B.E. (AUTOMOBILE ENGINEERING)

2011 Regulations, Curriculum & Syllabi

BANNARI AMMAN INSTITUTE OF TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai
Approved by AICTE - Accredited by NBA New Delhi, NAAC with 'A' Grade and ISO 9001:2008 Certified)
SATHYAMANGALAM – 638 401 Erode District Tamil Nadu
Phone: 04295 226000 Fax: 04295 226666
Web: www.bitsathy.ac.in E-mail:bitsathy@bannari.com

CONTENTS **Page Nos.**

Program Educational Objectives (PEOs)

I. Preparation

To provide insight to students on principles and mechanisms and make students aware of the multi-disciplinary and integrated of various automobile and mechanical systems (Engines & machinery), aspects of engineering and life sciences, necessary for applications of automobile engineering

II. Core Competence

To provide students with fundamental knowledge and skills in designing, production, manufacturing and thermal engineering to enable and empower them to solve problems in modern industries

III. Breadth

To inculcate scientific temper in students for designing and developing automobile and mechanical engineering solutions to the society

IV. Professionalism

To familiarize students with professional issues like ethics, Intellectual Property Rights (IPR) and to aquitaine them with managerial skills, entrepreneurial skills and also to foster essential job related skills such as improved oral and written communication, group discussion and to develop working spirit in a team

V. Learning Environment

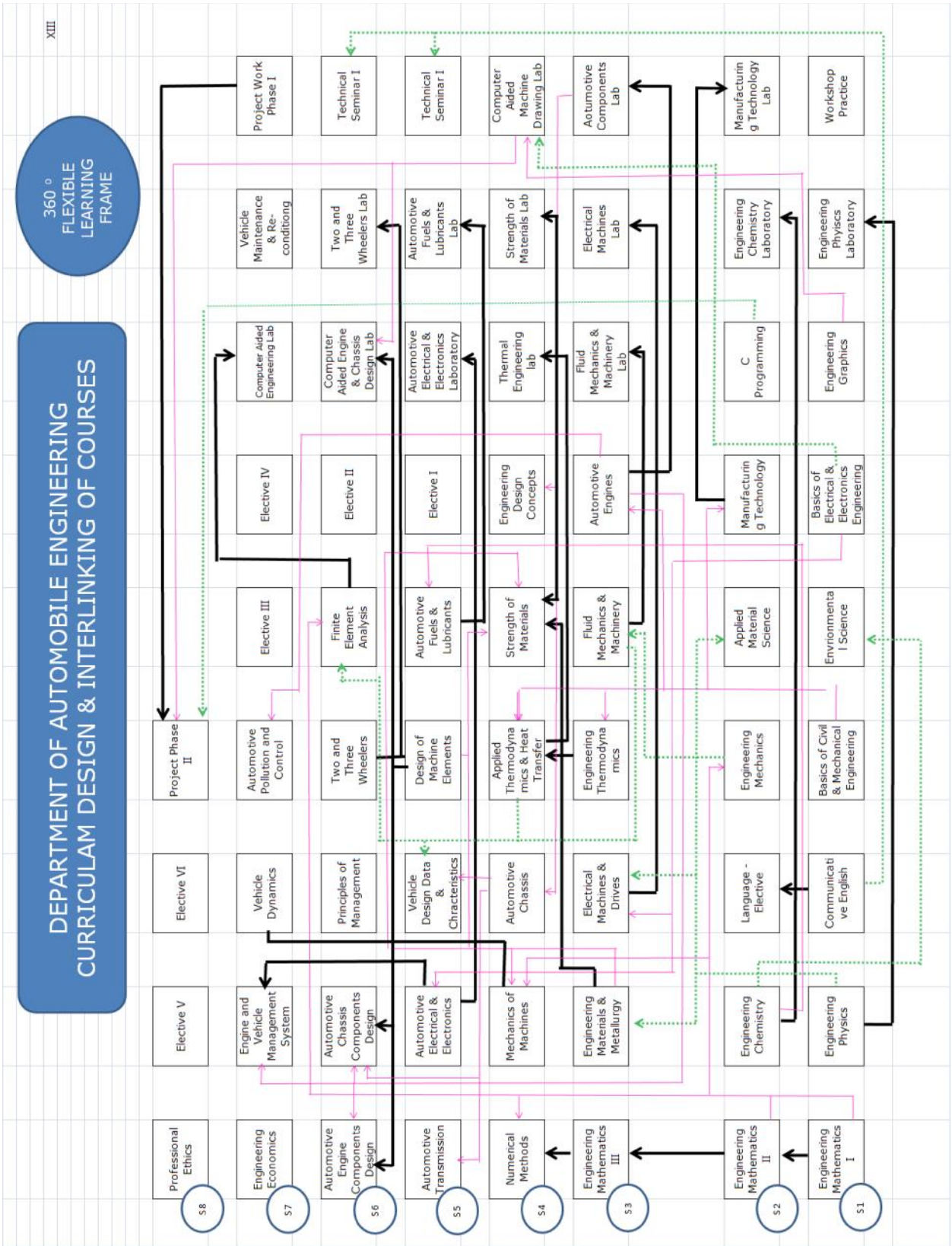
To prepare students for higher education opportunities and also to inculcate in them a spirit of lifelong learning towards a successful professional career

Program Outcomes (POs)

a. Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
b. Graduates will be able to identify, formulate and solve automobile engineering problems
c. Graduates will be able to conduct experiments as well as analyze and interpret data
d. Graduates will be able to design systems for automobiles
e. Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment
f. Graduates will be able to communicate effectively in both verbal and written form
g. Graduates will demonstrate skills to use modern engineering and information technology tools necessary for engineering practice
h. Graduates will have knowledge of professional and ethical responsibilities
i. Graduates will have solid foundation for succeeding in competitive examinations
j. Graduates will acquire knowledge by lifelong learning
k. Graduates will have knowledge of contemporary issues and modern practices

Mapping of PEOs and POs

PEOs	POs
I. To provide insight to students on principles and mechanisms and make students aware of the multi-disciplinary and integrated of various automobile and mechanical systems (engines and machineries), aspects of engineering and life sciences, necessary for applications of automobile engineering	a. Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles j. Graduates will acquire knowledge by lifelong learning
II. To provide students with fundamental knowledge and skills in designing, production, manufacturing and thermal engineering to enable and empower them to solve problems in modern industries	b. Graduates will be able to identify, formulate and solve automobile engineering problems c. Graduates will be able to conduct experiments as well as analyze and interpret data
III. To inculcate scientific temper in students for designing and developing automobile and mechanical engineering solutions to the society	d. Graduates will be able to design systems for automobiles
IV. To familiarize students with professional issues like ethics, Intellectual Property Rights (IPR) and to aquitaine them with managerial skills, entrepreneurial skills and also to foster essential job related skills such as improved oral and written communication, group discussion and to develop working spirit in a team	e. Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment f. Graduates will be able to communicate effectively in both verbal and written form g. Graduates will demonstrate skills to use modern engineering and information technology tools necessary for engineering practice h. Graduates will have knowledge of professional and ethical responsibilities
V. To prepare students for higher education opportunities and also to inculcate in them a spirit of lifelong learning towards a successful professional career	i. Graduates will have solid foundation for succeeding in competitive examinations k. Graduates will have knowledge of contemporary issues and modern practices


XIII
360 ° FLEXIBLE LEARNING FRAME
DEPARTMENT OF AUTOMOBILE ENGINEERING
CURRICULAM DESIGN & INTERLINKING OF COURSES
S8
S7
S6
S5
S4
S3
S2
S1
Professional Ethics
Elective V
Elective VI
Project Phase II
Engineering Economics
Engine and Vehicle Management System
Automotive Pollution and Control
Elective III
Elective IV
Vehicle Maintenance & Re-conditiong
Project Work Phase I
Automotive Engine Components Design
Automotive Chassis Components Design
Two and Three Wheelers
Finite Element Analysis
Two and Three Wheelers Lab
Technical Seminar I
Automotive Transmission
Automotive Electrical & Electronics
Design of Machine Elements
Vehicle Design Data & Chracteristics
Elective II
Elective I
Automotive Fuels & Lubricants Lab
Technical Seminar I
Numerical Methods
Mechanics of Machines
Applied Thermodynamics & Heat Transfer
Automotive Chassis
Automotive Fuels & Lubricants
Engineering Design Concepts
Strength of Materials Lab
Computer Aided Machine Drawing Lab
Engineering Mathematics III
Engineering Materials & Metallurgy
Engineering Thermodynamics
Electrical Machines & Drives
Fluid Mechanics & Machinery
Automotive Engines
Electrical Machines Lab
Autumotive Components Lab
Engineering Mathematics II
Engineering Chemistry
Engineering Mechanics
Language - Elective
Applied Material Science
Manufacturing Technology
C Programming
Engineering Chemistry Laboratory
Manufacturing Technology Lab
Engineering Mathematics I
Engineering Physics
Basics of Civil & Mechanical Engineering
Communicative English
Envrionmental Science
Basics of Electrical & Electronics Engineering
Engineering Graphics
Engineering Physics Laboratory
Workshop Practice
Computer Aided Engineering Lab
Computer Aided Engine & Chassis Design Lab
Automotive Electrical & Electronics Laboratory
Thermal Engineering lab
Fluid Mechanics & Machinery Lab
Strength of Materials Lab

B.E. AUTOMOBILE ENGINEERING

(Minimum credits to be earned: 193)

First Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
11O101	Engineering Mathematics I*	I	(a)	3	1	0	3.5
11O102	Engineering Physics*	I	(a)	3	0	0	3.0
	Language Elective I *	IV	(f)	3	0	0	3.0
11O202	Environmental Science*	V	(a), (h)	3	0	0	3.0
11O105	Basics of Civil and Mechanical Engineering**	II	(a)	4	0	0	4.0
11O205	Basics of Electrical and Electronics Engineering+	II	(a)	4	0	0	4.0
11O208	Engineering Graphics$	III	(a), (c), (e), (g)	2	0	2	3.0
11O108	Engineering Physics Laboratory#	I	(c), (e)	0	0	2	1.0
14U209	Workshop Practice	I	(c), (e)	0	0	2	1.0
			Total	**22**	**1**	**6**	**25.5**

Second Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
11O201	Engineering Mathematics II*	I	(a)	3	1	0	3.5
11O103	Engineering Chemistry*	I	(a)	3	0	0	3.0
	Language Elective II*	IV	(f)	3	1	0	3.5
14U204	Applied Materials Science@	II	(a)	3	0	0	3.0
14U205	Engineering Mechanics	II	(a)	3	0	0	3.0
14U206	Manufacturing Technology	II	(g)	3	0	0	3.0
14U207	Manufacturing Technology Laboratory	II	(c), (e)	0	0	2	1.0
14U208	'C' Programming Laboratory	I	(c), (e), (g)	2	0	3	3.5
11O109	Engineering Chemistry Laboratory¥	I	(c), (e)	0	0	2	1.0
			Total	**20**	**2**	**7**	**24.5**

* Common for all branches of B.E./B.Tech

** Common to all branches of B.E./B.Tech AE & CE; ECE,EIE,ME,MTRS,BT &TT (I Semester) and to CSE,EEE,FT,IT &TT (II Semester)

