION OF BEAMS AND BUCKLING OF COLUMNS 9

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.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lamé's theorem.

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

TEXT BOOKS

1. R.K.Bansal, "Strength of Materials", Laxmi Publications (P) Ltd., 2018.
2. R.K.Rajput, "Strength of Materials", S.Chand and Company Ltd., New Delhi 2018,.

REFERENCES

- 1 R.S.Khurmi, "Strength of Materials", S.Chand and Company Ltd. New Delhi 2015. (Unit I, II, IV, V).
- 2 Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books, 2012. (Unit II, IV, V).
- 3 Ryder G.H, "Strength of Materials, Macmillan India Ltd"., Third Edition, 2016 (Unit II, V).
- 4 Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2016 (Unit I, II, III, IV, V).
- 5 Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2009 (Unit I, II, III, IV, V).

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.

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

19AUB203	AUTOMOTIVE ENGINES AND EMISSION	L	T	P	J	C
	CONTROL	3	0	2	0	4

UNIT I INTRODUCTION 9 + 12

Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines – construction and working. Comparison of SI and CI engines and four stroke and two stroke engines – Indicated Power, Brake Power, Indicated thermal, brake thermal and volumetric efficiencies. Measurement of friction, Cylinder pressure – Measurement of Engine CC

Experiments:

1. Valve timing and port timing diagram.
2. Performance test on two-wheeler SI engine.
3. Performance test on automotive multi-cylinder SI engine
4. Performance test on automotive multi-cylinder CI engine.

UNIT II FUEL SYSTEM, SUPER CHARGING AND TURBO CHARGING 9 + 3

Air fuel ratio requirements of SI engines, Air fuel ratio and emissions, Working of a simple fixed venture carburettor, Constant vacuum carburettor. Diesel fuel injection systems-Jerk pumps, distributor pumps, pintle and multihole nozzles, Unit injector and Common Rail Direct Injection systems. Description of a simple diesel engine governor.

Experiments:

1. Morse test on multi-cylinder SI engine.

UNIT III COOLING AND LUBRICATION SYSTEMS 9 + 6

Need for cooling, types of cooling systems- air and liquid cooling systems. Forced circulation and pressurized cooling systems. Properties of coolants. Requirements of lubrication systems. Types-mist, pressure feed, dry and wet sump systems. Properties of lubricants.

Experiments:

1. Heat balance test on automotive multi-cylinder SI engine.
2. Heat balance test on automotive multi-cylinder CI engine.

UNIT IV COMBUSTION AND COMBUSTION CHAMBERS 9

Introduction to combustion in SI and diesel engines and stages of combustion - Dependence of ignition timing on load and speed. Knock in SI and CI engines - Combustion chambers for SI and CI engines - Direct and indirect injection combustion chambers for CI engines - Importance of Swirl, squish and turbulence - Factors controlling combustion chamber design

UNIT V CONTROL TECHNIQUES FOR REDUCTION OF EMISSION 9 + 9

Emission formation in SI and CI Engine - Design modifications – Optimization of operating factors – Fuel modification – Evaporative emission control - Exhaust gas recirculation – SCR – Fumigation – Secondary Air injection – PCV system – Particulate Trap – CCS – Exhaust treatment in SI engines – Thermal reactors – Catalytic converters – Catalysts – Use of unleaded petrol. Introduction to BS VI

Experiments:

1. Emission test on two-wheeler SI engine.
2. Emission test on automotive multi-cylinder SI engine
3. Emission test on automotive multi-cylinder CI engine.

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

TEXT BOOKS

1. Ganesan V., "Internal Combustion Engines", Tata McGraw Hill, 2007
2. Ramalingam K.K., "Internal Combustion Engine", Sci-Tech Publications, 2005.
3. Kirpal Singh, "Automobile Engineering", Vol 2, Seventh Edition, Standard Publishers, New Delhi, 1997.

REFERENCES

- 1 Heisler, "Advanced Engine Technology" SAE Publication, 1995
- 2 Edward F. Obert "Internal Combustion Engines" 3 Edition, 1970 .
- 3 Gupta. H.N. "Fundamentals of Internal Combustion" Engines, reprint, PHI Learning Pvt. Ltd. 2006
- 4 Mathur and Sharma "Fundamental Combustion Engines" DhanpatRai and Sons, 2002 .
- 5 John B. Heywood, "Fundamentals of Internal Combustion Engines", 1988.

COURSE OUTCOMES

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

- CO1** Understand the concept, construction and principle of operation of engine and various engine components
- CO2** Acquire knowledge about fuel injection systems and air fuel ratio requirements
- CO3** Illustrate the lubrication and cooling systems of an IC engine
- CO4** Relate the petrol and diesel engine emission along with the formation of emission compounds
- CO5** Use modern technologies and tools to control the vehicle emissions.

UNIT I ELECTRICAL SYSTEMS**9 + 6**

Principle and Construction of Lead Acid and Lithium-Ion Battery- Characteristics of Battery Rating Capacity and Efficiency of Batteries- Various Tests on Batteries- Maintenance and Charging. Lighting System and Photometry: insulated and Earth Return System- Details of Head Light and Side Light- LED Lighting System- Head Light Dazzling and Preventive Methods Horns- Wiper System and Trafficator.

Experiments:

1. Testing of batteries and battery maintenance
 - a. Hydrometer test
 - b. High rate discharge test
 - c. Open circuit voltage test
2. Study of Automobile electrical wiring

UNIT II STARTING AND IGNITION SYSTEM**9 + 6**

Condition at Starting- Behavior of Starter During Starting- Series Motor and Its Characteristics- Principle and Construction of Starter Motor- Working of Different Starter Drive mechanisms - Care and Maintenances of Starter Motor- Starter Switches -Spark Plugs- Advance Mechanisms - Different Types of Ignition Systems.

Experiments:

1. Testing of starting motors and AC generators
2. Study of ignition systems

UNIT III CHARGING SYSTEM**9 + 6**

Generation of Direct Current- Shunt Generator Characteristics- Armature Reaction- Third Brush Regulation- Cutout. Voltage and Current Regulators- Compensated Voltage Regulator Alternators Principle and Constructional Aspects and Bridge Rectifiers- New Developments.

Experiments:

1. Study of regulators and cut – outs
2. Design of half wave and bridge rectifiers

UNIT IV SENSORS AND ACTUATORS**9 + 6**

Types of Sensors: Sensor for Speed- Throttle Position- Exhaust Oxygen Level- Manifold Pressure- Crankshaft Position- Coolant Temperature- Exhaust Temperature- Air Mass Flow for Engine Application. Solenoids- Stepper Motors- Relay.

Experiments:

1. Study of transistor configuration
2. Design of Low Pass Filter & High Pass Filter
3. Interfacing of RTD and LVDT sensors

UNIT V ELECTRONICS SYSTEMS**9 + 6**

Current Trends in Automotive Electronic Engine Management System- Types of EMS Electromagnetic interference Suppression- Electromagnetic Compatibility- Electronic Dashboard Instruments- Onboard Diagnostic System- Security - Warning System infotainment and Telematics.

Experiments:

1. Interfacing ADC and DAC
2. Microcontroller programming & interfacing using
 - a. DC motor
 - b. Stepper motor
 - c. Traffic light controller
3. Study of MPFI System
4. Study of CRDI System

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

TEXT BOOKS

1. Kholi,P.L., Automotive Electrical Equipment, Tata McGraw-Hill Co. Ltd., New Delhi, 1975
2. William B. Ribbens “Understanding Automotive Electronics:’ 5th edition – Butter worth Heinemann Woburn, 1998

REFERENCES

- 1 Young,A.P.&Griffiths,L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990
- 2 Crouse,W.H., Automobile Electrical Equipment, McGraw Hill Book Co. Inc., New York, 1980.
- 3 Automotive Hand Book, fifth edition, Robert Bosch, Bently Publishers, 2003

COURSE OUTCOMES

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

- CO1** know the working principle of battery
- CO2** identify the components of starting system & different starter drive units
- CO3** Analyze the structure and function of charging system.
- CO4** understand the working of ignition system
- CO5** understand the working of different dash board equipments

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 Narain mathur “ Tuttle Publisher”
- 2 Learn hindi through English in 30 Days by Krishna gopal vikal “ 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
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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
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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
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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
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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
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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 COLLEAGU**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 als fremdsprache A1.1 Kursbuch
- 2 Netzwerk Deutsch als fremdsprache 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 Languet De Civilisation Francaises
- 2 Annie Heminway, Complete French all in one Premium Second Edition, Tata McGraw Hill Education.
- 3 Diamond French-Aprenons 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	Assignment (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.

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

2 Weeks

COURSE OUTCOMES

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

CO1
CO2
CO3
CO4
CO5

LIST OF EXPERIMENTS

1. Design and testing of speed control circuits – meter in and meter out
2. Design and testing of electro hydraulic circuit
3. Speed control of hydraulic motor.
4. Design and simulation of basic hydraulic and pneumatic circuit using software
5. Design and testing of fluid power circuits to control
 - Velocity
 - direction and
 - force of single and double acting actuators
6. Design of circuits with logic sequences in electro pneumatic trainer kits
7. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW
8. Computerized data logging system with control for process variables like pressure flow and temperature.
9. Circuits with multiple cylinder sequence in Electro pneumatic using PLC.
10. Study of pneumatic operation for Pick and place operation using six axis robot

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

1. Compressor, 1 HP, Single Phase
2. DC Motor speed control kit using open and closed loop circuits
3. Digital PID control trainer for speed control of DC motor
4. Basic pneumatic trainer kit with manual and electric controls
5. Basic pneumatic trainer kit with PLC control
6. 8051- Microcontroller kit with stepper motor and drive circuit
7. Process control Trainer for computerized Data logging system with control for flow, pressure and temperature
8. Hydrosim and Pneumosim
9. Labview software
10. ACER PC Intel Pentium-D-Dual core computers

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

COURSE OUTCOMES

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

- CO1** Identify the function of actuators
- CO2** build the hydraulic and pneumatic circuits for various applications
- CO3** Review the concept of industrial automation with the help of pneumatic, hydraulic and electro pneumatic circuits.
- CO4** Create the mechatronics system with the help of Microprocessor and PLC.
- CO5** Design simple circuit systems for sequential control involving valves and cylinders.

SEMESTER V

19AUT301	AUTOMOTIVE EMBEDDED SYSTEMS	L	T	P	J	C
		2	0	0	0	2
UNIT I	INTRODUCTION TO EMBEDDED SYSTEMS					6
RISC and CISC machines – 89c51 Microcontroller hardware block diagram - Data and program memory mapping - Register organization - Basic concepts of I/O pins - Interfacing to external memory.						
UNIT II	MICROCONTROLLER PROGRAMMING					6
Instruction sets - Addressing modes - Assembly language programming – addition – subtraction – multiplication – division. I/O port programming: LED - Seven segment display – switch interfacing – level triggering – edge triggering - Timer and counter programming - simple programs.						
UNIT III	COMMUNICATION WITH PERIPHERALS					6
Liquid Crystal Display interfacing – Matrix keypad interfacing - Serial data communication – applications - Interrupt programming - hardware interrupt - timer interrupt – external interrupt – serial interrupt.						
UNIT IV	SENSOR INTERFACING					6
Analog to digital converter - ADC 0808 with LM35 temperature sensor - signal conditioning. Motor Interfacing: Relay logic – Pulse width modulation - Speed control of DC motor using PWM - Stepper motor interfacing with automotive applications.						
UNIT V	INTELLIGENT AUTOMOTIVE SYSTEMS					6
Introduction to 8-bit ATmega microcontroller – simple programs – serial UART interfacing - Servo motor interfacing with angle control - Object detection on car reverse using ultrasonic sensor – building automotive mini project.						

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

TEXT BOOKS

1. Muhammad alimazidi, Janice Gillispiemazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C – VTU", 2nd Edition, Pearson Education, New Jersey, 2011.
2. Culkun, Jody, and Eric Hagan, "Make: Learn Electronics with Arduino: An Illustrated Beginner's Guide to Physical Computing", 1st Edition, Maker Media, San Francisco, 2017.

REFERENCES

- 1 Francoise Simonot-Lion, Nicolas Navet, "Automotive Embedded Systems Handbook", Taylor and Francis Group, New York, 2017
- 2 Ronald K.Jurgen, "Distributed Automotive Embedded Systems"SAEInternational,2007
- 3 M. Kathiresh, R. Neelaveni, "Automotive Embedded Systems", Springer Nature, 2021
- 4 ChristofPaar, Marko Wolf, "Embedded Security in Cars", Springer Berlin Heidelberg, 2006
- 5 Mark van den Brand, YanjaDajsuren, "Automotive Systems and Software Engineering", Springer International Publishing, 2019

COURSE OUTCOMES

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

- CO1** Comprehend the concepts embedded systems with 8-bit microcontroller
- CO2** Write assembly language programs for 8051 microcontroller
- CO3** Communicate with various peripheral using 8051 microcontroller
- CO4** Interface sensor and motor with 8-bit microcontroller
- CO5** Examine intelligent automotive systems with 8-bit microcontroller

19AUT302	VEHICLE DYNAMICS AND STRUCTURES	L	T	P	J	C
		3	0	0	0	3
UNIT I	VEHICLE DESIGN					9
Assumptions to be made in designing a vehicle Range of values for Gross Vehicle Weight, Frontal Area, maximum speed, maximum acceleration, Gradability in different gears- Calculation, Tabulation and Plotting of Curves for Air and Rolling Resistances at various vehicle speeds - Calculation and Plotting of Driving force - Power requirement for different loads and acceleration, Maximum Power calculation.						
UNIT II	TIRES					9
Tire forces and moments, Tire structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tires. Magic formulae tire model, Estimation of tire road friction. Test on Various road surfaces. Tire vibration.						
UNIT III	VERTICAL DYNAMICS					9
Human response to vibration - Sources of Vibration - Design and analysis of Passive, Semi-active and Active suspension using Quarter car model - Influence of suspension stiffness, suspension damping, and tire stiffness - Skyhook damping - Air suspension system and their properties.						
UNIT IV	LONGITUDINAL DYNAMICS AND CONTROL					9
Aerodynamic forces and moments – Load Distribution for three wheeler and four wheeler - Calculation of Maximum acceleration, Reaction forces for Different drives - Braking and Driving torque - Prediction of Vehicle performance - ABS, stability control, and Traction control.						
UNIT V	LATERAL DYNAMICS					9
Steady state handling characteristics - Steady state response to steering input - Testing of handling characteristics - Transient response characteristics - Direction control of vehicles - Roll center, Roll axis, Vehicle under side forces - Stability of vehicle on banked road, during turn - Effect of suspension on cornering.						
		L :45	T: 0	P: 0	J: 0	Total:45 PERIODS

TEXT BOOKS

1. Giri. N. K., "Automotive Mechanics," Khanna Publishers, New Delhi, 2008.
2. Rajesh Rajamani, "Vehicle Dynamics and Control", 2nd Edition, Springer 2012.

REFERENCES

- 1 William H. Crouse, "Automotive mechanics" – 10th Edition, Tata Mc Graw Hill Publications Co. New Delhi, 2016
- 2 Dean Karnopp, "Vehicle Dynamics, Stability & Control" 2nd Edition, CRC Press 2013.
- 3 Karl Popp & Werner Schiechlen, "Ground Vehicle Dynamics" Springer 2010.
- 4 Hans Pacajka, "Tire and Vehicle Dynamics" 3rd Edition, Elseveir 2012.
- 5 Reza N. Jazer, "Vehicle Dynamics: Theory and Application" 2nd Edition, Springer 2013.

COURSE OUTCOMES

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

- CO1** Analyze various design parameters for vehicle
- CO2** Estimate the property and performance of tire on various road surfaces.
- CO3** Interpret the vehicle dynamics characteristics of automotive suspension system.
- CO4** Predict longitudinal behavior of three & four-wheeler and its controls.
- CO5** Compute lateral dynamic characteristics of vehicles under steady state and transient conditions

19AUT303	ADDITIVE MANUFACTURING AND ITS APPLICATIONS	L	T	P	J	C
		2	0	0	0	2
UNIT I	INTRODUCTION TO 3D PRINTING & CAD FOR ADDITIVE MANUFACTURING					6
Introduction, Process, Classification, Advantages, Additive vs Conventional Manufacturing processes, 2D Vs 3D modelling -3D solid modelling software and their role in RPT.						
UNIT II	DATA PROCESSING FOR ADDITIVE MANUFACTURING					6
CAD Data formats - STL & other formats for additive manufacturing. Reverse engineering – 3D Scanning Digitization techniques – Data Processing for Additive Manufacturing Technology, Steps for 3d printing technology - Part Orientation - support generation – Model Slicing.						
UNIT III	LIQUID AND SOLID BASED ADDITIVE MANUFACTURING					6
Stereo Lithography apparatus (SLA), Laminated object manufacturing (LOM), Fused Deposition Modelling (FDM), Process parameter – materials – applications.						
UNIT IV	POWDER BASED ADDITIVE MANUFACTURING SYSTEMS					6
Principle, process, advantages - Selective Laser Sintering (SLS), Selective Laser melting (SLM), Binder Jet technology, Laser Engineered Net Shaping (LENS), Process parameter – materials – applications.						
UNIT V	ADDITIVE MANUFACTURING APPLICATIONS					6
Applications of additive manufacturing in Product design – rapid tooling - Automotive, Aerospace– General Manufacturing -Medical–Architectural domains - food industry. Case studies.						
		L :30	T: 0	P: 0	J: 0	Total:30 PERIODS

TEXT BOOKS

1. Chua, C.K., Leong K.F. and Lim C.S., “Rapid prototyping: Principles and applications”, second edition, World Scientific Publishers, 2010.
2. Gibson, Ian, Rosen, David, Stucker, Brent., “Additive Manufacturing Technologies 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing” Springer, 2014
3. Gebhardt A., “Rapid prototyping”, Hanser Gardener Publications, 2003

REFERENCES

- 1 Liou L.W. and Liou F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press, 2007.
- 2 Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.
- 3 Hilton P.D. and Jacobs P.F., “Rapid Tooling: Technologies and Industrial Applications”, CRC press, 2000.
- 4 DouglasBryden, “CAD and Prototyping for Product Design”, 2014

COURSE OUTCOMES

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

- CO1** Describe the differences and application of a range of additive manufacturing processes
- CO2** Select and use correct CAD formats in the manufacture of a 3D printed part.
- CO3** Understand the operating principles, capabilities, and limitations of liquid and solid based
- CO4** Additive manufacturing system, including fused deposition modeling and stereo lithography
- CO5** Appreciate the operating principles, capabilities and limitations of powder based additive manufacturing system, including 3D printing and laser sintering.

19AUB301	AUTOMOTIVE FUELS AND LUBRICANTS	L	T	P	J	C
		3	0	2	0	4
UNIT I	MANUFACTURE OF FUELS AND LUBRICANTS	9 + 6				
Structure of petroleum, refining process, fuels, thermal and catalytic cracking, polymerization, alkylation, isomerization, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants						
Experiments:						
1. ASTM distillation test of liquid fuels						
2. Temperature dependence of viscosity using Redwood Viscometer						
3. Viscosity Index of Fuels using Saybolt Viscometer						
UNIT II	THEORY OF LUBRICATION	9 + 6				
Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.						
Experiments:						
1. Temperature dependence of viscosity of lubricants using Redwood Viscometer						
2. Viscosity Index of lubricants using Saybolt Viscometer						
UNIT III	LUBRICANTS	9 + 6				
Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.						
Experiments:						
1. Ash content and Carbon Residue Test						
2. Drop point of grease and mechanical penetration in grease.						
UNIT IV	PROPERTIES AND TESTING OF FUELS	9 + 6				
Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion etc.						
Experiments:						
1. Aniline Point test of diesel						
2. Calorific value of liquid fuel						
3. Flash and Fire points of petrol and diesel.						
4. Copper strip Corrosion Test						
UNIT V	COMBUSTION & FUEL RATING	9 + 6				
SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels.						
Experiments:						
1. Reid vapour pressure test.						
2. Cloud & Pour point Test						
		L :45	T: 0	P: 30	J: 0	Total:75 PERIODS

TEXT BOOKS

- Francis, W, "Fuels and Fuel Technology", Vol. I & II, Pergamon, 1965.
- M.L.Mathur and P.Sharma "A Course in internal combustion engines," Dhanpatrai Publications, 2012.)
-

REFERENCES

- Brame, J.S.S. and King, J.G. – "Fuels Solids, Liquids, Gaseous". Edward Arnold, 196.

- 2 Ganesan.V., “Internal Combustion Engineering”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
- 3 Lansdown. A.R., Lubrication, "A practical guide to lubricant selection,” Pergamon press, 1982.
- 4 Raymond. C. Gunther, "Lubrication", Chilton Book Co., 1971.
- 5 Obert.E.F “Internal Combustion Engineering and Air Pollution,” International book Co., 1988.

COURSE OUTCOMES

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

- CO1** Gain the knowledge on various fuel and lubrication manufacturing techniques
- CO2** Learn the detailed conception on lubrication
- CO3** Evaluate the various lubrication and it application
- CO4** Practice the different fuel standardization techniques at laboratory level
- CO5** Be familiar with fuel rating

19AUB302	AUTOMOTIVE COMPONENT DESIGN	L	T	P	J	C
		3	0	2	0	4
UNIT I	DESIGN OF VEHICLE FRAME AND FRONT AXLE	9 + 6				
Introduction to Design - Study of loads-moments and stresses on frame members - Design of Vehicle frame -Analysis of loads-moments and stresses in front axle - Design of front axle beam – Wheel Spindle Bearing.						
Experiments:						
1. Design of Vehicle Frame						
2. Design of Front Axle						
UNIT II	DESIGN OF STEERING SYSTEM AND SUSPENSION SYSTEM	9 + 6				
Condition for True Rolling – Ackermann Principle in Steering System – Design of Steering System Components - Design of leaf Springs-Design of Coil springs – Design of torsion bar springs						
Experiments:						
1. Design of Leaf Spring Suspension System						
2. Design of Coil Spring Suspension System						
UNIT III	DESIGN OF ENGINE COMPONENTS	9 + 9				
Design of Cylinder – Design of Piston, Piston pins and Piston rings – Design of Connecting rod – Design of Valves - Design of Exhaust and Intake Manifold – Design of Crankshaft						
Experiments:						
1. Design of connecting rod assembly.						
2. Development of the crankshaft assembly.						
3. Design and drawing of the inlet and exhaust valves.						
UNIT IV	DESIGN OF CLUTCH AND GEARBOX	9 + 3				
Design of single plate clutch - Design of multiplate clutch - Design of Centrifugal clutch – Layout of Gearboxes - Design of three speeds and four speed gearboxes						
Experiment:						
1. Design of Clutch Assembly						
UNIT V	DESIGN OF FINAL DRIVE AND BRAKING SYSTEM	9 + 6				
Design of Propeller Shaft – Design of Rear Axle Drive Assembly - Energy Absorbed by brakes –Heat to be dissipated during braking – Design of Drum Brake – Design of Disc Brake						
Experiments:						
1. Design of Braking System						
2. Design of Propeller Shaft						
		L :45	T: 0	P: 30	J: 0	Total:75 PERIODS

TEXT BOOKS

1. N.K.Giri, “Automotive Mechanics” 9th Reprint, Khanna Publishers 2014.
2. R.S.Khurmi&Gupta.J.K., "A text book of Machine Design", Eurasia Publishing House (Pvt) Ltd, 2011.