+ Common for all branches of B.E./B.Tech except ECE,EEE & EIE; AE,CSE,ME,MTRS,IT & FT (I Semester) and to CE,BT&TT (II Semester)

$ Common for CE,EEE,ME,MTRS,BT,IT & TT (I Semester); AE,CSE,ECE,EIE & FT (II Semester)

Common for AE,CSE, ECE & EIE , ME & MTRS (I Semester); CE,EEE,BT,IT,TT & FT (II Semester)

@ Common for AE, CE, MTRS & ME (Regulation 2011)

¥ Common to AE,CE,CSE,ECE & EIE (I Semester); EEE,ME,MTRS,BT,IT,TT & FT (II Semester)

Third Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
11O301	Engineering Mathematics III[*`]	I	(a), (b)	3	1	0	3.5
14U302	Engineering Materials and Metallurgy[**]	II	(a), (i)	3	0	0	3.0
14U303	Automotive Engines	I	(a), (k)	3	0	0	3.0
14U304	Engineering Thermodynamics[**]	II	(b), (i)	3	1	0	3.5
14U305	Fluid Mechanics and Machinery[**]	II	(b), (i)	3	1	0	3.5
14U306	Electrical Machines and Drives[**]	II	(a)	3	0	0	3.0
14U307	Fluid Mechanics and Machinery Laboratory[**]	II	(c), (e), (i), (k)	0	0	3	1.5
14U308	Automotive Components Laboratory	II	(c), (e), (i), (k)	0	0	3	1.5
14U309	Electrical Machines Laboratory	II	(a), (e)	0	0	3	1.5
			Total	**18**	**3**	**9**	**24**

Fourth Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
11O401	Numerical Methods[***]	I	(a), (b)	3	1	0	3.5
14U402	Applied Thermodynamics and Heat Transfer	II	(b), (i)	3	1	0	3.5
14U403	Mechanics of Machines	I	(b)	3	1	0	3.5
14U404	Automotive Chassis	I	(a), (k)	3	0	0	3.0
14U405	Strength of Materials[**]	II	(a), (d)	3	1	0	3.5
14U406	Engineering Design Concepts[*]	III	(d), (k)	3	0	0	3.0
14U407	Thermal Engineering Laboratory[**]	II	(c), (e)	0	0	3	1.5
14U408	Strength of Materials Laboratory[**]	II	(c), (d), (e)	0	0	3	1.5
14U409	Computer Aided Machine Drawing Laboratory[**]	II	(c), (e), (g)	1	0	3	2.5
			Total	**19**	**4**	**9**	**25.5**

[*] Common to all branches of B.E./B.Tech except BT and CSE
[**] Common to AU & ME (Regulation 2011)
[***] Common to AE,AU, MTRS, ME and CE (Regulation 2011)

Fifth Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
14U501	Automotive Transmission	I	(d), (k)	3	0	0	3.0
14U502	Automotive Electrical and Electronics	III	(a), (g), (k)	3	0	0	3.0
14U503	Vehicle Design and Data Characteristics	II	(d), (g), (k)	3	1	0	3.5
14U504	Design of Machine Elements*	III	(b), (d)	3	1	0	3.5
14U505	Automotive Fuels and Lubricants	II	(a), (b)	3	0	0	3.0
	Elective I			-	-	-	3.0
14U507	Engine Performance and Emission Testing Laboratory	II	(c), (e), (g)	0	0	3	1.5
14U508	Automotive Electrical and Electronics Laboratory	III	(c), (e), (g)	0	0	3	1.5
14U509	Automotive Fuels and Lubricants Laboratory	II	(a), (c), (e)	0	0	3	1.5
14U510	Technical Seminar I	V	(f), (j)	-	-	-	1.0
			Total	**15**	**3**	**9**	**24.5[1]**
Sixth Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
14U601	Automotive Engine Components Design	I	(b), (d), (k)	3	1	0	3.5
14U602	Automotive Chassis Components Design	II	(b), (d), (k)	3	1	0	3.5
14U603	Principles of Management	IV	(h)	3	0	0	3.0
14U604	Two and Three Wheelers	II	(a), (i)	3	0	0	3.0
14U605	Finite Element Analysis	IV	(d), (g), (k)	3	1	0	3.5
	Elective II			-	-	-	3.0
14U607	Computer Aided Engine and Chassis Design Laboratory	II	(c), (d), (e)	1	0	3	2.5
14U608	Two and Three Wheelers Laboratory	III	(c), (e)	0	0	3	1.5
14U609	Technical Seminar II	V	(f), (j)	-	-	-	1.0
			Total	**15**	**3**	**9**	**24.5[1]**

* Common to AU & ME (Regulation 2011)

[1]Minimum credits to be earned. The maximum number of credits as well as the total number of L T P hours may vary depending upon the elective courses opted

Seventh Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
11O701	Engineering Economics*	IV	(h), (i)	3	0	0	3.0
14U702	Engine and Vehicle Management System	I	(a),(g), (k)	3	0	0	3.0
14U703	Vehicle Dynamics	I	(d), (g), (k)	3	1	0	3.5
14U704	Automotive Pollution and Control	II	(a), (k)	3	0	0	3.0
	Elective-III			-	-	-	3.0
	Elective-IV			-	-	-	3.0
14U707	Vehicle Maintenance and Re-conditioning Laboratory	V	(c), (e),(i)	0	0	3	1.5
14U708	Computer Aided Engineering Laboratory	III	(c), (e),(i)	0	0	3	1.5
14U709	Project Work Phase I	III	(e), (f), (g), (k)	-	-	-	3.0
			Total	**12**	**1**	**6**	**24.5**[2]

Eighth Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
11O801	Professional Ethics*	IV	(e), (f), (h)	2	0	0	2.0
	Elective-V			-	-	-	3.0
	Elective-VI			-	-	-	3.0
14U804	Project Work Phase II	III	(e), (f), (g), (k)	-	-	-	12.0
			Total	**2**	**0**	**0**	**20**[2]

* Common to all branches of B.E./B.Tech

[2]Minimum credits to be earned. The maximum number of credits as well as the total number of L T P hours may vary depending upon the elective courses opted

ELECTIVES

		L	T	P	C
LANGUAGE ELECTIVE I					
11O10B	Basic English I	3	0	0	3.0
11O10C	Communicative English	3	0	0	3.0
LANGUAGE ELECTIVE II					
11O20B	Basic English II	3	0	0	3.0
11O20C	Advanced Communicative English	3	1	0	3.5
11O20H	Hindi	3	1	0	3.5
11O20G	German	3	1	0	3.5
11O20J	Japanese	3	1	0	3.5
11O20F	French	3	1	0	3.5
DISCIPLINE ELECTIVES					
14U001	Automotive Air-conditioning	3	0	0	3.0
14U002	Alternate Fuels and Energy Systems	3	0	0	3.0
14U003	Vibration, Noise and Harshness Control	3	0	0	3.0
14U004	Advanced Theory of I.C Engines	3	0	0	3.0
14U005	Quality Control and Reliability Engineering	3	0	0	3.0
14U006	Metrology and Instrumentation	3	0	0	3.0
14U007	Supercharging and Scavenging	3	0	0	3.0
14U008	Automotive Aerodynamics	3	0	0	3.0
14U009	Composite Materials	3	0	0	3.0
14U010	Automotive Safety	3	0	0	3.0
14U011	Combustion Thermodynamics and Heat Transfer	3	0	0	3.0
14U012	Rubber Technology for Automobiles	3	0	0	3.0
14U013	Fundamentals of Nano-science	3	0	0	3.0
14U014	Advanced production process for Automotive Components	3	0	0	3.0
14U015	Hydraulic and Pneumatic Systems	3	0	0	3.0
14U016	Special Types of Vehicles	3	0	0	3.0
14U017	Tractor and farm Equipments	3	0	0	3.0
14U018	Fleet Management	3	0	0	3.0

11O101 ENGINEERING MATHEMATICS-I

(Common to all Branches) 3 1 0 3.5

Objectives

- Acquire knowledge in matrix theory, a part of linear algebra, which has wider application in engineering problems.
- To make the student knowledgeable in the area of infinite series, their convergence and to solve first and higher order differential equations using Laplace transform.

Programme Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

Course Outcomes (COs)

- Able to get knowledge in basic concepts of engineering mathematics.
- Able to improve problem evaluation technique.
- Able to choose an appropriate method to solve a practical problem.

ASSESSMENT PATTERN

S. No	Bloom's Taxonomy (New Version)	Test I[1]	Test II[1]	Model Examination[1]	End Semester Examination
1	Remember	20	20	20	20
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze/ Evaluate	10	10	10	10
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. State Cayley Hamilton theorem.
2. Define eigen value and eigen vector of a matrix.
3. Write the definition of convergence and divergence of a series.
4. State the necessary and sufficient condition for the differential equation to be exact.
5. Write the Radius of curvature in cartesian coordinates.
6. Define evolute, centre of curvature and Circle of curvature.
7. Write the Leibneitz's form of linear equation in x and y.
8. Write the general form of Euler's and Legendre linear differential equations.
9. Define Convolution of two functions on Laplace transform.
10. State the existence conditions for Laplace transform.

Understand

1. Find eigen values and eigen vectors of the matrix$A = \begin{pmatrix} 2 & 2 & 0 \\ 3 & 5 & 1 \\ 8 & 1 & 3 \end{pmatrix}$
2. Find the radius of curvature at (a,0) on the curve $xy^2 = a^3 - x^3$
3. Find the circle of curvature of the parabola $y^2 = 12x$ at the point (3.6)
4. Solve $\cos^2 x \frac{dy}{dx} + y = \tan x$

[1] The marks secured in Test I and II will be converted to 20 and model examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly, internal assessment will be calculated for 50 marks.

5. Solve $y(2xy + e^x)\,dx = e^x\,dy$.
6. Find evolute of the parabola $x^2 = 4ay$.
7. Solve $(D^2 + 4)\,y = x^2$.
8. Solve $(D - 3)^2\,y = x\,e^{-2x}$.
9. Find the Laplace transform of $e^{2t}\sin 3t$.
10. Find the laplace transform of $t\cos 4t$.

Apply

1. Diagonalise the matrix $A=\begin{bmatrix} 3 & 1 & 1 \\ 1 & 3 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ by means of an orthogonal transformation
2. Find the inverse of the matrix $A = \begin{pmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{pmatrix}$ us ing Cayley Hamilton theorem.
3. Test the convergence of the series $\frac{3}{4} + \frac{3.4}{4.6} + \frac{3.4.5}{4.6.8} + \ldots\ldots$
4. Using Convolution theorem, find inverse Laplace transform of $\frac{1}{(s+1)(s+2)}$.
5. Use method of variation of parameters , to solve $(D^2+4)y = \tan 2x$
6. Use Laplace transform to solve $(D^2 + 4D + 13)\,y = e^{-t}\sin t$, given $y = 0$ and $Dy = 0$ at $t = 0$.
7. Test for convergence of the series $\sum \frac{n}{1+n}$
8. Use Bernoulli's equation to solve $xy(1 + xy^2)\frac{dy}{dx} = 1$
9. Use Leibnitz's linear equation to solve $(x+1)\frac{dy}{dx} - y = e^{2x}(x+1)^2$
10. Use Laplace Transform to evaluate, $\int_0^\infty \frac{e^{-t}(\sin\sqrt{3t})}{t}dt$

Analyze / Evaluate

1. Reduce the quadratic form $8x_1^2 + 7x_2^2 + 3x_3^2 - 12x_1x_2 - 8x_2x_3 + 4x_3x_1$ to canonical form by orthogonal transformation and find the rank, signature, index and the nature.
2. Reduce $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$ to its canonical form through an orthogonal transformation and find the rank, signature, index and the nature.
3. Find the evolute of the cycloid : $x = a(\theta + \sin\theta)$; $y = a(1 - \cos\theta)$.
4. Find the circle of curvature of $\sqrt{x} + \sqrt{y} = \sqrt{\sim}$ at $\left(\frac{a}{4}, \frac{a}{4}\right)$
5. Discuss the convergence of the series $\frac{1}{3.4.5} + \frac{2}{4.5.6} + \frac{3}{5.6.7} + \ldots$
6. Verify Cayley-Hamilton theorem for the matrix $A=\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$. Hence find its inverse.
7. Using the method of variation of parameters, solve $(D^2 + a^2)\,y = \tan ax$.
8. Solve $(x^2D^2 + 4xD + 2)\,y = x^2 + \frac{1}{x^2}$.
9. Find the envelope of the straight line $\frac{x}{a} + \frac{y}{b} = 1$, here a and b are connected by the relation $a^2 + b^2 = c^2$
10. Find the Laplace transform of the following functions (i) $(t + 2t^2)^2$ (ii) $\sin^2 2t$ (iii) $\sin 3t \cos 2t$

Unit I
Matrices

Characteristic equation - eigen values and eigen vectors of a real matrix - properties of eigen values - Cayley–Hamilton theorem- Reduction of a real matrix to a diagonal form- Orthogonal matrices- Quadratic form -Reduction of a quadratic form to a canonical form by orthogonal transformation-application to engineering problems.

9 Hours

Unit II
Series and Differential Calculus

Series- Convergences and divergence- Comparison test– Ratio test - Curvature in Cartesian Coordinates- Centre and radius of curvature - Circle of curvature – Evolutes –Envelopes – application to engineering problems.

9 Hours

Unit III
Differential Equation of First Order

Linear differential equation of first order-exact-integrating factor- Euler's equation-Bernoulli's-modeling-application to engineering problems.

9 Hours

Unit IV
Differential Equations of Higher Order

Linear differential equations of second and higher order with constant and variable coefficients - Cauchy's and Legendre's linear differential equations - method of variation of parameters –application of engineering problems.

9 Hours

Unit V
Laplace Transforms

Laplace Transform- conditions for existence(statement only) -Transforms of standard functions – properties (statement only) - Transforms of derivatives and integrals - Initial and Final value theorems (statement only) - Periodic functions - Inverse transforms - Convolution theorems(statement only) - Applications of Laplace transforms for solving the ordinary differential equations up to second order with constant coefficients-application to engineering problems.

9 Hours
Total: 45+15 Hours

Textbook(s)

1. B.S. Grewal, "*Higher Engineering Mathematics"*, Khanna Publications , New Delhi 2000
2. K.A. Lakshminarayanan, K. Megalai, P. Geetha and D. Jayanthi, "*Mathematics for Engineers"*, Volume I, Vikas Publishing House, New Delhi. 2008.

References

1. P. Kandasamy, K. Gunavathy and K. Thilagavathy, "*Engineering Mathematics"*, Volume I, S. Chand and Co., New Delhi-2009.
2. T. Veerarajan, "*Engineering Mathematics*", Tata McGraw Hill Publications , New Delhi 2008.
3. E. Kreyszig, "*Advanced Engineering Mathematics"*, 8th Edition, John Wiley and Sons, Inc, Singapore, 2008.

11O102 ENGINEERING PHYSICS
(Common to all branches)

3 0 0 3

Objectives

- To impart fundamental knowledge in the areas of acoustics, crystallography and new engineering materials
- To apply fundamental knowledge in the area of LASERS and fiber optics
- To use the principles of quantum physics in the respective fields

Program Outcome (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

Course Outcomes (COs)

- Able to learn the basic concepts of acoustics and ultrasonics.
- Able to develop applications for real world problems such as designing acoustic buildings and study the basics and applications of crystal physics.
- Able to analyze the construction, working and applications of laser.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I*	Test II*	Model Examination*	Semester End Examination
1	Remember	25	25	20	20
2	Understand	25	25	25	25
3	Apply	20	20	20	20
4	Analyze	20	20	20	20
5	Evaluate	10	10	15	15
6	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Give the classifications of sound.
2. Write a note on loudness.
3. Define decibel.
4. What is meant by reverberation time?
5. Define magnetostriction effect.
6. Give the classification of crystals.
7. Define Miller indices.
8. Define lattice and unit cells.
9. Mention the applications of X-ray diffraction.
10. Write a short note on air wedge.
11. List the applications of air wedge method.
12. Give the applications of LASER.
13. Give the classification of laser based on refractive index.
14. Write a note on holography.
15. Draw the block diagram of fiber optic communication system.
16. Define the term Compton effect.
17. What is the physical significance of wave function?
18. What are metallic glasses?
19. Write a note on shape memory alloys.
20. Mention the merits of nano materials.
21. List the advantages of ceramic materials.

Understand

1. How Weber-Fechner law is formulated?
2. Explain the characteristics of loudness.

* The marks secured in Test 1 and Test 2 will be converted to 20 and Model examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

3. Elucidate the significance of timber.
4. How the magnetostriction effect is utilized in the production of ultrasonic waves?
5. What is the importance of reverberation time in the construction of building?
6. Give the importance of lattice and lattice planes in a crystal.
7. How do you measure the d-spacing?
8. How do you calculate the packing factor of BCC structure?
9. How air wedge is used in determining the flatness of a thin plate?
10. Give the importance of optical pumping in the production of LASER.
11. What are the various steps involved in holography?
12. How can you derive the acceptance angle in fiber?
13. Why the wave function is called as probability density?
14. Why the wave function is finite inside the potential well?
15. Why the particle is not escaping through the walls of the well?
16. How ceramic materials are prepared by slip casting technique?
17. What are the advantages of nano materials?

Apply

1. Discuss the factors affecting the acoustics of buildings.
2. Ultrasonic waves are electromagnetic waves. Justify.
3. Sketch the circuit diagram for piezo electric oscillator.
4. How can you determine the velocity of ultrasonic by acoustic grating?
5. Explain how Miller indices are used in crystal structures?
6. How do you calculate the packing factor for FCC structure?
7. Draw the crystal lattice for (110) plane.
8. Why does air wedge occur only in the flat glass plates?
9. Explain the various steps involved in holography techniques.
10. Discuss the particle in a one dimensional box by considering infinite length of well.
11. Explain how shape memory alloy change its shape?
12. How can you prepare the nano materials synthesized by sol gel technique?

Analyze/ Evaluate

1. Compare magnetostriction and piezo-electric method in the production of ultrasonic waves.
2. Differentiate musical sound and noises.
3. Compare the packing factor of BCC, FCC and HCP structures.
4. Distinguish between photography and holography.
5. Compare slip casting and isostatic pressing.

Unit I

Acoustics and Ultrasonics

Acoustics: Classification of sound – characteristics of musical sound – loudness – Weber – Fechner law – decibel – absorption coefficient – reverberation – reverberation time – Sabine's formula (growth & decay). Factors affecting acoustics of buildings and their remedies. Ultrasonics: Ultrasonic production – magnetostriction - piezo electric methods. Applications: Determination of velocity of ultrasonic waves (acoustic grating) - SONAR.
The phenomenon of cavitation.

9 Hours

Unit II

Crystallography

Crystal Physics: Lattice – unit cell – Bravais lattices – lattice planes – Miller indices – 'd' spacing in cubic lattice – calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC and HCP structures - X-ray Diffraction: Laue's method – powder crystal method.
Crystal defects. **9 Hours**

Unit III

Waveoptics

Interference: Air wedge – theory – uses – testing of flat surfaces – thickness of a thin wire. LASER: Types of lasers – Nd – YAG laser – CO_2 laser – semiconductor laser (homojunction). Applications: Holography – construction – reconstruction – uses. Fiber Optics: Principle of light transmission through fiber - expression for acceptance angle

and numerical aperture - types of optical fibers (refractive Index profile, mode) fiber optic communication system (block diagram only)
Laser gas sensors.

9 Hours

Unit IV
Modern Physics
Quantum Physics: Development of quantum theory – de Broglie wavelength – Schrödinger's wave equation – time dependent – time independent wave equations – physical significance – applications – particle in a box (1d). X-rays**:** Scattering of X-rays – Compton Effect – theory and experimental verification.
Degenerate and non degenerate

9 Hours

Unit V
New Engineering Materials
Metallic glasses: Manufacturing – properties – uses. Shape Memory Alloys**:** Working principle – shape memory effect – applications. Nanomaterials**:** Preparation method – sol gel technique – mechanical – magnetic characteristics – uses. Ceramics**:** Manufacturing methods – slip casting – isostatic pressing – thermal and electrical properties - uses.
Carbon nano tubes and applications.

9 Hours
Total: 45 Hours

Textbook(s)
1. V. Rajendran, "*Engineering Physics"*, Tata McGraw-Hill, New Delhi, 2011.
2. P. K. Palanisami, "*Physics for Engineers"*, Vol. 1, Scitech Pub. (India) Pvt. Ltd., Chennai, 2002.

References
1. M. N. Avadhanulu and P G Kshirsagar, *"A Textbook of Engineering Physics"*, S Chand & Company Ltd., New Delhi, 2005
2. S. O. Pillai, "*Solid State Physics"*, New Age International Publication, New Delhi, 2006.
3. V. Rajendran and A Marikani, "*Physics I"*, TMH, New Delhi, 2004.
4. Arthur Beiser, "*Concepts of Modern Physics"*, TMH, 2008.
5. R. K. Gaur and S L Gupta, "*Engineering Physics"*, Dhanpat Rai Publishers, New Delhi, 2006

Language Elective I
(Common to all Branches- Regulation 2011)

3 0 0 3.0

11O202 ENVIRONMENTAL SCIENCE
(Common to all branches)

3 0 0 3.0

Objectives

- To impart knowledge on principles of environmental science and engineering
- To understand the concepts of ecosystem, biodiversity and impact of environmental pollution
- To create awareness on value education, population and social issues

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

h) Graduates will have knowledge of professional and ethical responsibilities

Course Outcomes (COs)

- Able to comprehend the importance of environment, its purpose, design, exploitation of natural resources and perspectives.
- Able to understand fundamental physical and biological principles that govern natural processes and role of professionals in protecting the environment from degradation.
- Able to understand current environmental challenges like pollution and its management.