REFERENCES

- 1 S.Md.Jalaludeen, “A text book of Machine Design”, AnuradhaPublications, 2014.
- 2 Heldt, P.M., "Automotive Chassis", literary licensing. 2012.
- 3 Julian Happian-Smith, “An Introduction to Modern Vehicle Design”, Butterworth Heinemann Publishers, 2004
- 4 Dean Aaverns, "Automobile Chassis Design", Illife Book Co., 2016.
- 5 Mathur&Sharma, “A course in I.C. Engine”, DhanputRai& Sons, 2016

COURSE OUTCOMES

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

- CO1** Analyze various parameters for designing Vehicle frame and Front Axle
- CO2** Design the Steering system and Suspension System
- CO3** Interpret the design methodology of various Engine components.
- CO4** Discover the design of gearboxes and Automotive Clutches
- CO5** Evaluate the design considerations in Final Drive and Braking System

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 vehicle dynamics, embedded systems, Additive manufacturing, Automotive fuels, Automotive components Design & Electives studied 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

COURSE OUTCOMES

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

CO1

CO2

CO3

CO4

CO5

LIST OF EXPERIMENTS

11.
 1. Measurement of temperature using thermocouple and thermistor
 2. Measurement of displacement using Potentiometer.
 3. Measurement of displacement using capacitive transducer
 4. Torque measurement using torque measuring devices
 5. Strain Measurement using strain gauge
 6. Analog to Digital Converters
 7. Digital Comparator
 8. Voltage to frequency converter
 9. Frequency to Voltage Converter
 10. Study on the application of data acquisition system for industrial purposes

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

1. Thermocouple module
2. Thermistor module
3. Potentiometer Kit
4. Capacitive transducer trainer kit
5. Strain Measurement trainer kit
6. Torque measurement kit
7. Cathode Ray Oscilloscope
8. Function Generator
9. Regulated power supply
10. Voltage to frequency and Frequency to Voltage Converter
11. Digital Comparator

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

COURSE OUTCOMES

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

- CO1** Students will be able to know about the working and construction of sensors measuring various physical parameters.
- CO2** Design suitable signal conditioning and filter circuits for sensors
- CO3** Outline operations of various data acquisition and transmission systems
- CO4** Distinguish the Electrical and Mechanical Measurements.
- CO5** Classify various sensing methods used in condition monitoring

SEMESTER VI

19AUB303	FINITE ELEMENT METHODS AND ANALYSIS	L	T	P	J	C
		3	0	2	0	4

UNIT I INTRODUCTION 9 + 6

Introduction to FEM- Historical Back ground – Weighted Residual, Ritz and Galerkin method – Variational formulation- General procedure of FEM

Experiments:

1. Study of different commercial FEA tools used for design and analysis

UNIT II FORMULATION OF ELEMENT CHARACTERISTIC MATRICES AND VECTORS FOR ELASTICITY PROBLEMS 9 + 12

One dimensional elasticity – Two-dimensional elasticity- Axisymmetric elasticity- Formulation of element characteristic matrices and vectors for elasticity problems.

Experiments:

1. Stress analysis of Crankshaft
2. Stress analysis of leaf spring
3. Stress analysis of composite bumper
4. Design and analysis of chassis frames

UNIT III FORMULATION OF ELEMENT CHARACTERISTIC MATRICES AND VECTORS FOR THERMAL PROBLEMS 9 + 6

One dimensional, Two dimensional heat transfer – Axisymmetric heat transfer – Torsion problems - Formulation of element characteristic matrices and vectors for Field Problems Thermal problems

Experiments:

1. Thermal analysis of cylinder liners
2. Thermal analysis of piston crown

UNIT IV HIGHER ORDER AND ISOPARAMETRIC FORMULATIONS 9

Natural coordinate system and Numerical Integration – Higher-order, one-dimensional, two-dimensional elements – Structural beam, plate and shell elements – Isoparametric elements – Isoparametric formulation.

UNIT V COMPUTER IMPLEMENTATION 9 + 6

An overview of FE analysis program – pre-processing – solution – post processing.

Experiments:

1. Design and analysis of torsion bar
2. Cam Profile analysis

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

TEXT BOOKS

1. J.N. Reddy, “An Introduction to Finite Element Method”, McGraw Hill, 3rd Edition, 2017.
2. S.S.Rao, “The finite element method in Engg.”, Pergamon Press, 2005

REFERENCES

- 1 S. S. Bhavikatti, “Finite Element Analysis”, New Age International Publishers, 2005
- 2 P.Seshu, “Finite Element Analysis”, PHI Learning Private Ltd., 2012
- 3 Chandrupatla, “Introduction to Finite Elements in Engineering”, 4th Edition, Pearson India Ltd. 2015.
- 4 Y. M. Desai, “Finite Element Method with Applications in Engineering”, Pearson Education India 2011
- 5 Logan D.L., “A First course in the Finite Element Method”, CL Engineering; 5th edition, 2010

COURSE OUTCOMES

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

- CO1** Understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics and thermal analysis.
- CO2** Understand the behaviour of various finite elements.
- CO3** Derive finite element equations for simplex and complex elements.
- CO4** Solve problems in solid mechanics and heat transfer using FEM.
- CO5** Analyze more complex problems (in solid mechanics or thermal analysis) using the commercial FEM code.

19AUB304	VEHICLE MAINTANENCEAND RECONDITIONING	L	T	P	J	C
		2	0	2	0	3
UNIT I	MAINTENANCE OF RECORDS AND SCHEDULES	9				
Requirements and importance of maintenance, types of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance. Motor vehicle acts, insurance etc and traffic rules, motor vehicle driving rules and regulation.						
UNIT II	ENGINE MAINTENANCE – REPAIR AND OVERHAULING	9 + 3				
Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up, including modern engines.						
Experiments:						
1. Engine fault diagnosis using scan tool						
UNIT III	CHASSIS MAINTENANCE - REPAIR AND OVERHAULING	9 + 15				
Mechanical and automobile clutch, fluid flywheel, torque converter, automatic transmission and gear box, servicing and maintenance. Maintenance servicing of propeller shaft and differential system. Maintenance servicing of suspension systems. Brake systems, types and servicing techniques. Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.						
Experiments:						
1. Fault diagnosis and service of transmission system						
2. Fault diagnosis and service of braking system						
3. Fault diagnosis and service of suspension system						
4. Fault diagnosis and service of steering system						
5. Study of wheel alignment and balancing						
6. Removal and fitting of tire and tube						
UNIT IV	AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE	9 + 6				
Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.						
Experiments:						
1. Fault diagnosis and service of lighting system.						
UNIT V	MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLE BODY	9 + 6				
Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance.						
Experiments:						
1. Minor and major tune up of gasoline and diesel engines						
2. Calibration of Fuel pump						

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

TEXT BOOKS

1. Clifton E. Owen “Basic Automotive Service and Systems “– 4th Edition, Cengage Learning 2010.
2. Tim Gilles “Automotive Service” – 5th Edition, Cengage Learning 2015.

REFERENCES

- 1 N.K.Giri, “Automotive Mechanics” 9 th Reprint, Khanna Publishers 2014.
- 2 James D Halderman, “Advanced Engine Performance Diagnosis” Prentice Hall India Learning Private Limited 2015

- 3 Doshi.J.A, “Vehicle Maintenance and Garage Practice” Prentice Hall India Learning Private Limited 2014
- 4 Dr.Kripal Singh, “Automobile Engineering vol 1” 13th Edition, standard publishers 2012
- 5 W.H.Crouse, “Automotive Mechanics” 10th Edition , Tata McGraw Hill Publications, 2006

COURSE OUTCOMES

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

- CO1** Identify the faults and knowledge on maintenance.
- CO2** Impart the knowledge in working of automobile components.
- CO3** Diagnosis the faults and rectify the faults in vehicle.
- CO4** Describe the minor and major tuning of diesel and petrol engines.
- CO5** Adjust the pedal play in clutch brake, hand brake and steering wheel.

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.

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

2 Weeks

COURSE OUTCOMES

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

CO1
CO2
CO3
CO4
CO5

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’s Arthashastra, 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, Vidyanidhi Prakasham, Delhi,2016					
10	RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016					
11	R Sharma (English translation), Shodashang Hridayam					
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					

SEMESTER VII

19GET277

BIOLOGY FOR ENGINEERS

L	T	P	J	C
2	0	0	0	2

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 e 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 neuralnetworks-bioremediation-biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic biomedical instrumentation.

L :30 T: 0 P: 0 J: 0 T: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 students should be able to

- CO1** Grasp and apply biological engineering principles, procedures needed to solve real-world problems
- 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

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-existenceImplications 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, G P 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

SEMESTER VIII

19AUP401

PROJECT – I

L	T	P	J	C
0	0	0	4	2

PROJECT WORK GUIDELINES

The students in convenient groups of members on a project involving theoretical and experimental studies related to automobile engineering. Every project work shall have a guide who is the member of the faculty of the institution.

Four periods per week shall be allotted in the time table and this time shall be utilized by the students for carrying out the project work.

GENERAL GUIDELINES

1. Selection of a topic or project title in consultation with a staff member.
2. Develop a project planning strategy.
3. If it is an industry – sponsored project, a concurrent letter from industry is required.
4. A maximum of 4 students per group will do the project.
5. The project may be done in one of the labs under the supervision of a guide or in the selected industry.
6. At the end of the project, a report will be written and a technical presentation along with demonstration will be made by the students.
7. The report, project demonstration and technical presentation will be evaluated by the internal and external examiners. Selection of a topic or project title in consultation with a staff member.

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

COURSE OUTCOMES

At the end of the course students should be able to

CO 1: Design, analyze, and fabricate the device and mechanisms of specific automotive.

CO 2: Provide opportunity for the students to implement their skills acquired in the previous semesters practical problems.

CO 3: Brings out innovative ideas to the students.

CO 4: Prepare models / projects related to their skills acquired in the previous semesters practical problems

CO 5: Prepare process planning, assembly methods, testing and cost analysis.