ASSESSMENT PATTERN

S.No	Bloom's Taxonomy (New Version)	Test I[G]	Test II[G]	Model Examination[G]	Semester End Examination
1	Remember	25	25	15	15
2	Understand	25	25	25	25
3	Apply	20	20	20	20
4	Analyze	20	20	20	20
5	Evaluate	10	10	20	20
6	Create	-	-	-	-
Total		**100**	**100**	**100**	**100**

Remember

1. Give the scope and importance of environmental studies.
2. Distinguish between renewable and non- renewable resources.
3. Explain the impacts of mining on forests.
4. Explain why fresh water is a precious resource and classification of different water pollutants?
5. What are the Impacts of modern agriculture?
6. State the two energy laws and give examples that demonstrate each law.
7. List the physical, chemical, and biological factors responsible for soil formation.
8. Give examples of point and nonpoint sources of pollution.
9. Draw a food web that includes ten or more aquatic organisms.
10. Distinguish between primary and secondary pollutants.
11. Identify the four parts of the atmosphere.
12. Describe secondary and primary succession with suitable examples.
13. Define the term extinction.
14. Relate the concept of food web and food chain to trophic levels.
15. Describe energy flow in a ecosystem.
16. Define the roles of producers, herbivore, carnivore, omnivore, scavenger, parasite and decomposer.
17. List some of the components of an ecosystem.
18. Distinguish between the biotic and abiotic factors in an ecosystem.
19. Give some impacts of water pollution.
20. Explain the source and effects of *e waste*.

[*] The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

21. What is the loudest sound possible?
22. What are the laws regarding noise pollution?
23. What is rainwater harvesting?
24. Discuss the concept and reactions of acid rain.
25. Describe the salient features of Wildlife (protection) Act, 1972.
26. What is 3R approach?
27. Give the effects of nuclear fallout.
28. Differentiate between mortality and natality.
29. What is exponential growth and zero population growth?
30. What are the objectives and elements of value education?

Understand

1. Explain why providing adequate food for all of the world's people is so difficult?
2. Rank the five major sources of energy used to produce electricity and classify the energy sources as renewable or nonrenewable.
3. Describe the causes of desertification and its preventive measures.
4. Describe the advantages and disadvantages of the green revolution.
5. Explain the relationship between technology and global warming.
6. Describe any three health effects of air pollution.
7. Identify "greenhouse gases" and explain how they cause the "greenhouse effect".
8. Identify a few plants and animals with the various biomes.
9. Explain the importance of primary species.
10. Explain the five major types of species interactions and give examples of each.
11. Environmental problems involve social, political, and economic issues—Justify.
12. What problems does noise pollution cause to animals?
13. What type of pollution threatens wetlands?
14. What are the major measures to attain sustainability?
15. Why is urban energy requirement more than rural requirement?
16. What are the major limitations to successful implementation of our environmental legislation?
17. Explain the concept of Malthusian theory.
18. How age-structure pyramids serve as useful tools for predicting population growth trends of a nation?

Apply

1. Compare the energy efficiencies of any two inventions.
2. Name some alternatives to pesticides.
3. Identify four different habitats found in bodies of water and give examples of organisms that live in each habitat.
4. Explain how we could reduce air pollution?
5. What are the measures to be taken to reduce your own noise pollution?
6. List the top ten polluted countries in the world?
7. Identify the grants available for rain water harvesting in buildings?
8. What are the major implications of enhanced global warming?
9. Discuss the methods implemented by government to control HIV/AIDS.
10. What is the role of an individual in prevention of pollution?

Analyze/ Evaluate

1. List reasons why it is important that we seek alternatives to fossil fuels.
2. Explain why fresh water is often in short supply?
3. Give examples of human-made sources of radiation and explain how human-made sources differ from natural sources of radiation.

Unit I

Introduction to Environmental Studies and Natural Resources

Environment: Definition- scope - importance – need for public awareness. Forest resources: Use –over exploitation- deforestation - case studies- mining - effects on forests and tribal people. Water resources: Use – over utilization of surface and ground water- floods – drought - conflicts over water. Mineral resources: Use – exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: World food problems - changes caused by agriculture and overgrazing - effects of modern agriculture- fertilizer-pesticide problems - water logging - salinity -case studies. Energy resources: Growing energy needs - renewable and non renewable energy sources. Land resources: Land as a resource - land degradation - soil erosion. Role of an individual in conservation of natural resources.

Documentation of the effect of degradation of forest resource.

9 Hours

Unit II

Ecosystems and Biodiversity

Concept of an ecosystem: Structure and function of an ecosystem – producers - consumers -decomposers – energy flow in the ecosystem – ecological succession – food chains - food webs and ecological pyramids. Types of ecosystem: Introduction - characteristic features - forest ecosystem - grassland ecosystem - desert ecosystem - aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity: Introduction– definition (genetic - species –ecosystem) diversity. Value of biodiversity: Consumptive use - productive use – social values – ethical values - aesthetic values. Biodiversity level: Global - national - local levels- India as a mega diversity nation- hotspots of biodiversity. Threats to biodiversity: Habitat loss - poaching of wildlife – man wildlife conflicts – endangered and endemic species of India. Conservation of biodiversity: *In-situ* and e*x-situ* conservation of biodiversity - field study.

Documentation of the endangered flora and fauna in your native place.

9 Hours

Unit III

Environmental Pollution

Pollution: Definition –air pollution - water pollution - soil pollution - marine pollution - noise pollution - thermal pollution - nuclear hazards. Solid waste management: Causes - effects - control measures of urban and industrial wastes. Role of an individual in prevention of pollution - pollution case studies. Disaster management: Floods – earthquake - cyclone - landslides. Electronic wastes.

Investigation on the pollution status of Bhavani river.

9 Hours

Unit IV

Social Issues and Environment

Sustainable development : Unsustainable to sustainable development – urban problems related to energy. Water conservation - rain water harvesting - watershed management. Resettlement and rehabilitation of people. Environmental ethics: Issues - possible solutions – climate change - global warming and its effects on flora and fauna - acid rain - ozone layer depletion - nuclear accidents - nuclear holocaust - wasteland reclamation - consumerism and waste products. Environment protection act: Air (Prevention and Control of Pollution) act – water (Prevention and control of Pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation.

Analyze the recent steps taken by government of India to prevent pollution.

9 Hours

Unit V

Human Population and Environment

Human population: Population growth - variation among nations – population explosion – family welfare programme and family planning – environment and human health – Human rights – value education – HIV / AIDS, Swine flu – women and child welfare . Role of information technology in environment and human health.

Population explosion in India, China – the present and future scenario

9 Hours

Total: 45 Hours

Textbook(s)

1. T. G. Jr. Miller, *Environmental Science*, Wadsworth Publishing Co., 2004.
2. Raman Sivakumar, *Introduction to Environmental Science and Engineering,* Tata McGraw Hill Education Private Limited, New Delhi, 2010.

References

1. Bharucha Erach, *The Biodiversity of India*, Mapin Publishing Pvt. Ltd., Ahmedabad India, 2010 .
2. S. Divan, *Environmental Law and Policy in India*, Oxford University Press, New Delhi, 2001.
3. K. D. Wager, *Environmental Management*, W. B. Saunders Co., Philadelphia, USA, 1998.
4. W. P. Cunningham, *Environmental Encyclopedia*, Jaico Publising House, Mumbai, 2004.
5. S. K. Garg, R. Garg, R. Garg, *Ecological & Environmental Studies*, Khanna Publishers, Delhi, 2006.

11O105 BASICS OF CIVIL AND MECHANICAL ENGINEERING
(Common to all branches of B.E./B.Tech AE,AU,CE;ECE,EIE,ME,MXE,BT &TT (I Semester) and to CSE,EEE,FT,IT &TT (II Semester))

4 0 0 4.0

Objectives

- To impart basic knowledge in the field of Civil Engineering focusing building materials, surveying, foundation and transportation Engineering
- To impart basic knowledge in the field of Mechanical Engineering focusing on generation of power from various natural resources and to know about various types of Boilers and Turbines used for power generation and to understand the working of IC engines and basic manufacturing processes

Program Outcome (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

Course Outcomes (COs)

- Able to understand the fundamental philosophy of Civil engineering and enable them to work together in a multidisciplinary technical team.
- Able to identify the nature of building components, functions, construction practices and material qualities
- Able to Understand the manufacturing processes like casting, welding, machining operations
- Able to Understand the construction and working of IC engines and refrigerators
- To Know about the working principle of boilers, turbines and various power plants utilizing conventional and non-conventional sources of energy

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	30	30	30	30
3	Apply	30	30	30	30
4	Analyze / Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What are the classifications of stones?
2. What is the frog in a brick?
3. What is quarrying?
4. What do you mean by dressing of stones?
5. What are the systems of bearing?
6. How the surveying is classified based on purpose?
7. Define Benchmark and state its effects.
8. What are the accessories used in chain surveying?
9. Define bearing of a line.
10. Define leveling & state its objectives.
11. State the objectives and requirement of good foundation.
12. Mention the site improvement techniques.
13. Define bearing capacity of soil.
14. How stone masonry is classified?
15. Define Beam, Column and Lintel.
16. What are the basic forms of roof?
17. How floors are classified based on floor finish?
18. List the materials used for damp proofing.
19. How roads are classified?

† The marks secured in Test 1 and Test 2 will be converted to 20 and Model examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

20. What do you mean by W.B. M. road?
21. Define Gauge.
22. What is a permanent way?
23. How bridges are classified?
24. What are the advantages of railways?
25. What are docks?
26. Classify sleepers.
27. What are the requirements of a sleeper?
28. What are the types of traffic signs?
29. What are the advantages of road signs?
30. What are the prohibitory signs?
31. What is the main function of hangars?
32. What are the sources of Energy Generation?
33. What are the accessories used in a boiler?
34. Define Turbine.
35. Compare and contrast fire tube and water tube boiler?
36. List the types of steam Turbines?
37. Classify the I.C engine.
38. List out the Part of the I.C. Engine.
39. Define the terms: Top Dead Center, Bottom Dead Center.
40. Define the term: Compression Ratio.
41. What are the different sources of energy?
42. Name four non-renewable sources of energy.
43. Name some renewable sources of energy.
44. Name four solid/liquid/gaseous/ fuels.
45. Name two nuclear fuels.
46. What are the advantages of wind energy?
47. State some of the applications of steam boilers.
48. Classify different steam boilers.
49. What do you understand by Scavenging
50. What do you understand by the term IC engine?
51. What are the operations performed on a Lathe?
52. What is impulse turbine? Give example.
53. What is Reaction turbine? Give example.
54. Define Boiler.
55. Classify Boilers.
56. List out the Boiler Mountings and Accessories.
57. Define Refrigeration.
58. Define refrigerant. Give some examples of refrigerant.
59. Define C.O.P.

Understand

1. What are the qualities of good building stone?
2. What are the various stages of manufacturing brick?
3. What is mean by concrete?
4. State the properties of cement concrete.
5. What is curing of concrete?
6. What is water – cement ratio?
7. What is the difference between a plan and a map?
8. Differentiate between plane surveying and geodetic surveying.
9. State the principles of surveying.
10. What is the use of cross – staff?
11. What are the functions of foundation?
12. Differentiate between shallow foundation & deep foundation
13. What are the causes of failure of foundation?
14. Compare stone masonry and brick masonry.
15. Why bonding in brick wall is necessary?
16. State the special features of English and Flemish bond.
17. Define super elevation.
18. What are the uses of fish plates?

19. What are the necessities of highway drainage?
20. What are the three stages of construction of a new railway track?
21. Define the term visibility.
22. Define passenger flow.
23. Differentiate between wharf and jetty.
24. What are the requirements of a good harbour?
25. What are the requirements of a good naval port?
26. How Solar Energy is generated?
27. How Energy is Generated using steam Turbines?
28. How power plants are classified?
29. Compare and contrast reaction and impulse turbines.
30. How energy is generated from Diesel Power Plants?
31. What is the difference between renewable and non-renewable sources of energy?
32. Mention the applications of solar energy.
33. What is the function of a hydraulic turbine?
34. What is the function of a surge tank?
35. What is the function of a moderator?
36. What are the functions of a control rod?
37. Name of the important components of diesel power plant.
38. Name the important parts of gas turbine.
39. State the function of condenser in steam power plant.
40. What are the requirements of a good boiler?
41. What are the specific advantages of water-tube boilers?
42. What are the aims of pre-heating of air in a boiler?
43. State the function of economizer.
44. How does a fusible plug function as a safety device?
45. What is the function of a steam nozzle?
46. What is the function of flywheel?
47. What is the function of a spark plug?
48. What is the function of a fuel injector in diesel engine?
49. Why is cooling necessary in an IC engine?
50. Define compression ratio of an IC engine.
51. List the ports used in a 2-stroke engine
52. What are the requirements of a good boiler?
53. What is the difference between impulse and reaction turbine?
54. How energy is generated from Nuclear Power Plants?
55. How energy is generated from Hydro Power Plants?
56. Compare and contrast 4 stroke and 2 stroke engine.
57. What is the Purpose of a fusible Plug?
58. Differentiate petrol & diesel engines.
59. How Taper Turning is carried out in Lathes?
60. Various Mechanical properties of Cast Iron, Steel and HSS.

Apply/Evaluate

1. What is Hardness?
2. What are the operations to be performed while setting up a plane table at a station?
3. Explain the steps involved in measuring vertical angle of an object using theodolite.
4. Explain the methods to improve bearing capacity of soil
5. What are the points to be observed in the construction of brick masonry?
6. Explain the method of construction of cement concrete flooring.
7. What are the methods of applying surface dressing in bituminous roads?
8. Explain the construction steps in bituminous macadam road.
9. How can you express the hardness number of stones?
10. Apply the concept of power generation and saving from other energy sources
11. Apply the concept of Refrigeration in Heat removal and Heat addition
12. Draw the pressure-velocity diagram for a single stage impulse turbine.

Unit I

Introduction to Civil Engineering

History, development and scope of Civil Engineering - Functions of Civil Engineers. Construction Materials: Characteristics of good building materials such as stones - Bricks, A.C. sheets - G.I. sheets and Ceramic tiles - Timber, cement - Aggregates and concrete. Surveying: Definition and purpose – Classification – Basic principles – Measurement of length by chains and tapes – Calculation of area of a plot – Measurement of bearings and angles using a prismatic compass – Leveling – Contours

Application of contours

10 Hours

Unit II

General Concepts Relating to Buildings

Selection of site – Basic functions of buildings – Major components of buildings. Foundations: Purpose of foundation – Bearing capacity of soils – Types of foundations. Proper methods of construction of: Brick masonry – Stone masonry – Hollow Block masonry. Beams – Lintels – Columns – Flooring – Doors and windows – Roofing

Damp proof course – Surface finishes

10 Hours

Unit III

Transportation Engineering

Classification of Highways – Cross sections of water bound macadam - Bituminous and cement concrete roads – Traffic signs and signals. Importance of railways - Gauges – Components of a permanent way – Classification of bridges – Components of Airport

Examples of Marvelous Structures

10 Hours

Unit IV

Engineering Materials and Manufacturing Processes

Classification of Engineering materials, Mechanical properties and uses of cast iron, steel, and High Speed Steel. Introduction to casting process, Green sand moulding - Pattern, Melting furnaces - Cupola and Electric Furnace. Metal Forming - Forging Process. Introduction to Arc and Gas Welding. Centre Lathe - Specifications - Principal parts - Operations - Straight turning, Step turning, Taper turning methods, Knurling, Thread cutting methods, Facing, Boring, and Chamfering - Lathe tools and Materials. Drilling – Radial drilling machine - Specification and Operation

Milling operation

10 Hours

Unit V

Internal Combustion Engines and Refrigeration

Classification of IC engines, Main components of IC engines, working of a 4 stroke & 2 stroke petrol & diesel engine, differences between 4 stroke and 2 stroke engine, Lubrication and Cooling systems in IC Engines. Refrigeration: Working Principle of Vapour Compression & Vapour Absorption System, Domestic refrigerator

Domestic air conditioning

10 Hours

Unit VI

Alternate Sources of Energy, Power Plants and Boilers

Solar, Wind, Tidal, Geothermal and Ocean Thermal Energy Conversion (OTEC). Power Plant: Classification of Power Plants- Steam - Nuclear, Diesel, and Hydro Power Plants. Types of Boilers – Simple Vertical, Babcock and Wilcox and La-Mont Boiler, Differences between fire tube and water tube boiler. Types of steam turbines- working of a single stage impulse and reaction turbines

Biomass and Biofuels in power generation

10 Hours

Total: 60 Hours

Textbook(s)

1. M. S. Palanichamy, *Basic Civil Engineering*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2009
2. G. Shanmugam & S Ravindran, *Basic Mechanical Engineering*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010

References

1. N. Arunachalam, *Bascis of Civil Engineering*, Pratheeba Publishers, 2000
2. B. K. Sarkar, *Thermal Engineering*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008
3. P. N. Rao, *Manufacturing Technology: Foundry, Forming and Welding*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003.
4. S. R. J. Shantha Kumar, *Basic Mechanical Engineering*, Hi-tech Publications, Mayiladuthurai, 2000
5. http://www.tutorvista.co.in/content/science/science-ii/sources-energy/sources-energyindex.php

11O205 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to all branches except EEE, ECE, EIE)

4 0 0 4.0

Objectives

- To understand the basics concepts of electric circuits & magnetic circuits
- To learn the operations of electrical machines
- To impart knowledge in the concepts of Communication systems

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

Course Outcomes (COs)

- Able to analyze the power in single phase AC systems
- Able to derive an equation for self and mutual inductance
- Able to determine the characteristics of Bipolar junction transistors

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	10	10	10	10
2	Understand	20	20	20	20
3	Apply	30	30	30	30
4	Analyze / Evaluate	40	40	40	40
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is an inductor?
2. State Ohm's law.
3. State the operating principle of a transformer.
4. Draw the circuit symbols of i] step up transformer ii] step down transformer.
5. What is resistor? Give its symbol.
6. What are impurities?
7. Draw the neat-labelled I-V characteristics of zener diode.
8. Draw circuit symbol of diode and zener diode,
9. Which process is used to convert the material into extrinsic?
10. What is junction barrier?
11. Define the term rectification and efficiency
12. What is done in the base region of a transistor to improve its operation.
13. What is BJT?
14. List the needs for modulation.
15. Draw symbol of 2-input NOR gate & write its truth table.

Understand

1. Explain Ohm's law relating to (V), (I) and (R).
2. Explain the working principle of a transformer.
3. Explain the working principle of an induction motor.
4. Discuss intrinsic semiconductor are pure semiconductors.
5. Explain pentavalent impurities with example.
6. Explain trivalent impurities with example.
7. Explain in brief, knee voltage of diode.
8. Explain in brief, breakdown voltage of diode.

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

9. Explain the operation of P-N Junction diode when forward and reverse bias.
10. Explain the formation of depletion region in P-N Junction.
11. Explain Zener diode as voltage regulator.
12. With a neat circuit diagram explain the working of a half wave rectifier.
13. Derive an expression for the efficiency of a half wave rectifier.
14. With a neat circuit diagram, explain the working of full wave rectifier.
15. What is Ex-OR gate? Explain its working & tabulate the truth table.

Apply

1. Why opamp is called as linear amplifier?
2. Why impurities are used?
3. Calculate the value of resistance having co lour code sequence Red , Yellow, orange and Gold.
4. Why do we use transformer in rectifier circuit?
5. Which impurity play important role in formation of P type semiconductor?
6. Calculate the % ripple factior, if the dc output voltage 20 V and ac voltage 2V.
7. Three resistors are connected in series across a 12V battery. The first resistance has a value of 2 Ω, second has a voltage drop of 4V and third has power dissipation of 12 W. Calculate the value of the circuit current.
8. A 25 Ω resistor is connected in parallel with a 50 Ω resistor. The current in 50 Ω resistor is 8A. What is the value of third resistance to be added in parallel to make the total line current as 15A.
9. A toroidal air cored coil with 2000 turns has a mean radius of 25cm, diameter of each turn being 6cm. If the current in the coil is 10A, find mmf, flux, reluctance, flux density and magnetizing force.
10. The self inductance of a coil of 500turns is 0.25H.If 60% of the flux is linked with a second coil of 10500 turns. Calculate a) the mutual inductance between the two coils and b) emf induced in the second coil when current in the first coil changes at the rate of 100A/sec.
11. An air cored toroidal coil has 480 turns, a mean length of 30cm and a cross-sectional area of 5 cm^2.Calculate a)the inductance i\of the coil and b) the average induced emf, if a current of 4 A is reversed in 60 milliseconds

Analyze / Evaluate

1. Why inductor is referred as a choke?
2. Why single phase induction motor are not self starting?
3. How the barrier potential is developed across the P-N Junction, what are the approximate values this potential for Germenium and Silicon?
4. Trivallent impurity is called as donor impurity, comment.
5. Distinguish with diagram, then solid material on the basis of band diagram.
6. How a zener diode can be used for voltage regulation in power supply?
7. How voltage source is converted into current source and vice versa?
8. Differentiate P type and N type semiconductor
9. Distinguish between metal, semiconductor and insulator. Give examples of each.
10. Distinguish between half wave and full wave rectifier

Create

1. Design a half wave uncontrolled rectifier and calculate the ripple factor.
2. Design a full wave uncontrolled rectifier and calculate the efficiency.

Unit I

Electric Circuits

Definition of Voltage, Current, Power & Energy, Ohm's law, Kirchoff's Law & its applications – simple problems, division of current in series & parallel circuits, generation of alternating EMF, definition of RMS value, average value, peak factor, form factor. Power in single phase AC – three phase system.

Star to delta and delta to star transformations, R-L and R-C series circuit

12 Hours

Unit II

Magnetic Circuits

Definition of MMF, Flux, Reluctance, Properties of Flux lines, Self & Mutual Inductance, Ampere Turns, Series & parallel magnetic circuits, Comparison between Electric & magnetic circuits, Law of Electromagnetic induction, Fleming's Right & Left hand rule.

Magnetic impedance, Effective resistance, Magnetic capacitivity

12 Hours

Unit III

Electrical Machines

Construction, Type, Principle of Operation & Working Principle of DC Generator, DC Motor, Transformer, Induction Motor, Induction type single phase energy meter, Domestic wiring practice, Tube light circuit, Earthing & earthing methods.

Characteristics of DC generators and DC motors,

12 Hours

Unit IV

Electronics Engineering

PN Junction diode & Zener diode – Characteristics – Half wave and full wave rectifier – Bipolar junction transistors – CB,CE, CC Configurations and characteristics – basic concepts of amplifiers and oscillators – Logic gates – Inverting, Non inverting amplifiers and Operational amplifiers- Basic Computer organization – Block diagram of Microprocessors (8085).

Semiconductor theory, Diode clippers, op-amp parameters and applications

12 Hours

Unit V

Communication Engineering

Introduction to communication systems – Need for modulation – Types- Block Diagram representation only – Block diagram of TV system – Introduction to cellular & mobile telephony- Block diagram of Optical and Satellite communication systems.