THE PROJECT WORK INVOLVES THE FOLLOWING

1. Preparing a project brief proposal including
 - Problem identification
 - A statement of system / process specification proposed to be developed (Block diagram / concept tree)
 - List of possible solutions including alternative and constraints
 - Cost benefit analysis
 - Time Line of activities
2. A report highlighting the design finalization (based on functional requirements & standards (if any))
3. A presentation including the following:
 - Implementation Phase (Hardware / Software / both)
 - Testing & Validation of the developed system
 - Learning in the Project
4. Consolidated project report preparation

GENERAL GUIDELINES

1. The progress of the project is evaluated based on a minimum of three reviews.
2. The review committee may be constituted by the Head of the Department.
3. A project and project reports are required at the end of the semester.
4. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

L: 0 T: 0 P:0 J: 300 TOTAL: 300 PERIODS**COURSE OUTCOMES**

At the end of the course students should be able to

CO1: Take up industrial design and fabrication projects.

CO2: Create innovative ideas to solve real time engineering problems.

CO3: Design their conceptual methods for Automobile Engineering sector

CO4:

CO5:

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

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

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

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

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

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 Psychology
- 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- Indu Sijwali, 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
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
Introduction to Cost Accounting- Elements of cost- Types of cost -Cost Accounting systems: Job costing- Process costing						
UNIT IV	Budget					3
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
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- Indu Sijwali, 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- Indu Sijwali, 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- Indu Sijwali, 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- Indu Sijwali, 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- Indu Sijwali, 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- Post & 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

19AUE301	TWO AND THREE WHEELER TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3

UNIT I THE POWER UNIT 9

Two stroke and four stroke SI & CI engine Construction and Working, merits and demerits. Symmetrical and unsymmetrical valve & port timing diagrams. Scavenging process. Construction and operation of Rotary valve engines.

UNIT II FUEL AND IGNITION SYSTEMS 9

Fuel system – Different circuits in two wheeler fuel systems, fuel injection system. Lubrication system, Ignition systems - Magneto coil and battery coil spark ignition system, Electronic ignition System, Variable timing ignition system (VTI). Starting system - Kick starter system – Self-starter system. Recent technologies.

UNIT III CHASSIS AND SUB-SYSTEMS 9

Main frame for two and three wheelers, its types, Chassis and different drive systems for two wheelers, Single, multiple plates and centrifugal clutches, Gear box and its and various gear controls in two wheelers. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar, Freewheeling devices.

UNIT IV BRAKES AND WHEELS 8

Drum brakes & Disc brakes Construction and Working and its Types, Front and Rear brake links layouts. Brake actuation mechanism. Spoked wheel, cast wheel, Disc wheel & its merits and demerits. Tyres and tubes Construction & its Types. Anti-lock braking systems.

UNIT V TWO & THREE WHEELERS – CASE STUDY 10

Case study of Sports bike-Kawasaki Ninja ZX-14R, Suzuki Hayabusa, Ducati 1199 Panigale R, KTM 1190 RC8R, Motor cycles-Mahindra kine, Honda Dio, Honda Shine, Bajaj Avenger. Auto rickshaws Pick up van, Delivery van, and Trailer. Servicing and maintenance. Recent developments.

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

TEXT BOOKS

1. DhruvPanchal, “Two and Three Wheeler Technology”, PHI learning PvtLtd, Delhi, 2015.
2. S.K.Gupta, “A Textbook of Automobile Engineering”, S.Chand& Company Pvt ltd., New Delhi, 2016.

REFERENCES

- 1 Ben Spies., Mark Lindemann, “The Total Motorcycling Manual”, Cycle World, 2013.
- 2 Ramalingam. K. K., "Two Wheelers", Scitech publications, Chennai, 2012.
- 3 John Robinson, “Motorcycle Fuel Systems TechBook”, HayneesTechBookPvt ltd., 2015.
- 4 Edmundson David D, "Motorcycles: Fundamentals- Service- Repair”, Editors of HayneesPvt Ltd., 2016.
- 5 Raymond Broad Lambretta – "A practical guide to maintenance and repair,” Edition-2010.

COURSE OUTCOMES

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

- CO1** Define the power generation unit of two & three wheelers and operation of rotary valve.
- CO2** Understand the fuel and ignition systems in the two and three wheelers.
- CO3** Demonstrate the various chassis and subsystems of the two and three wheelers.
- CO4** Infer knowledge on transmission and braking unit of two and three wheelers.
- CO5** Recognize the servicing and maintenance of various vehicles.

19AUE302	AUTOMOTIVE SAFETY AND INFOTRONICS	L	T	P	J	C
		3	0	0	0	3

UNIT I INTRODUCTION 9

Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumple zone, safety sandwich construction.

UNIT II SAFETY CONCEPTS 9

Active safety: driving safety, conditional safety, perceptibility safety, operating safety, passive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT III SAFETY EQUIPMENTS AND COMFORT SYSTEM 9

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety, Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control system, Active suspension system.

UNIT IV COLLISION WARNING AND AVOIDANCE 8

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.

UNIT V INFOTRONICS FOR AUTOMOBILES 10

TELEMATICS: Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems

ADAPTIVE CONTROL SYSTEMS: Adaptive cruise control - adaptive noise control - active roll control system - cylinder cut- off technology.

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

TEXT BOOKS

1. George A. Peters, Barbara J. Peters, "Automotive Vehicle Safety" CRC Press, 2002.
2. Richard Bishop, "Intelligent Vehicle Technology and Trends" Artech House, 2005.

REFERENCES

- 1 William Ribbens, "Understanding Automotive Electronics: An Engineering Perspective", Eight Edition, Elsevier Science & Technology Books., - 2017.
- 2 Vivek D. "Ergonomics in the Automotive Design Process" Bhise publisher CRC press, Taylor and Francis group, - 2016
- 3 JullianHappian Smith "An Introduction to Modern Vehicle Design", SAE, 2004.
- 4 Geoffrey Davies., "Materials for Automobile Bodies", Elsevier, 2012.
- 5 Bosch, "Automotive Handbook", 8th Edition, SAE publication, 2011

COURSE OUTCOMES

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

- CO1** Recognize the need of design for safety
- CO2** Demonstrate about various safety concepts
- CO3** Summarize the safety equipment's and comfort system
- CO4** Explain collision warning and avoidance system
- CO5** Justify Infotronics for Automobile

19AUE303	AUTOMOTIVE VIBRATION AND NOISE CONTROL	L	T	P	J	C
		3	0	0	0	3
UNIT I	FUNDAMENTALS OF ACOUSTICS AND NOISE, VIBRATION					9
Theory of Sound—Predictions and Measurement, Sound Sources, Sound Propagation in the Atmosphere, Sound Radiation from Structures and Their Response to Sound, General Introduction to Vibration, Vibration measurement- Accelerometer ,Vibration of Simple Discrete and Continuous Systems, Random Vibration, Response of Systems to Shock, Passive Damping.						
UNIT II	EFFECTS OF NOISE, BLAST, VIBRATION, AND SHOCK ON PEOPLE					9
Sleep Disturbance due to Transportation Noise Exposure, Noise-Induced Annoyance, Effects of Infrasound, Low-Frequency Noise, and Ultrasound on People, Auditory Hazards of Impulse and Impact Noise, Effects of Intense Noise on People and Hearing Loss, Effects of Vibration on People, Effects of Mechanical Shock on People.						
UNIT III	TRANSPORTATION NOISE AND VIBRATION—SOURCES, PREDICTION, AND CONTROL					9
Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine Noise Prediction and Control—Diesel, Exhaust and Intake Noise and Acoustical Design of Mufflers, Tire/Road Noise—Generation, Measurement, and Abatement, Aerodynamic Sound Sources in Vehicles—Prediction and Control, Transmission and Gearbox Noise and Vibration Prediction and Control, Brake Noise Prediction and Control.						
UNIT IV	INTERIOR TRANSPORTATION NOISE AND VIBRATION SOURCES – PREDICTION AND CONTROL					7
Automobile, Bus, and Truck Interior Noise and Vibration Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors- Prediction and Control						
UNIT V	NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES					11
Measuring Equipment, Measurements, Signal Acquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, Sound Level Meters, Noise Dosimeters, Analyzers and Signal Generators, Equipment for Data Acquisition, Noise and Vibration Measurements, Determination of Sound Power Level and Emission Sound Pressure Level, Sound Intensity Measurements, Noise and Vibration Data Analysis.						
		L :45	T: 0	P: 0	J: 0	Total:45 PERIODS

TEXT BOOKS

1. David A.Bies and Colin H.Hansen “Engineering Noise Control: Theory and Practice” Spon Press, London, 2009
2. Thomson W T, "Theory of Vibration with Applications", CBS Publishers and Distributors, New Delhi, 1990.

REFERENCES

- 1 Clarence W. de Silva, “Vibration Monitoring, Testing, and Instrumentation”, CRC Press, 2007.
- 2 Allan G. Piersol, Thomas L. Paez “Harris’ Shock and Vibration Handbook”, McGraw-Hill, New Delhi, 2010
- 3 Colin H Hansen “Understanding Active Noise Cancellation “, Spon Press, London 2003.
- 4 Matthew Harrison “Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles “, Elsevier Butterworth-Heinemann, Burlington, 2004.
- 5 S. Graham Kelly, “Mechanical Vibrations “, Schaum Outline Series, McGraw Hill Book Company, New Delhi, 2000.

COURSE OUTCOMES

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

- CO1** Acquire the basic knowledge in fundamentals of automotive acoustics
- CO2** Summarize the impact of noise, vibration and shock on people.
- CO3** Identify the sources, effects of transportation noise
- CO4** Impart knowledge in the interior transportation noise and vibration
- CO5** Measure noise and vibration pertain to an automobile.

UNIT I INTRODUCTION**9**

Basics of controls systems – different types, tuning of PID controller, fault tolerant sliding model control design and analysis – Case study of armature controlled DC motor for electric power steering.

UNIT II ENGINE CONTROL SYSTEMS**9**

Introduction –lambda control – engine model for lambda control- lambda control circuit adaptive Lambda control- Idle speed control – use of state space control –knock control- knock sensors adaptive knock control –Air fuel ratio model for open and closed loop systems using Root Locus sketch and Bode plot- Modeling and simulation of Nyquist stability criteria for lambda oxygen sensor.

UNIT III TRANSMISSION AND DRIVE LINE CONTROL**9**

Goals of drive line control(static and dynamic gear shift experiments) – Basic drive line equation- modeling neutral gear- state space formulation controller formulation-speed control with active damping –simulations – Driveline control for gear shifting –Influence of sensor locations –transmission torque control design.

UNIT IV VEHICLE CONTROL SYSTEM**9**

ABS control systems –control of yaw dynamics- road and driver model control – PID driver model and hybrid driver model- modeling and analysis of electric and Hybrid Vehicle using PID controller.

UNIT V VEHICLE STABILITY ANALYSIS**9**

Linear vehicle model- non-linear vehicle model- vehicle stability model using Routh Hurwitz criteria- Nyquist stability criteria – modeling and analysis of Roll and Yaw Stability in control Mode.

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

1. UWE Kiencke, Lars Nielsen, “Automotive control systems”, Springer, 2005
2. Tom Weathers, Claud C. Hunter, “Automotive computers and controls”, Prentice-Hall 1984.

REFERENCES

- 1 GalipUlsoy and Huei Peng, “Automotive control Systems”, Cambridge University press.2012
- 2 Norman C S. Nise, “Control system Engineering”, John Wiley & Sons, Singapore, 2015.
- 3 Masato Abe, “Vehicle Handling Dynamics”, Butterworth-Heinemann, UK, 2009.
- 4 Nagrath I J and Gopal M, “Control Systems Engineering”, Prentice Hall of India, New Delhi, 2002.
- 5 Wong J Y, “Theory of Ground Vehicles”, John Wiley & Sons, New York, 1978.

COURSE OUTCOMES

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

- CO1** Understand the basics of automotive control systems
- CO2** Identify the various engine control systems and its application
- CO3** Examine the various transmission and drive line control system
- CO4** Formulate the required vehicle control systems for any vehicle.
- CO5** Analyze the vehicle stability

19AUE305	AUTOMOTIVE COMPUTATIONAL FLUID DYNAMICS	L	T	P	J	C
		3	0	0	0	3

UNIT-I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Physical boundary conditions – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT-II FINITE DIFFERENCE METHOD 9

Finite difference method-forward, backward and central difference schemes, explicit and implicit methods. Properties of numerical solution methods-stability analysis, error estimation, difference between the FDM and FVM methods-Iterative solution Methods– Example problems on elliptic and parabolic equations.

UNIT-III FINITE VOLUME METHOD (FVM) FOR HEAT CONDUCTION 9

Finite volume formulation for steady state One, Two and Three-dimensional heat conduction problems. One dimensional unsteady heat conduction through Explicit, Crank–Nicolson and fully implicit schemes.

UNIT-IV FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 10

Steady one- dimensional convection and diffusion– Central, upwind differencing schemes- properties of discretization schemes – Conservativeness, Boundedness, Transportiveness-Hybrid, Power-law, Spalding’s SIMPLE algorithm, QUICK Schemes.

UNIT-V CALCULATION FLOW FIELD BY FVM 9

Representation of the pressure gradient term and continuity equation– Staggered grid– Momentum equations– Pressure and Velocity corrections–Pressure Correction equation, SIMPLE algorithm and its variants. Turbulence models, mixing length model, Two equation (k- ϵ) and (k- ω) models– High and low Reynolds number models.

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

TEXT BOOKS

1. Suhas V Patankar, “Numerical Heat Transfer and Fluid Flow”, Hemisphere Publishing Corporation, 2004 .
2. Versteeg H K and Malalasekara W, “An Introduction to Computational Fluid Dynamics- The Finite Volume Method”, Pearson Education, 2nd Edition, 2011.

REFERENCES

- 1 John D Anderson, “Computational Fluid Dynamics-The Basics with Applications”, McGraw -Hill Education, New York, 2012. .
- 2 Muralidhar, K., and Sundararajan, T., “Computational Fluid Flow and Heat Transfer”, Alpha Science International, 2nd Edition, 2003.
- 3 Anderson, D.A., Tannehill, J.C., and Pletcher, R.H, “Computational Fluid Mechanics and Heat Transfer”, CRC Press, 3rd Edition, 2012.
- 4 Ghoshdashtidar, P.S., “ Computer Simulation of flow and heat transfer” Tata McGrawHill Publishing Company Ltd., 1998.
- 5 Chung, T.J. "Computational Fluid Dynamics", Cambridge University, Press, 2002.

COURSE OUTCOMES

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

- CO1** Classify basic governing equations and study the mathematical behaviour of PDE on them.
- CO2** Identify different types of finite difference methods and distinguish between FDM and FVM methods.
- CO3** Formulate different types of heat conduction equations and solve them by explicit and implicit schemes.
- CO4** Develop the basic concepts of discretization schemes and apply knowledge in real time convection and diffusion problems.
- CO5** Categorize the various models of turbulence equations and rate the complexity of turbulence flow field problems.

19AUE306	AUTOMOTIVE AERODYNAMICS AND ACOUSTICS	L	T	P	J	C
		3	0	0	0	3
UNIT I	AERODYNAMIC DRAG OF CARS					9
Flow phenomenon related to vehicles, external and internal flow - Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.						
UNIT II	SHAPE OPTIMIZATION OF CARS					9
Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners. Case studies on modern vehicles.						
UNIT III	VEHICLE HANDLING					9
Forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments – vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles and racing cars.						
UNIT IV	WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS					9
principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods. CFD analysis.						
UNIT V	ACOUSTICS					9
Sound Measurement - Human Sensitivity and Weighting Factors. Combining Sound Sources - Acoustical Resonances - Properties of Acoustic Materials - Transient and Steady State Response of One Degree of Freedom System Applied to Vehicle Systems Transmissibility - Modes of Vibration.						
		L :45	T: 0	P: 0	J: 0	Total:45 PERIODS

TEXT BOOKS

3. Hucho.W.H., “Aerodynamic of Road Vehicles”, Butterworths Co., Ltd., 1997
4. T. YomiObidi, “Theory and Applications of Aerodynamics for Ground Vehicles” SAE International, 2014
5. Munjal M.L., Acoustic Ducts and Mufflers, John Wiley, 1987

REFERENCES

- 1 Pope, “Wind Tunnel Testing”, 2nd Edition, John Wiley & Sons New York, 1974.
- 2 “Automotive Aerodynamic”, Update SP-706, Society of Automotive Engineers Inc,1987
- 3 “Vehicle Aerodynamics”, SP-1145, Society of Automotive Engineers Inc, 1996.
- 4 R. H. Barnard, “Road Vehicle Aerodynamic Design: An Introduction” Mech Aero Publishing, 2009
- 5 “Vehicle Aerodynamics Design and Technology”, SAE special publication: Society of Automotive Engineers, 2001

COURSE OUTCOMES

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

- CO1** Acquire the knowledge in fundamentals of aerodynamics, vehicle body optimization, measuring aerodynamics forces etc.
- CO2** Analyse the influence of aerodynamic drag forces in car
- CO3** Demonstrate various aerodynamic shapes of car.
- CO4** Identify the various forces that controls vehicle handling
- CO5** Apply the concept of wind tunnel for aerodynamic design of automobiles

UNIT I AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS 9

Purposes of Heating, Ventilation, and Air Conditioning- Environmental Concerns- Ozone layer depletion- Location of air conditioning components in a car – Schematic layout of a vehicle refrigeration system. Psychometric – Basic terminology and Psychometric mixtures- Psychometric Chart- Related problems.

UNIT II AUTOMOTIVE COOLING AND HEATING SYSTEM 9

Vehicle Refrigeration System and related problems- Fixed thermostatic and Orifice tube system- Variable displacement thermostatic and Orifice tube system- Vehicle air conditioning operation Types of compressor- Compressor Clutches- Compressor Clutch electrical circuit- Compressor lubrication- Condensers- Evaporators- Expansion devices- Evaporator temperature and pressure controls- receiver-drier- Accumulators- refrigerant hoses, Connections and other assemblies- Heating system.

UNIT III AIR CONDITIONING CONTROLS, DELIVERY SYSTEM, AND REFRIGERANTS 9

Types of Control devices- Preventing Compressor damage- Preventing damage to other systems- Maintaining drivability- Preventing Overheating Ram air ventilation- Air Delivery Components- Control devices- Vacuum Controls Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

UNIT IV AUTOMATIC TEMPERATURE CONTROL 9

Different types of sensors and actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system- Climatronic Air-conditioning system.

UNIT V AIR CONDITIONING SERVICE AND CONTROL 9

Air Conditioner Maintenance & Service - Servicing Heater System - Removing & Replacing Components - Trouble Shooting of Air Conditioning System -Compressor Service, Methods of Dehydration, Charging & Testing. Air Conditioning Control - Common Control Such as Thermostats- Humidistat Us - Control Dampers - Pressure Cutouts and Relays- Gas refilling.

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

TEXT BOOKS

1. Russel Carrigan, John Eichelberger, "Automotive Technology Heating and Air Conditioning", Cengage Learning, Stamford, 2011.
2. Steven Daly "Automotive Air Conditioning and climate control systems", Butterworth Heinemann, Burlington, 2011

REFERENCES

- 1 Boyce H Dwiggins, "Automotive Air conditioning," Cengage Learning, Stamford, 2002.
- 2 Arora C.P, "Refrigeration & Air conditioning" Tata McGraw Hill, New Delhi 2000.
- 3 William H Crouse and Donald L Anglin, Automotive Air conditioning, McGraw Hill Inc., 1990.
- 4 Mitchell Information Services, Inc., Mitchell Automatic Heating, and Air Conditioning Systems, Prentice Hall Inc., 1989.
- 5 Mark Schnubel, "Automotive Engineering Heating & Air Conditioning," Cengage Learning, Stamford, 2010.

COURSE OUTCOMES

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

- CO1** Identify and describe the basic principles of air conditioning system.
- CO2** Apply the concept of heating systems in air conditioner.
- CO3** Identify the types of refrigerants, its applications and properties.
- CO4** Describe the working principles of the components of the air conditioning system.
- CO5** Identify and describe the current developments relating to the automotive air conditioning.

UNIT I EARTH MOVING VEHICLES**9**

Dumper, Front-End Loaders, Bulldozers, Backhoe loaders, Scrappers, Bucket Wheel Excavator, Trencher Machine, Skid Steer Loader, Dump Truck.

UNIT II CONSTRUCTIONAL VEHICLES**9**

Excavators, Jip Cranes, Hoist, Motor graders, Mixing machine, Concrete ready mixers, Driller Rig, Pile Driver, Vibratory Compactor.

UNIT III AGRICULTURAL VEHICLES**9**

Tractors, Working attachment of tractors, Trailers and body tipping mechanism, Paddy Plantation Machine, Paddy Harvesting Machine, Sugarcane Harvester, Power Tillers.

UNIT IV CRANES AND SPECIAL UTILITY VEHICLE**9**

Industrial Jib cranes, Mobile Crane, Forklifts and its alternative front end attachment, Scissors lift trucks, Towing vehicles and its types, Fire Service Truck, Ambulance and its features, Oil Tankers.

UNIT V MILITARY AND MOTOR SPORTS VEHICLES**9**

Military Vehicle - Battle Tank, Gun Carriers and Transport Vehicles, Bridge Builder, Communication Vehicle. Motorsport Vehicle – Formula one car, Go-kart, Off road racing vehicle

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

1. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.
2. Steve Parker, Military Machines, Mason Crest Publishers, 2010.

REFERENCES

- 1 Ia. S. Ageikin “Off the road wheeled and combined traction devices”, Ashgate Publishing Co. Ltd. 1998.
- 2 Liljedahl, John.B., Paul K. Turnquist, David W. Smith and MokotoHoki. “Tractor and their power units” fourth edition, CSB Publishers and Distributors, New Delhi, 2002
- 3 Ashok G. Powar& Vijay V. Aware, “Farm Machinery and Power”, New india publishing agency, New Delhi, 2007.
- 4 George W. Green, “Special Use Vehicles”, Mcfarland& Company Press, 2003.
- 5 William H. Crouse, “Automotive mechanics” – 10th Edition, Tata McGraw Hill Publications Co. New Delhi, 2006

COURSE OUTCOMES

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

- CO1** Understand the knowledge of earth moving equipment and construction layouts.
- CO2** Acquire the knowledge of hoist, conveyors, elevators and cranes applications.
- CO3** Describe the basic concepts of agricultural vehicles.
- CO4** Apply the knowledge of the concepts of jib cranes in automobile industries.
- CO5** Acquire knowledge on military vehicles and motorsports vehicles.