Analog and digital signals, Transmission medium, Digital communication

12 Hours

Total: 60 Hours

Textbook(s)

1. T. K. Nagsarkar and M. S. Sukhija, "*Basic of Electrical Engineering"*, Oxford Press, 2012
2. R. Muthusubramaninan, S. Salivahanan and K. A. Muraleedharan, "*Basic Electrical, Electronics and Computer Engineering"*, Tata McGraw Hill, 2006

References

1. J. A. Edminister, "*Electric Circuits"*, Schaum's Series, McGraw Hill, 2005
2. Van Valkenbergm, "*Electric Circuits and Network Analysis"*, Prentice Hall (India) Pvt. Ltd., 2005
3. Smarjith Ghosh, "*Fundamentals of Electrical and Electronics Engineering"*, Prentice Hall (India) Pvt. Ltd., 2005

11O208 ENGINEERING GRAPHICS

(Common for AU,CE,EEE,ME,MXE,BT,IT & TT (I Semester); AE,CSE,ECE,EIE & FT (II Semester)

2 0 2 3.0

Objectives

- To understand and appreciate the importance of Engineering Graphics in Engineering
- To understand the basic principles of Technical/Engineering Drawing
- To understand the different steps in producing drawings according to BIS conventions

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment
g) Graduates will demonstrate skills to use modern engineering and information technology tools necessary for engineering practice

Course Outcomes (COs)

- Able to understand the pictorial representation
- Able to understand different views of orthographic projection
- Able to draw the three dimensional object from the given orthographic views

ASSESSMENT PATTERN

	Internal Assessment	Semester End Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	15	25
Record	10	-
Mini-project / Model Examination / Viva-voce	15	10
Total	**50**	**50**

Remember

1. Define Graphic communication or Drawing.
2. List the different drawing instruments.
3. What is blueprint?
4. What are the applications of engineering graphics?
5. What are the two types of drawings?
6. What are the different types of projections?
7. Define Orthographic projection.
8. What do you mean by I angle projection?
9. What is III angle projection?
10. Define Plan.
11. What is Elevation?
12. List the various types of lines.
13. What do you mean by a Plane?
14. Name the five standard sizes of drawing sheets that are specified by BIS.
15. Give the BIS codes for Lettering, Dimensioning and lines.
16. State few important dimensioning rules.
17. What are the two types of Solids?
18. What is Representative Fraction (RF)?
19. What is a Frustum?
20. Define Truncation.

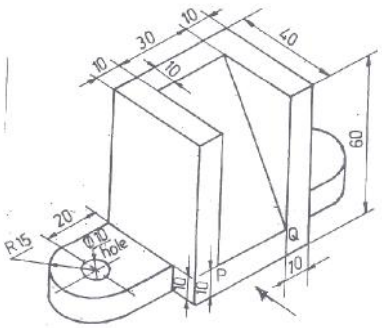
21. Define Section Plane and give its types.
22. What do you mean by development of surfaces?
23. State the principle of Isometric projection.
24. What is Isometric View?
25. Define Isometric scale.

Understand

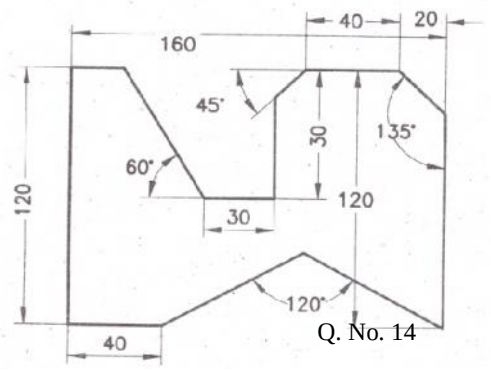
1. When an object is said to be in III quadrant?
2. Why are the projectors perpendicular to the Projection Plane in the Orthographic projection?
3. What is the Shape of the section obtained when a cone is cut by a plane passing through the apex and center of the base of the cone?
4. Why II and IV angle projections are not used in industries?
5. What are the differences between I angle and III angle projections?
6. Which method is suitable for developing a truncated prism?
7. Why is a hexagonal headed bolt and nut more common in use as compared to square headed bolt and nut?
8. Which is the most suitable method for drawing the Perspective Projection?
9. What are the prerequisites for Free hand sketching?
10. What are the two methods used to obtain the Isometric view of a circle?

Apply/Evaluate

1. How will you project a point which is above HP and in front of VP?
2. How will you project a point which is below HP and behind VP?
3. What is the method used to determine the True length and inclination of a line inclined to both the planes?
4. How will you project a prism whose axis is inclined to HP and parallel to VP by Change of Position method?
5. How will you project a cylinder when the axis is inclined to VP and parallel to HP by change of position method?
6. How will you project a pyramid whose axis is inclined to HP and parallel to VP by Change of Position method?
7. How will you project a cone when the axis is inclined to VP and parallel to HP by change of position method?
8. How will you obtain the Sectional view of solids in simple vertical position cut by planes inclined to any one reference plane?
9. How will you develop the lateral surfaces of simple and truncated solids?
10. How will you develop the complete surfaces of Frustums?
11. Construct an isometric scale.
12. A cricket ball thrown from the ground level reaches the wicket keeper's gloves. Maximum height reached by the ball is 5m. The ball travels a horizontal distance of 11m from the point of projection. Trace the path of the ball.
13. The Pictorial view of an object is shown below. Draw the following views to full size scale.
    a) Elevation in the direction of arrow
    b) Left end elevation
14. Read the dimensioned drawing shown below. Redraw the figure to full size and dimension it as per Indian Standards.



Q. No. 13



Q. No. 14

Unit I

Concepts and Conventions

Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. General principles of orthographic projection – First angle projection – Layout of views – Projection of points, located in all quadrant and straight lines located in the first quadrant – Determination of true lengths and true inclinations.

6 Hours

Unit II

Projection of Solids

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

6 Hours

Unit III

Section of Solids and Development of Surfaces

Sectioning of solids like prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one Reference: plane – Obtaining the true shape of section. Development of lateral surfaces of simple solids – prisms, pyramids, cylinders and cones.

6 Hours

Unit IV

Isometric Projection and Perspective Projection

Principles of isometric projection – isometric scale – isometric projections of simple solids, pyramids, cylinders and cones. Orthographic projection - Systems of orthographic projection - First angle orthographic projection - Conversion of pictorial to orthographic views (Free hand).

6 Hours

Unit V

Introduction to AutoCAD and 2D Modeling

Starting AutoCAD – Interfaces – Menus – Tool bars – Coordinates – Limits – Units – 2D commands – Drawing Commands - Creating a Point, Construction of Lines, Polyline, Multiline, Circles, Arcs, Rectangle, Polygon, Ellipse, Hatch, Text, Mtext, Linetypes – Edit and Modify commands - Copy, Move, Erase, Mirror, Zoom, Pan, Arrays, Trim, Break, Fillet, Chamfer, Redraw, Regen, Dimensioning, Colors, Layers – Exercises

6 Hours

Total: 30+30 Hours

Textbook(s)

1. K. V. Natarajan, "*A Textbook: of Engineering Graphics*", Dhanalakshmi Publishers, Chennai, 2006

References

1. S. Julyes Jaisingh, "*Engineering Graphics*", Tri Sea Publishers, 2010
2. V. Rameshbabu, "*Engineering Graphics*", VRB Publishers Pvt Ltd., 2009
3. K. Venugopal, "*Engineering Graphics*", New Age International (P) Limited, 2002
4. N. D. Bhatt, "*Engineering Drawing*", Charotar publishing House 2003
5. K. L. Narayana and P. Kannaiah, "*Engineering Graphics*", Scitech Publications (Pvt) Limited-2002

List of Experiments

1. Projection of points located in all quadrants.
2. Projection of straight lines located in the first quadrant inclined to both the planes.
3. Determination of true lengths and true inclinations of Straight lines.
4. Projection of Solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.
5. Sectioning of solids in simple vertical position by cutting planes inclined to one reference plane and obtaining true shape of section.
6. Development of lateral surfaces of simple and truncated solids like prisms, pyramids cylinder and cone.
7. Isometric Projections / Views of Solids like prisms, pyramids and Cylinders.
8. Orthographic Projection of various components from pictorial views.
9. Drawing of front, top and side views from given pictorial views using AutoCAD.
10. Drawing sectional views of prism, pyramid and cylinder using AutoCAD.

Practical Schedule **Total: 30 Hours**

Sl. No	Experiment	Hours
1	Projection of points located in all quadrants	3
2	Projection of straight lines located in the first quadrant inclined to both the planes.	3
3	Determination of true lengths and true inclinations of Straight lines	3
4	Projection of Solids when the axis is inclined to one reference plane by change of position method.	3
5	Sectioning of solids in simple vertical position by cutting planes inclined to one reference plane and obtaining true shape of section	3
6	Development of lateral surfaces of simple and truncated solids.	3
7	Isometric Projections / Views of Solids like prisms, pyramids and Cylinders.	3
8	Orthographic Projection of various components from pictorial views.	3
9	Drawing of front, top and side views from given pictorial views using AutoCAD.	3
10	Drawing sectional views of prism, pyramid and cylinder using AutoCAD.	3

11O108 ENGINEERING PHYSICS LABORATORY
(Common for AE, AU, CSE, ECE & EIE & ME (I Semester); CE, EEE, BT, IT, TT & FT (II Semester))

0 0 2 1.0

Objectives

- To know how to execute experiments properly, presentation of observations and arrival of conclusions
- It is an integral part of any science and technology program
- To view and realize the theoretical knowledge acquired by the students through experiments
- To realize the theoretical knowledge acquired through experiments

Program Outcome (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to develop proper and efficient usage of instruments in the Laboratory.
- Able to attain practical knowledge in physics principles and laws especially in optics, thermal physics and properties of matter by performing experiments.
- Able to design experiments by using the concepts of optics, thermal physics and properties of matter for solving engineering problems.

ASSESSMENT PATTERN

	Internal Assessment	Semester End Examination
Preparation	10	15
Execution	10	15
Observation and Results	10	15
Record	5	-
Model Examination	10	-
Viva Voce	5	5
Total	**50**	**50**

List of Experiments (Any 10 Experiments)

1. Determination of moment of inertia and rigidity modulus of wire using torsion pendulum (symmetrical masses method).
2. Determination of Young's modulus by non-uniform bending.
3. Determination of thermal conductivity of a bad conductor using Lee's disc.
4. Determination of frequency of vibrating rod using Melde's apparatus.
5. Determination of viscosity of a liquid - Poiseulle's method.
6. Determination of thickness of a thin wire - air wedge method.
7. Determination of wavelength of mercury spectrum – grating.
8. Determination of refractive index of a liquid and solid using traveling microscope.
9. Determination of energy band gap of a semiconductor diode.
10. Determination of wavelength of LASER and particle size of a given powder.
11. Measurement of numerical aperture and acceptance angle of a optical fiber.
12. Young's modulus – uniform bending (pin and microscope).

Practical Schedule **Total: 30 Hours**

S.No	Experiment	Hours
1.	Determination of moment of inertia and rigidity modulus of wire using torsion pendulum (symmetrical masses method).	3

2.	Determination of Young's modulus by non-uniform bending.	3
3.	Determination of thermal conductivity of a bad conductor using Lee's disc.	3
4.	Determination of frequency of vibrating rod using Melde's apparatus.	3
5.	Determination of viscosity of a liquid - Poiseulle's method.	3
6.	Determination of thickness of a thin wire - air wedge method.	3
7.	Determination of wavelength of mercury spectrum – grating.	3
8.	Determination of refractive index of a liquid and solid using traveling microscope.	3
9.	Determination of energy band gap of a semiconductor diode.	3
10.	Determination of wavelength of LASER and particle size of a given powder.	3

14U209 WORKSHOP PRACTICE

0 0 2 1.0

Objectives

- To learn the use of basic hand tools and
- To know the need for safety in work place
- To gain hands on experience on Carpentry, Fitting, Sheet metal, Plumbing, Arc welding, Foundry, Basic electrical circuits and electronic components
- To have the basic knowledge on working of domestic appliances

Program Outcome (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to use their skills during their project work
- Able to understand the practical difficulties encountered in industries during any assembly work
- Able to do simple electronic and electrical work throughout their carrier.
- Able to rectify simple problem connected with pipe fittings

ASSESSMENT PATTERN

	Internal Assessment	Semester End Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	10	25
Record	10	-
Mini-project / Model Examination / Viva-voce	20	10
Total	**50**	**50**

Remember

1. What are the tools used in sheet metal work?
2. What are the types of joints in sheet metal work?
3. What is moulding?
4. What is green sand mould?
5. What is gas welding?
6. List out the types of flames in welding.
7. What is meant by carpentry?
8. What is the use of Saw?
9. What are the types of joints in pipe connection?
10. What is staircase wiring?
11. What are the types of valves in plumbing and where it is used?
12. List out the cutting tools used in carpentry with specification.
13. What are the necessary equipments used in Arc Welding?
14. What are the methods used in sheet metal work?
15. List out the types and components of Air- Conditioner.
16. What is resistor?

Understand

1. Compare the Refrigeration system with air Condition system.
2. How the refrigeration system works?
3. How will you select the suitable welding process for various materials?
4. How will make a V joint in the given MS flat?

5. How will you make a green sand mould using solid pattern?
6. How gadget like chair, sofa, table, cell phone stand by using welding joints?
7. How metals are manufactured by using casting process?
8. How cavity is formed by using pattern?

Apply / Evaluate

1. Sketch the wiring diagram for a room consist of two fans ,three tubelights, and one plug point.
2. Sketch the line diagram of the plumbing work carried out in your house.
3. Sketch all the wooden furniture present in your house in three dimensional view.
4. How will make a connection of basic pipe lines, using PVC pipes, that includes valves and taps?
5. How will form Staircase and Godown wiring?
6. Prepare a hexagonal shape pen stand by using power tools.
7. Prepare a cover with handle by using sheet metal to cover a motor.
8. Prepare a small trolley to carry wastage by using welding work.
9. Evaluate the resistance of the given resistor using colour codes.

List of Experiments

1. Forming of simple objects using sheet metal.
2. Preparing a V joint from the given MS flat.
3. Preparing a half round joint from the given MS flat.
4. Making simple gadget like chair, sofa, table, cell phone stand by using welding joints.
5. Making simple gadget like pen stand, box, cell phone stand etc., by using power tools.
6. Making a connection of basic pipe lines, using PVC pipes, that includes valves and taps.
7. Preparing a green sand mould using solid pattern.
8. Demonstration of residential house wiring using switches, fuse, indicator, lamp and energy meter.
9. Staircase and Go down wiring.
10. Demonstration of working of domestic appliances: Washing Machine/ Refrigerator and Window Air-Conditioner.
11. Demonstration of working of domestic appliances: Mixer Grinder, Electric Iron/ Heater.
12. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
13. Assembly and disassembly of television system

Practical Schedule **Total: 30 Hours**

Sl. No.	Experiment	Hours
1.	Forming of simple objects using sheet metal.	3
2.	Preparing a V joint from the given MS flat.	3
3.	Preparing a half round joint from the given MS flat.	3
4.	Making simple gadget like chair, sofa, table, cell phone stand by using welding joints.	3
5.	Making simple gadget like pen stand, box, cell phone stand etc., by using power tools.	2
6.	Making a connection of basic pipe lines, using PVC pipes, that includes valves and taps.	2
7.	Preparing a green sand mould using solid pattern.	3
8.	Demonstration of residential house wiring using switches, fuse, indicator, lamp and energy meter	2
9.	Staircase and Godown wiring.	2
10.	Demonstration of working of domestic appliances: Washing Machine/	2

	Refrigerator and Window Air-Conditioner.	
11.	Demonstration of working of domestic appliances: Mixie, Electric Iron/ Heater.	1
12.	Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.	2
13.	Assembly and disassembly of television system	2

11O201 ENGINEERING MATHEMATICS II
(Common to all branches)

3 1 0 3.5

Objectives

- To acquire knowledge to use multiple integrals to find area and volume of surfaces and solids respectively.
- To have a good grasp of analytic functions, complex integration and their interesting properties and applications.

Programme Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

Course Outcomes (COs)

- Able to acquire more knowledge in basic concepts of engineering mathematics.
- Able to improve problem evaluation technique.
- Able to choose an appropriate method to solve a practical problem.

ASSESSMENT PATTERN

S. No	Bloom's Taxonomy (New Version)	Test I[G]	Test II[G]	Model Examination[G]	Semester End Examination
1	Remember	20	20	20	20
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze/Evaluate	10	10	10	10
5	Evaluate	-	-	-	-
6	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define Jacobian in two dimensions.
2. State Green's theorem.
3. Define directional derivative of a vector point function.
4. Define analytic function.
5. What is the formula for finding the residue of a double pole?
6. State Cauchy's integral formula.
7. Write the necessary condition for a function f (z) to be analytic.
8. Write the formula for unit normal vector?
9. Write all types of singularities.
10. State the sufficient conditions for a function of two variables to have an extremum at a point.

Understand

1. If $u = 2xy, v = x^2 - y^2,\ x = r\cos^{-},\ y = r\sin^{-}$ compute $\frac{\partial(u,v}{\partial(x,y)}$..

[*] The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

2. If $u = f\left(\frac{y-x}{xy}, \frac{z-x}{xz}\right)$ show that $x^2\frac{\partial u}{\partial x} + y^2\frac{\partial u}{\partial y} + z^2\frac{\partial u}{\partial z} = 0..$

3. Transform the integral $\int_0^{\infty}\int_0^{y} f(x,y)dxdy$ to polar coordinates.

4. Change the order of integration in $\int_0^{2}\int_0^{x} f(x,y)dydx$.

5. Find a, such that (3x-2y+z) $\bar{i}$ + (4x+ay-z) $\bar{j}$ + (x-y+2z) $\bar{k}$ is solenoidal.

6. What is the greatest rate of increase of $¤ = xyz^2$ at (1,0,3)?

7. Test the analyticity of the function w = sin z.

8. Find $\frac{dw}{dz}$ given w = tan z.

9. Evaluate $\int_c \frac{dz}{(z-3)^2}$ where c is the circle $|z| = 1.$

10. Find the residue of the function $f(z) = \frac{4}{z^3(z-2)}$ at its simple pole.

Apply

1. Examine the function $u = x^4 + y^4 - 2x^2 + 4xy - 2y^2$ for extreme values.

2. Check if $u = \frac{x+y}{x-y}, v = \frac{xy}{(x-y)^2}$ are functionally dependent. If so find the relationship between them.

3. By transforming into cylindrical polar coordinates evaluate $\iiint_R (x^2+y^2+z^2)dxdydz$ taken over the region of space defined by $x^2 + y^2 \le 1$ and $0 \le x \le 1.$

4. Using Gauss divergence theorem evaluate $\iint_s \vec{F}\cdot\hat{n}ds$ *where* $\vec{F} = 4xz\,\vec{i} - y^2\,\vec{j} + yz\,\vec{k}$ and S is the surface of the cube bounded by x = 0, y = 0, z = 0, x = 1, y = 1, z = 1.

5. When the function f(z) = u + iv is analytic, show that u = constant and v = constant are orthogonal.

6. Determine the image of $1 < x < 2$ under the mapping $w = \frac{1}{z}.$

7. Find the area of the cardiod r = 4 (1+ cos θ) using double integral.

8. Apply Green's theorem in the plane to evaluate $\int_c (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the boundary of the region defined by x = 0, y = 0 and x + y = 1.

9. If $u = \log(x^2 + y^2)$, find v and f (z) such that f (z) = u + iv is analytic.

10. Using Cauchy's integral formula evaluate $\int_C \frac{e^z\,dz}{(z+2)(z+1)^2}$ where C is the Circle $|z| = 3.$

Analyze / Evaluate

1. Prove that $x = \frac{u}{v-w}, y = \frac{v}{w-u}, z = \frac{w}{u-v}$ are functionally dependent.

2. If $g(x,y) = \cdot(u,v)$ where $u = x^2 - y^2,\ v = 2xy$ prove that $\frac{\partial^2 g}{\partial x^2} + \frac{\partial^2 g}{\partial y^2} = 4(x^2 + y^2)\left(\frac{\partial^2 \cdot}{\partial u^2} + \frac{\partial^2 \cdot}{\partial v^2}\right)$.

3. Evaluate the integration $\int\int\int xyzdxdydz$ taken throughout the volume for which $x, y, z \geq 0$ and $x^2 + y^2 + z^2 \leq 9$.

4. Evaluate the following integral by changing to spherical coordinates $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dx\,dy\,dz}{\sqrt{1 - x^2 - y^2 - z^2}}$.

5. Verify Gauss divergence theorem for $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$ where S is the surface of the cuboid formed by the planes x= 0, x= a, y = 0, y = b, z = 0 and z = c.

6. Determine the bilinear transformation that maps the points -1, 0, 1 in the z-plane onto the points 0, i, 3i in the w-plane.

7. Evaluate $\int_0^{2\pi} \frac{\cos 2\theta}{5 - 4\cos\theta} d\theta$.

8. Using contour integration, evaluate $\int_0^{\infty} \frac{x^2}{(x^2+9)(x^2+4)} dx$.

9. Expand $f(z) = \frac{z}{(z-1)(z-3)}$ as Laurent's series valid in the regions:
$1 < |z| < 3$ and $0 < |z-1| < 2$.

10. Show that $\vec{F} = (6xy + z^3)\vec{i} + (3x^2 - z)\vec{j} + (3xz^2 - y)\vec{k}$ is irrigational vector and find the scalar potential function ¤ such that $\vec{F} = \nabla ¤$.

Unit I
Functions of Several Variables
Functions of two variables - Partial derivatives - Total differential - Derivative of implicit functions - Maxima and minima - Constrained Maxima and Minima by Lagrangian Multiplier method - Jacobians-application to engineering problems.

9 Hours

Unit II
Multiple Integrals
Double integration in cartesian and polar co-ordinates - Change of order of integration - change of variables- Area and volume by multiple integrals- application to engineering problems.

9 Hours

Unit III
Vector Calculus
Gradient - divergence - curl- line - surface and volume integrals - Green's - Gauss divergence and Stokes' theorems (statement only) - application to engineering problems.