19AUE309	RUBBER TECHNOLOGY FOR AUTOMOBILES	L	T	P	J	C
		3	0	0	0	3
UNIT I	INTRODUCTION					9
Identification of plastics / rubber components in automobiles - function - selection criteria.						
UNIT II	STRUCTURE-PROPERTY RELATIONSHIP OF RUBBER					9
Resilience, creep, hysteresis and damping, stability, set and stress relaxation, behavior in dynamic applications						
UNIT III	VIBRATION AND RUBBER SPRING					9
Principle of vibration isolation - Rubber mounts - spring design - comparison with metallic springs - shape factor and its effect - forced and free vibrations with damping - typical mounts, compounding and manufacture.						
UNIT IV	FLUID SEALINGS AND FLEXIBLE COUPLING AND HOSES					9
Seals for static and dynamic applications - effect of heat/ oil ageing - frictional behaviour - fundamental of sealability.						
UNIT V	COMPOUNDING AND MANUFACTURE					9
Types of couplings - specification and selection- torque Vs deflection relationships - brake fluid /hydraulic hoses, materials, manufacture and shaping process for rubber products						
		L :45	T: 0	P: 0	J: 0	Total:45 PERIODS

TEXT BOOKS

1. M. Morton, "Rubber Technology", Springer Science & Business Media, 2013
2. Andrew Ciesielski, "An Introduction to Rubber Technology" iSmithers Rapra Publishing, 1999

REFERENCES

1. Hobel, E.F., Rubber Springs Design, Newnes-Butterworth 1974
2. C. Hepburn, "Rubber Technology and Manufacture", Butterworth-Heinemann, 2009
3. Kothandaraman, "Rubber Materials", Ane Books Pvt Ltd, 2008
4. James Lindsay White, "Rubber Processing: Technology, Materials, Principles" Hanser Publishers, 1995
5. Anil K. Bhowmick, "Rubber Products Manufacturing Technology" CRC Press, 1994

COURSE OUTCOMES

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

- CO1** Identify and select the suitable polymer components for the automobile application
- CO2** Differentiate the structure and property relationship of rubber
- CO3** Impart the knowledge about vibration isolation, spring design and typical mounts
- CO4** Attain the knowledge about fundamental of seal ability
- CO5** Demonstrate the rubber manufacturing methods

19AUE310	SUPERCHARGING AND SCAVENGING	L	T	P	J	C
		3	0	0	0	3
UNIT I	SUPERCHARGING					9
Supercharging Basic concept-Supercharging principle-Effects on Engine performance-Engine modification required-Types of compressor-Surging in compressor-Performance characteristic curves.						
UNIT II	TURBOCHARGING					9
Turbocharging Basic concept-Turbocharging principle- Comparison between turbocharging and supercharging-Effects on Engine performance- Turbocharging methods-Variable Geometry Turbocharging – Multistage turbocharging - Engine exhaust manifolds arrangements-waste gate-Turbocharger lag-Engine modification required for turbocharging						
UNIT III	SCAVENGING OF TWO STROKE ENGINES					9
Features of two stroke cycle engines – Classification of scavenging systems – Charging Processes in two stroke cycle engine – Terminologies – Sankey diagram – Relation between scavenging terms – scavenging modelling – Perfect displacement, Perfect mixing. Mixture control through Reed valve induction-Types of backflow.						
UNIT IV	PORTS DESIGN					9
Porting – Port Essence of port design-Design considerations – Design of Intake and Exhaust Systems – Tuning- Kadenacy system.						
UNIT V	EXPERIMENTAL METHODS AND RECENT TRENDS IN TWO STROKE ENGINES					9
Experimental techniques for evaluating scavenging – Firing engine tests – Non firing engine tests – Development in two stroke engines for improving scavenging-Direct injection two stroke concepts.						
		L :45	T: 0	P: 0	J: 0	Total:45 PERIODS

TEXT BOOKS

1. R K Rajput, Internal Combustion Engines, Lakshmi Publications (P) Ltd,2016
2. Heinz Heisler, Advanced Engine Technology, Butterworth Heinmann Publishers, 2002

REFERENCES

- 1 Blair G P, Two stroke Cycle Engines Design and Simulation, SAE Publications, 1997
- 2 Heinz Heisler, Advanced Engine Technology, Butterworth Heinmann Publishers, 2002
- 3 John B. Heywood, Two Stroke Cycle Engine, SAE Publications, 1999.
- 4 Schweitzer, P.H., Scavenging of Two Stroke Cycle Diesel Engine, MacMillan Co., 1949.
- 5 Watson, N. and Janota, M.S., Turbocharging the I.C. Engine, MacMillan Co., 1982

COURSE OUTCOMES

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

- CO1** Recognise and understand reasons for differences among operating characteristics of superchargers
- CO2** Differentiate among different types of turbocharging methods and design turbochargers
- CO3** Exposure to the different terminologies and scavenging systems
- CO4** Design a two stroke cycle engine
- CO5** Develop skills to run engine dynamometer experiments and understand methods of eliminating short circuiting

19AUE311	COMPOSITE MATERIALS FOR AUTOMOBILE	L	T	P	J	C
		3	0	0	0	3

UNIT I INTRODUCTION TO COMPOSITES 9

Introduction to composite - fundamentals of composites - Need for composites - classification of composites - advantages of composites - disadvantages of composites - properties of composites - particulate composite - fibre reinforced composite - elastic behaviour under longitudinal loading - elastic behaviour under transverse loading - longitudinal tensile strength - transverse tensile strength - discontinuous fibre reinforced composites - application of composites

UNIT II POLYMER MATRIX COMPOSITES 9

Polymer Matrix composites - reinforcement materials – fibres - glass fibre - carbon fibre - processing - aramid fibre and boron fibre - processing - properties and application - particle reinforcement - Nano reinforcement - polymer Matrix material - thermosetting resins - thermoplastic resins – fillers – additives - preprocessed material - molding compound – prepregs - PMC processes - hand layup process – Spray processes - compression moulding - injection moulding - autoclave molding - resin transfer molding - pultrusion, filament winding - properties of PMCs - automotive application of PMCs

UNIT III METAL MATRIX COMPOSITES 9

Metallic Matrix - selection of reinforcement - processing of MMC - liquid state processes - Stir casting, Squeeze casting, slurry casting, melt infiltration – spray deposition - solid state processes - powder metallurgy technique - hot pressing - diffusion bonding - gaseous state processes - deposition technique - machining and joining of MMCs - properties of MMCs - parameters affecting properties of MMCs - interfacial problems - automotive applications of MMCs.

UNIT IV CERAMIC MATRIX COMPOSITES 9

Ceramic Matrix material - failure behaviour of CMCs - toughening of CMCs - processing of CMCs - ceramic particle based process processes - cold compaction - slurry impregnation –Sol-Gel processing - reaction bonding processes - in-situ ceramic composite processing – melt processing - polymer infiltration and pyrolysis - properties of CMCs - automotive applications of CMCs.

UNIT V ADVANCES IN COMPOSITES 9

Carbon/carbon composites - carbon fibre reinforcements - Matrix systems – Thermosetting - thermoplastic and gaseous precursor - processing of Carbon/carbon composites - thermosetting resin based processing - thermoplastic pitch based processing - chemical vapour infiltration - properties of Carbon/carbon composites - oxidation protection of Carbon/carbon composites - application of Carbon/carbon composites – Nanocomposites – Polymer nanocomposites - metal nanocomposites - ceramic nanocomposites - Nanocomposites - properties and its applications

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

TEXT BOOKS

1. Krishnan K Chawla, Composite Materials: Science and Engineering, International Edition, Springer, 2012.
2. M. Balasubramanian, “Composite Materials and Processing”, CRC press, Taylor and Francis Group, 2014

REFERENCES

- 1 Henderson, G. R. (2007), Six Sigma Quality Improvement with MINITAB, Wiley
- 2 ASM Handbook – Composites, Vol-21, 2001
- 3 Mel M. Schwartz, Composite Materials: Properties, Non-destructive testing and Repair, Prentice Hall, New Jersey
- 4 L.J. Broutman and R.M. Krock, Modern Composite Materials, Addison-Wesley, 1967.
- 5 David A Colling & Thomas Vasilos, Industrial Materials: Polymers, Ceramics and Composites, vol. 2, Prentice Hall, N. Jersey, 1995

COURSE OUTCOMES

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

- CO1** Understand the basics of reinforcements and matrix material
- CO2** Use of mathematical techniques to predict the macroscopic properties of different laminates
- CO3** Choose suitable material to design composites
- CO4** Select suitable manufacturing process for different types of composites
- CO5** Compare/evaluate the relative merits of using various conventional and composite materials for important engineering and other applications.

UNIT I INTRODUCTION**9**

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tested.

UNIT II TRANSPORT SYSTEMS AND TAXATION**9**

Introduction to various transport systems - Advantages of motor transport - Principal function of administrative, traffic, secretarial and engineering divisions - Chain of responsibility, forms of ownership by state, municipality, public body and private undertakings – taxation objectives – structures of laving tax – methods – one-time tax – tax exemption - tax renewal

UNIT III SCHEDULING AND FARE STRUCTURE**9**

Principal features of operating costs for transport vehicles with examples of estimating the costs - Fare structure and method of drawing up of a fare table - Various types of fare collecting methods. Basic factors of bus scheduling - Problems on bus scheduling

UNIT IV MOTOR VEHICLE ACT**9**

Traffic signs, fitness certificate, registration requirements, permit – state, interstate–, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles.

UNIT V MAINTENANCE AND INSURANCE**9**

Preventive maintenance system in transport industry, tyre maintenance procedures - Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout. Accident – causes and analysis – preventive measures, insurance – types, comprehensive insurance – third party insurance.

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

1. John Dolce, "Fleet Management", McGraw-Hill Co, USA -1984 Digitized in 2007
2. Kitchin.L.D., "Bus Operation", Illiff and Sons Co., London, III edition – 1992

REFERENCES

- 1 Teodar Gabriel Crainic, Gilbert Laprte, "Fleet Management and Logistics" Springer Science and Business Media, 2012.
- 2 Government Motor Vehicle Act –Publication on latest act to be used as on date.
- 3 Motor Vehicles Act, 1988 along with Comparative Tables of Old and New Acts - (Bare Act)– Eastern Book Company, Lucknow – 26th Edition, 2017.
- 4 The Motor Vehicle Act 1988–Universal Law Publishing Co. Pvt. Ltd, India – 2011.
- 5 Edmund J. Gubbins, "Managing Transport Operations" Kogan Page Publishers, 2003.

COURSE OUTCOMES

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

- CO1** Impart knowledge on transport and personnel management
- CO2** Identify the various procedure in motor transport administration
- CO3** Manage a transport fleet and their related activities for minimizing operational cost.
- CO4** Understand the meaning of traffic signs and various motor vehicle acts
- CO5** Realize the importance of various maintenance system in transport industry

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

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 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

19AUE401	TRACTOR AND FARM EQUIPMENTS	L	T	P	J	C
		3	0	0	0	3
UNIT I	GENERAL DESIGN OF TRACTORS					8
Classification of Tractors-Main components of Tractor-Safety Rules.						
UNIT II	CONTROL OF THE TRACTOR AND FUNDAMENTALS OF ENGINE OPERATION					9
Tractor controls and the starting of the tractor engines-Basic notions and definition-Engine Cycles-Operation of multi cylinder engines-General engine design - Basic engine performance characteristics.						
UNIT III	ENGINE FRAME WORK AND VALVE MECHANISM OF TRACTOR					9
Cylinder and pistons-Connecting rods and crankshafts Engine balancing – Construction and operation of the valve mechanism-Valve mechanism components – Valve mechanism troubles.						
UNIT IV	COOLING SYSTEM AND LUBRICATING SYSTEM OF TRACTOR					9
Cooling Systems, Lubrication System and Fuel System of a Tractor: Cooling system – Classification – Liquid cooling system – Components, Lubricating system servicing and troubles – Air cleaner and turbocharger – Fuel tanks and filters –Fuel pumps.						
UNIT V	FARM TRACTOR TRANSMISSION SYSTEM & FARM EQUIPMENTS					10
Farm Tractor Transmission System: layout, Load Distribution, transmission and drive line, steering, braking system. Farm Equipment: Working attachment of tractors – Farm equipment – Classification – Auxiliary equipment – Trailers and body dipping Mechanism.						
		L: 45	T: 0	P: 0	J: 0	TOTAL: 45 PERIODS

TEXT BOOKS

1. Liljedahl, John.B., Paul K. Turnquist, David W.Smith and MokotoHoki. Tractor and their power units” fourth edition, CSB Publishers and Distributors, New Delhi, 2012
2. Nakra C P, Tractor and Automobiles, DhanpatRai Publishing Company (P) Ltd-New Delhi, 2016.

REFERENCES

1. K. Srinivasan, Tractors and Agricultural Machinery, New India Publishing Agency, Delhi, 2011.
2. Ashok G. Powar& Vijay V. Aware, Farm Machinery and Power, New India publishing agency, New Delhi, 2015.
3. Jain S.C and Grace Philip, ‘Farm Machinery – an approach”, Standard Publishers Distributors, Delhi, 2011.
4. Amitosh De, Latest Development of Heavy Earth Moving Machinery, Annapurna Publishers, Dhanbad, 2015.
5. Sharma D.N. & Mukesh., Design of agriculture tractors, Jain Brothers Pvt. Ltd., New Delhi, 2012.

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Understand basic design and safety factors of a Tractor.

CO2: Explain the controls and fundamentals of engine operation in a Tractor.

CO3: Demonstrate the engine frame work and valve mechanism of tractor.

CO4: Interpret the cooling system and lubrication system in a tractor.

CO5: Infer the knowledge of transmission system, tractor tailor mechanism and farm equipment’s in a tractor.

19AUE402	INTELLIGENT VEHICLE TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3

UNIT I INTRODUCTION

9

Understanding autonomy –review of the role of control in autonomy - Role of sensors and actuators. Examples of autonomy cruise control and ABS – Case study on Autonomous Vehicle.

UNITII ENGINE CONTROL SYSTEM

9

Fuel control-Ignition control in SI engines- Lambda control- idle speed control- Knock control- cylinder balancing.

UNIT III DRIVE LINE CONTROL SYSTEM

9

Speed control – gear shifting control – traction control- steering- suspension – vehicle handling and ride characteristics of road vehicles- adaptive cruise control.

UNIT IV INTELLIGENT TRANSPORTATION SYSTEM

9

Overview – control architecture – collision avoidance control – traffic routing system- automated high way systems- lane warning system- driver information system- data communication within the car.

UNIT V SAFETY IMPACTING DEVICES

9

Vision enhancement- driver conditioning warning- anti-lock braking systems – route guidance and navigation systems – in-vehicle computing – commercial vehicle diagnostic/ prognostics – hybrid/ electric and future cars- case study.

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

TEXT BOOKS

1. U.Kienckeand L. Nielson “Automotive control systems” , SAE and springer - Verlag, 2000
2. Benjamin C.Kuo and FaridGolnaraghi, Automatic Control System, John Wiley & Sons, Eight edition, 2003.

REFERENCES

1. Crouse, W.H. &Anglin,D.L., “Automotive Mechanics”, Tata McGraw Hill, New Delhi. 2010.
2. Artamonov, M.D., Harionov,V.A.& Morin, M.m. “Motor Vehicle”,MirPublishers,Moscow 1978.
3. Richard C.Dorf and Robert H.Bishop, Modern Control Systems, Pearson Prentice Hall,2008
4. Stockel Martin W and Stocker Martin T., Auto Mechanics Fundamentals, Goodheartwilcox, South Holland, Illinois,1982.
5. Robert Bosch,“Automotive Handbook”, Sixth Edition,2004

COURSE OUTCOMES

At the end of the course students should be able to

CO 1: Understand the technologies involved in autonomous vehicles

CO 2: Demonstrate the Various Engine Control System.

CO 3: Examine the drive line control system in automobiles.

CO 4: Criticize the intelligent transportation system.

CO 5: Value the safety impact devices and its advancements.

19AUE403	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3

UNIT I INTRODUCTION TO ELECTRIC VEHICLES 9

Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life. Ultra-capacitor, Charging – Methods and Standards. Alternate charging sources – Wireless & Solar.

UNIT II ELECTRIC VEHICLE MOTORS 9

Motors (DC, Induction, BLDC) – Types, Principle, Construction, Control. Electric Drive Trains (EDT) – Series HEDT (Electrical Coupling) – Power Rating Design, Peak Power Source (PPS); Parallel HEDT (Mechanical Coupling) – Torque Coupling and Speed Coupling. Switched Reluctance Motors (SRM) Drives – Basic structure, Drive Convertor, Design

UNIT III ELECTRONICS AND SENSOR-LESS CONTROL IN EV 9

Basic Electronics Devices – Diodes, Thyristors, BJTs, MOSFETs, IGBTs, Convertors, Inverters. Safety – Risks and Guidance, Precautions, High Voltage safety, Hazard management. Sensors - Autonomous EV cars, Self Drive Cars, Hacking; Sensor less – Control methods- Phase Flux - Linkage-Based Method, Phase Inductance- Based, Modulated Signal Injection, Mutually Induced Voltage-Based, Observer-Based.

UNIT IV MOBILITY AND CONNECTORS 9

Connected Mobility and Autonomous Mobility- case study Emobility Indian Roadmap Perspective. Policy: EVs in infrastructure system, integration of EVs in smart grid, social dimensions of EVs. Connectors- Types of EV charging connector, North American EV Plug Standards, DC Fast Charge EV Plug Standards in North America, CCS (Combined Charging System), CHAdeMO, Tesla, European EV Plug Standards

UNIT V ENERGY MANAGEMENT SYSTEM 9

Green Energy- Energy Management Strategies, Automotive networking and communication, EV charging standards, V2G, G2V, V2B, V2H. Business: E-mobility business, electrification challenges, Business- E-mobility business, electrification challenges.

TEXT BOOKS

1. Electric and Hybrid Vehicles, Tom Denton, Taylor & Francis, 2018.
2. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, MehrdadEhsaniYiminGao Stefano Longo Kambiz M. Ebrahimi, Taylor & Francis Group, LLC, 2018

REFERENCES

1. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017
2. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
3. Emadi, A. (Ed.), Miller, J., Ehsani, M., “Vehicular Electric Power Systems” Boca Raton, CRC Press, 2003

4. Tariq Muneer and Irene IllescasGarcía, “The automobile, In Electric Vehicles: Prospects and Challenges”, Elsevier, 2017
5. Larminie, James, and John Lowry, “Electric Vehicle Technology Explained” John Wiley and Sons, 2012

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

COURSE OUTCOMES

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

CO1: Describe about working principle of electric vehicles

CO2: Explain the construction and working principle of various motors used in electric vehicles.

CO3: Understand about working principle of electronics and sensor less control in electric vehicles

CO4: Design battery charger for an Electric Vehicles

CO5: Analyze energy mangement systems in Electric Vehicles

19AUE405	INDUSTRIAL SAFETY FOR AUTOMOBILE	L	T	P	J	C
		3	0	0	0	3
UNIT I	SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES				9	
General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards.						
UNIT II	PRINCIPLES OF MACHINE GUARDING				9	
Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening.						
Selection and suitability: lathe – drilling – boring – milling – grinding – shaping –sawing shearing presses - forgehammer – flywheels – shafts – couplings – gears - sprockets wheels and chains - pulleys and belts - authorized entry to hazardous installations - benefits of good guarding systems.						
UNIT III	SAFETY IN WELDING AND GAS CUTTING				9	
Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders.						
UNIT IV	SAFETY IN COLD FORMING AND HOT WORKING OF METALS				9	
Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes.Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.						
UNIT V	SAFETY IN FINISHING, INSPECTION AND TESTING				9	
Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation.						
L: 45 T: 0 P: 0 J:0 TOTAL: 45 PERIODS						

Textbooks

1. “Accident Prevention Manual” – NSC, Chicago, 1982.
2. “Occupational safety Manual” BHEL, Trichy, 1988.

References

1. “Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989.
2. “Safety in Industry” N.V. Krishnan JaicoPublishery House, 1996.
3. Indian Boiler acts and Regulations, Government of India
4. Safety in the use of wood working machines, HMSO, UK 1992
5. Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.

COURSEOUTCOMES

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

CO1: handle metal working machinery and wood working machines

CO2: understand the principle of machine guarding

CO3: operate the welding and gas cutting equipments with safety precautions.

CO4: deal with forming equipments with safe environment

CO5: understand the heat treatment process, testing and inspection of components

19AUO301	BASICS OF ELECTRIC VEHICLE TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3

UNIT I INTRODUCTION TO ELECTRIC VEHICLES 9

Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life. Ultra-capacitor- Super capacitor.

UNIT II ELECTRIC VEHICLE MOTORS 9

Motors– Types, Principle, Construction, Control. Electric Drive Trains– Series HEDT– Power Rating Design, Peak Power Source (PPS); Parallel HEDT (Mechanical Coupling) – Torque Coupling and Speed Coupling.

UNIT III ELECTRONICS AND SENSOR-LESS CONTROL IN EV 9

Basic Electronics Devices – Diodes, Thyristors, BJTs, MOSFETs, IGBTs, Convertors, Inverters. Safety – Risks and Guidance, Precautions, High Voltage safety, Hazard management. Sensors - Autonomous EV cars, Self Drive Cars, Hacking; Sensor less – Control methods.

UNIT IV HYBRID VEHICLES 9

Hybrid Electric vehicles – Classification – Micro, Mild, Full, Plug-in, EV. Layout and Architecture – Series, Parallel and Series-Parallel Hybrid, Propulsion systems and components. Regenerative Braking.

UNIT V FUEL CELLS FOR ELECTRIC VEHICLES 9

Fuel cells for automotive applications, components of fuel cell - Membrane Electrode Assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates, materials for fuel cell-carbon fibre, Fuel cell based vehicle, technological advancements in fuel cell vehicle systems

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

TEXT BOOKS

1. Hybrid, Electric & Fuel-Cell Vehicles Jack Erjavec, Delmar, Cengage Learning.
2. Electric and Hybrid Vehicles, Tom Denton, Taylor & Francis, 2018.

REFERENCES

- 1 Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
- 2 Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017
- 3 Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
- 4 Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, MehrdadEhsaniYiminGao Stefano Longo Kambiz M. Ebrahimi, Taylor & Francis Group, LLC, 2018.

COURSE OUTCOMES

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

- CO1** Describe about working principle of electric vehicles
- CO2** Explain the construction and working principle of various motors used in electric vehicles.
- CO3** Understand about working principle of electronics and sensor less control in electric vehicles.
- CO4** Describe the different types and working principle of hybrid vehicles.
- CO5** Illustrate the various types and working principle of fuel cells

UNIT I DRIVER ASSISTANCE SYSTEMS**9**

Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, collision avoidance, vehicle status monitoring.

UNIT II TELEMATICS**9**

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems, Lane warning System.

UNIT III SAFETY AND SECURITY SYSTEMS**9**

Airbags, seat belt tightening system, collision warning systems, child lock, anti lock braking systems. Center Lock, smart card system, number plate coding

UNIT IV COMFORT SYSTEMS**8**

Active suspension systems, Hill Assist System, power steering, Collapsible and tiltable steering column, power windows & electronically adjustable mirrors.

UNIT V ADAPTIVE CONTROL SYSTEMS**10**

Cruise Control, Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems, cylinder cut-off technology.

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

1. Ljubo Vlacic, Michel Parent and Fumio Harashima, “Intelligent Vehicle Technologies”, Butterworth-Heinemann publications, Oxford, 2001.
2. Ronald K Jurgen, “Navigation and Intelligent Transportation Systems – Progress in Technology”, Automotive Electronics Series, SAE, USA, 1998

REFERENCES

1. Heinz Heisler, “Advanced Vehicle Technology”, second edition, Butterworth – Heinemann, New York, 2002
2. William B Riddens, “Understanding Automotive Electronics”, 5th edition, Butter worth Heinemann Woburn, 1998
3. Richard C.Dorf and Robert H.Bishop, Modern Control Systems, Pearson Prentice Hall, 2008
4. Bechhold, “Understanding Automotive Electronics”, SAE, 1998.
5. Robert Bosch, “Automotive Handbook”, Sixth Edition, 2004

COURSE OUTCOMES

At the end of the course students should be able to

CO 1: Understand the systems which helps the drivers while running

CO 2: Understand the information provided by various systems.

CO 3: Understand the working of safety and security systems

CO 4: Understand the road handling comfort of modern vehicles.

CO 5: Understand the various adaptive systems equipped in Automobile.

19AUO303	ROAD SAFETY AND TRAFFIC RULES	L	T	P	J	C
		3	0	0	0	3

UNIT I ROAD ACCIDENTS 9

Causes, scientific investigations and data collection, Analysis of individual accidents to arrive at real causes, statistical methods of analysis of accident data, Basic concepts of Road accident statistics, Safety performance function: The empirical Bayes method Identification of Hazards road location. Application of computer analysis of accident data.

UNIT II SAFETY IN ROAD DESIGN 9

Operating the road network for safety, highway operation and counter measures, road safety audit, principles-procedures and practice, code of good practice and checklists, vehicle design factors & Driver characteristics influencing road safety.

UNIT III ROAD SIGNS AND TRAFFIC SIGNALS 9

Classification, Location of Signs, measures of sign effectiveness, Types of visual perception, sign regulations, sign visibility, sign variables, Text versus symbols. Road Marking: Role of Road markings, Classification, visibility. Traffic Signals: Need, Signal face. Illumination and location of Signals, Factors affecting signal design, pedestrians' safety, fixed and vehicle actuated signals. Design of signals, Area Traffic control. Delineators, Traffic Impact Attenuators, Road side rest areas, Safety Barriers, Traffic Aid Posts

UNIT IV TRAFFIC MANAGEMENT TECHNIQUES 9

Integrated safety improvement and Traffic Calming Schemes, Speed and load limit, Traffic lights, Safety cameras, Tests on driver and vehicles, pedestrian safety issues, Parking, Parking enforcement and its influence on Accidents. Travel Demand Management; Methods of Traffic management measures: Restriction of Turning Movements, One-way streets, Tidal Flow Operation Methods, Exclusive Bus Lanes and Closing Side-streets; Latest tools and techniques used for Road safety and traffic management. Road safety issues and various measures for road safety; Legislation, Enforcement, Education and Propaganda, Air quality, Noise and Energy Impacts; Cost of Road Accidents.

UNIT V INCIDENT MANAGEMENT 9

Introduction, Characteristics of Traffic Incidents, Types of Incidents, Impacts, Incident management process, Incident traffic management; Applications of ITS: Motorist information, Equipment used; Planning effective Incident management program, Best practice in Incident management programs. National importance of survival of Transportation systems during and after all natural disasters especially cyclones, earthquakes, floods etc. and manmade disasters like sabotage, terrorism etc.

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

TEXT BOOKS

1. Guidelines on Design and Installation of Road Traffic Signals, IRC: 93.
2. Specification for Road Traffic Signals IS: 7537-1974.

REFERENCES

- 1 Principles and Practice of Highway Engineering by L.R. Kadiyali and N.B. Lal.
- 2 Hand Book of T.E. Myer Kutz, Editor McGraw Hill, 2004.

COURSE OUTCOMES

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

- CO1** Attain the knowledge of accidents data collection and computer analysis.
- CO2** Demonstrate about various road design for safety
- CO3** Understand the traffic signs and traffic regulation
- CO4** Identify the different traffic management techniques
- CO5** Summarize traffic incident types incident management programs

UNIT I INTRODUCTION TO LEAN MANUFACTURING**6**

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT II CELLULAR MANUFACTURING, JIT, TPM**6**

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM

UNIT III SET UP TIME REDUCTION, TQM, 5S, VSM**6**

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

UNIT IV SIX SIGMA**6**

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation

UNIT V CASE STUDIES**6**

Various case studies of implementation of lean manufacturing at industries.

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

1. Womack J. P., Jones D.T. and Roos D. – ‘The Machine that Changed the World: the Story of Lean Production’ – Simon & Schuster, New York – 1996
2. Liker J. K. – ‘Becoming Lean’ – Industrial Engineering and Management Press – 1998

REFERENCES

1. Toyota Production System -An integrated approach to Just in Time – Yasuhiro Monden, – Engineering and Management Press -Institute of Industrial Engineers – 1983
2. James P Womack, Daniel T Jones, and Daniel Roos, The Machine that changed the World. The Story of Lean Production -Harper Perennial edition published 1991
3. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003
4. Mikell P. Groover (2002) _Automation, Production Systems and CIM.
5. Rother M. and Shook J, 1999 _Learning to See: Value Stream Mapping to Add Value and Eliminate Muda‘ , Lean Enterprise Institute, Brookline, MA.

COURSE OUTCOMES

At the end of the course students should be able to

CO1: To understand issues & challenges in implementing & developing lean manufacturing techniques from TPS & its contribution for improving organizational performance

CO2: Apply lean techniques to bring competitive business culture for improving organization performance

CO3: Analyze how lean techniques can be applied to manufacturing & service industry

CO4:Developing lean management strategy for Supply chain management

CO5: Analyzing how lean technique can create value generation for organization.

UNIT I INTRODUCTION**6**

Availability, Suitability, Properties, Merits and Demerits of Potential Alternative Fuels – Alcohols, Bio-Diesel, Hydrogen, Liquefied Petroleum Gas, Natural Gas, Biogas, Fuel standards – ASTM & EN.

UNIT II ALCOHOL FUELS**6**

Alcohols – Properties, Production methods and usage in engines. Blending, dual fuel operation, surface ignition, spark ignition and oxygenated additives. Performance, combustion and emission Characteristics in engines. Issues & limitation in alcohols.

UNIT III BIO-DIESEL FUELS**6**

Vegetable oils and their important properties. Fuel properties characterization. Methods of using vegetable oils – Blending, preheating, Transesterification and emulsification – Performance, combustion and emission Characteristics in diesel engines. Third generation biofuels, Ternary and Quaternary fuels, Issues & limitation of using vegetable oils in IC engines

UNIT IV GASEOUS FUELS**6**

Biogas, Natural gas, LPG, Hydrogen – Properties, problems, storage and safety aspects. Methods of utilisation in engines. Performance, combustion and emission Characteristics in engines. Issues & limitation in Gaseous fuels

UNIT V SPECIAL AND SYNTHETIC FUELS**6**

Different synthetic fuels, Merits and demerits, Dual, Bi-fuel and Pilot injected fuel systems, Fuel additives – types and their effect on performance and emission characteristics of engines, Flexifuel systems, Ethers - as fuel and fuel additives, properties and characteristics.

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

1. S S Thipse , Alternative fuels , Jaico publishers,2010
2. Richard L. Bechtold, Automotive Fuels Guide Book, SAE Publications, 1997

REFERENCES

1. Keith Owen and Trevor Eoley, Automotive Fuels Handbook, SAE Publications,1990.
2. Pundir B.P , I.C. Engines Combustion and Emission, 2010, Narosa Publishing House.
3. Pundir B.P , Engine Combustion and Emission, 2011, Narosa Publishing House Keith
4. Richard L. Bechtold, Automotive Fuels Guide Book, SAE Publications, 1997

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Understand potential alternate fuels and their characteristics

CO2 Utilise alcohol fuels effectively for lower emissions

CO3: Elaborate on the utilisation of Bio-Diesel and its types as a suitable fuel in CI engines

CO4:Utilise different gaseous fuels and predict their performance and combustion characteristics

CO5: Use appropriate synthetic fuels and fuel additives for better combustion characteristics

Introduction to Types of Vehicles-E-Vehicle – Nomenclature - Systems in an EV -Electricity Sources & Lithium Ion Battery - Ground, Airborne and Waterborne EV's Design - Energy & Motors - Charging Stations & Methods of Charging - Internal Development Technologies
Environmental Safety and Vehicle Safety - Energy Efficiency -Improvements in Battery Managements
-Infrastructure Management

Total:15 PERIODS

COURSE OUTCOMES

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

- CO1** Apply the principles on electric vehicle.
- CO2** Describe the applications different types of energy storage system.
- CO3** Apply and characterize the battery management system

19AUOC2 HEATING VENTILATION AND AIR CONDITIONING

Functions of HVAC -Unit's Conversion - Refrigerant Cycle - Psychometric– Design of ventilation system in a car – Design of Air Distribution System- Duct Design -Heating Load & cooling load Calculations - Equipment Erection and Commissioning, Software application - Duct Design,Heat Load Estimation, Air-Terminal Unit Design

Total:15 PERIODS

COURSE OUTCOMES

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

- CO1** Apply the principles on refrigeration and air conditioning.
- CO2** Describe the applications different types of components in the system.
- CO3** Describe and estimate the cooling load requirement.

19AUOC3 GEOMETRICAL DIMENSIONING AND TOLERANCE

Introduction - Features and Rules of GD&T - Datums Control - Adding GD&T to a Drawing / Design - Form Tolerances - Orientation Tolerances: Parallelism, Perpendicularity, Angularity - Profile Tolerances - Location Tolerances - True Position –Basics, Position – In-Depth - Run out Tolerances

Total:15 PERIODS

COURSE OUTCOMES

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

- CO1** Understand fundamentals of GD&T
- CO2** Analyze Tolerance charts for manufacturing products
- CO3** Incorporate the concepts of GD&T for industrial applications