9 Hours

Unit IV
Analytic Functions
Analytic functions- Necessary condition of analytic function-Sufficient condition of analytic function(statement only)- properties - Determination of analytic function using Milne Thomson's method, conformal mappings - Mappings of w= z + a, az, 1/z, e^z- bilinear transformation - application to engineering problems.

9 Hours

Unit V

Complex Integration

Cauchy's fundamental theorem (statement only)- and application of Cauchy's integral formula(statement only) – Taylor's and Laurent's series- classification of singularities - Cauchy's residue theorem (statement only) – Contour integration - circular and semi circular contours (excluding poles on the real axis)- application to engineering problems

9 Hours

Total: 45+15 Hours

Textbook(s)

1. B. S. Grewal, "*Higher Engineering Mathematics"*, Khanna Publications, New Delhi, 2000.
2. K. A. Lakshminarayanan, K. Megalai, P. Geetha and D. Jayanthi, *"Mathematics for Engineers"*, Volume II, Vikas Publishing House, New Delhi. 2008.

References

1. P. Kandasamy, K.Gunavathy and K. Thilagavathy, "*Engineering Mathematics"*, Volume II, S. Chand & Co., New Delhi, 2009.
2. T. Veerarajan, "Engineering *Mathematics"*, Tata McGraw Hill Publications, New Delhi, 2008.
3. E. Kreyszig, "*Advanced Engineering Mathematics*", John Wiley & Sons, Inc, Singapore, 2008.
4. C. Ray Wylie and Louis. C. Barrett, "*Advanced Engineering Mathematics"*, Tata McGraw Hill Publications, 2003.

11O103 ENGINEERING CHEMISTRY
(Common to all branches)

3 0 0 3.0

Objectives

- To impart knowledge on the principles of water characterization, treatment methods and industrial applications
- To understand the principles and application of electrochemistry and corrosion science
- To provide basic information and application of polymer chemistry, nanotechnology and analytical techniques

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

Course Outcomes (COs)

- Able to differentiate hard and soft water, understand the disadvantages of using hard water domestically and industrially, select and apply suitable treatments.
- Able to gain an understanding of oxidation and reduction reactions as they relate to engineering applications such as batteries and electroplating.
- Able to comment on design of a metallic part which shows resistance to corrosion and analyze losses incurred due to corrosion.

ASSESSMENT PATTERN

S.No	Bloom's Taxonomy (New Version)	Test I[G]	Test II[G]	Model Examination[G]	Semester End Examination
1	Remember	20	20	10	10
2	Understand	20	20	20	20
3	Apply	30	30	30	30
4	Analyze	20	20	20	20
5	Evaluate	10	10	20	20
6	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Distinguish between alkaline and non alkaline hardness.
2. What is meant by priming? How is it prevented?
3. What is meant by caustic embrittlement?
4. What is the role of calgon conditioning in water treatment?
5. What is break point chlorination?
6. Write the significances of EMF series.
7. Define single electrode potential of an electrode.
8. Differentiate between electrochemical and electrolytic cells.
9. What are the advantages of H_2-O_2 fuel cell?
10. What are reference electrodes?
11. Mention the various factors influencing the rate of corrosion.
12. State Pilling-Bedworth rule.
13. What are the constituents of water repellant paints?
14. What is pitting corrosion?

[*] The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

15. Write any four applications of galvanic series.
16. Differentiate nanocluster and nanocrystal.
17. List the monomers of nylon -6 and nylon-11.
18. Define functionality of a monomer.
19. What are the monomers of epoxy resin?
20. Differentiate addition and condensation polymers.
21. What are auxochromes? Give examples.
22. Give any two applications of IR spectroscopy.
23. State Beer-Lambert's law.
24. Write any two applications of flame photometry.
25. What are the limitations of Beer-Lambert's law?

Understand

1. Soft water is not demineralized water whereas demineralized water is soft water- Justify.
2. Why sodium carbonate conditioning is not advisable for high pressure boilers?
3. Boiling cannot give protection to water for all time – Reason out.
4. What are the significances of RO method of water treatment?
5. Compare reversible and irreversible cells?
6. Reason out why do the properties of materials change at nanoscale?
7. Why calomel electrode is called as secondary reference electrode?
8. A steel screw in a brass marine hardware corrodes. Why?
9. What is the action of brine solution on iron rod?
10. Why magnesium element is coupled with underground pipe line?
11. Which is the easier way to control corrosion?
12. Lithium battery is the cell of future- Justify.
13. Iron corrodes at a faster rate than aluminium- Give reason.
14. Differentiate electro and elctroless platting.
15. How do thermoplastics differ from thermosetting plastics?
16. TEFLON is superior to other addition polymers-Justify.
17. Write any two advantages of free radical polymerization.
18. Calculate the degree of freedom of water molecule.
19. Differentiate AAS and flame photometry.
20. What is the role of thiocyanide solution in the estimation of iron by colorimetry?

Apply

1. A water sample contains 204 mgs of $CaSO_4$ and 73 mgs of $Mg(HCO_3)_2$ per litre. Calculate the total hardness in terms of $CaCO_3$ equivalence.
2. 100 ml of sample water has hardness equivalent to 12.5ml of 0.08N $MgSO_4$. Calculate hardness in ppm.
3. What is the single electrode potential of a half cell of zinc electrode dipped in a 0.01M $ZnSO_4$ solution at 25^0C? $E^0_{Zn/Zn^{2+}} = 0.763$ V, R=8.314 $JK^{-1}Mol^{-1}$, F= 96500 Coulombs.
4. Calculate the reduction potential of Cu^{2+}/Cu=0.5M at 25^0C. $E^0_{Cu^{2+}/Cu}$= +0.337V.
5. Mention the type of corrosion that takes place when a metal area is covered with water.
6. Bolt and nut made of the same metal is preferred in practice. Why?
7. Caustic embrittlement is stress corrosion- Justify.
8. Metals which are nearer in electrochemical series is preferred in practice. Why?
9. What are the disadvantages of NICAD battery?
10. What are the requirements of a good paint?
11. What information can you get from DP?
12. What is degree of polymerization? Calculate the degree of polymerization of polypropylene having molecular weight of 25200.
13. How the functionality of monomer influences the structure of polymer?
14. Mention the commercial applications of epoxy resins.
15. On what basis polyamide is named as NYLON?
16. Why UV spectroscopy is called as electronic spectra?
17. IR spectrum is called as vibrational spectrum- Justify.
18. How absorption spectrum is differing from emission spectrum?

Analyze/Evaluate

1. Distinguish between hardness and alkalinity.
2. Distinguish between battery and cell.

3. Corrosion phenomenon is known as thousand dollar thief - reason out.
4. What is the basic difference between polymers and oligomers?
5. How do you identify an organic molecule using IR spectrum?

Unit I

Chemistry of Water and its Industrial Applications

Hardness of water: Equivalents of calcium carbonate - Units of hardness - Degree of hardness and its estimation (EDTA method) - Numerical problems on degree of hardness - pH value of water. Use of water for industrial purposes: Boiler feed water-scale-sludge - caustic embrittlement. Softening of hard water: External conditioning – zeolite - ion exchange methods - internal conditioning – calgon - phosphate methods. Desalination: Reverse osmosis - electrodialysis. Use of water for domestic purposes: Domestic water treatment - Disinfection of water - break point chlorination.

Characterization of your campus water.

9 Hours

Unit II

Electrochemistry for Materials Processing

Introduction – emf - Single electrode potential - Hydrogen electrode - Calomel electrode - Glass electrode - pH measurement using glass electrode - Electrochemical series. Cells: Electrochemical cells – Cell reactions- Daniel cell – Reversible cells and irreversible cells - Difference between electrolytic cells and electrochemical cells. Concept of electroplating: Electroplating of gold - electroless plating (Nickel). Batteries: Secondary batteries - lead acid, nickel - cadmium and lithium batteries. Fuel cell: Hydrogen - oxygen fuel cell.

Electricity assisted painting.

9 Hours

Unit III

Chemistry of Corrosion and its Control

Corrosion: Mechanism of corrosion- – Chemical and electrochemical - Pilling-Bedworth rule - Oxygen absorption – Hydrogen evolution - Galvanic series. Types of corrosion: Galvanic corrosion - Differential aeration corrosion - Examples - Factors influencing corrosion. Methods of corrosion control: Sacrificial anodic protection - Impressed current method. Protective coatings: Paints - Constituents and Functions. Special paints: Fire retardant - Water repellant paints.

Applications of vapour phase inhibitors.

9 Hours

Unit IV

Introduction to Polymer and Nanotechnology

Polymers: Monomer - functionality - Degree of polymerization - Classification based on source - applications. Types of polymerization: Addition, condensation and copolymerization. Mechanism of free radical polymerization. Thermoplastic and thermosetting plastics - Preparation, properties and applications: Epoxy resins, TEFLON, nylon and bakelite. Compounding of plastics. Moulding methods: Injection and extrusion. Nanomaterials: Introduction – Nanoelectrodes - Carbon nanotubes - Nanopolymers - Application.

A detailed survey on application of polymer in day to day life.

9 Hours

Unit V

Instrumental Techniques of Chemical Analysis

Beer – Lambert's law - Problems. UV visible and IR spectroscopy: Principle- Instrumentation (block diagram only) - Applications. Colorimetry: Principle – Instrumentation (block diagram only) - Estimation of iron by colorimetry. Flame photometry: Principle - Instrumentation (block diagram only) - Estimation of sodium by flame photometry. Atomic absorption spectroscopy: Principle - Instrumentation (block diagram only) - Estimation of nickel by atomic absorption spectroscopy.

Applications of analytical instruments in medical field.

9 Hours

Total: 45 Hours

Textbook(s)

1. P. C. Jain and M. Jain, "*Engineering Chemistry*", Dhanpat Rai Publications., New Delhi, 2009.
2. R. Sivakumar and N. Sivakumar, "*Engineering Chemistry*", Tata McGraw-Hill, New Delhi, 2009.
3. B. R. Puri, L. R. Sharma and Madan S. Pathania, "*Principles of Physical Chemistry*", Shoban Lal Nagin Chand & Co., 2005.

References

1. Sashi Chawla, "*Text Book of Engineering Chemistry*", Dhanpat Rai Publications, New Delhi, 2003.
2. B. S. Bahl, G. D. Tuli and Arun Bahl, "*Essentials of Physical Chemistry*", S. Chand & Company, 2008.
3. J. C. Kuriacose and J. Rajaram, "*Chemistry in Engineering & Technology*", Vol. 1&2, Tata McGraw-Hill, 2009.
4. C. P. Poole Jr., J. F. Owens, "*Introduction to Nanotechnology*", Wiley India Private Limited, 2007.
5. Andre Arsenault and Geoffrey A. Ozin, "*Nanochemistry*: *A Chemical Approach to Nanomaterials*", Royal Society of Chemistry, London, 2005.

Language elective II
(Common to all branches- Regulation 2011)

3 1 0 3.5

14U204- APPLIED MATERIALS SCIENCE
(Common to AE, AU, CE, and ME- Regulation 2011)

3 0 0 3.0

Objectives

- To make students familiar in the properties of conducting, semiconducting, magnetic and dielectric materials
- To acquire knowledge in thermal properties of materials used in construction and non-destructive techniques

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

Course Outcomes (COs)

- Able to understand how conducting materials are influencing engineering design.
- Able to demonstrate magnetic and electrical properties of materials.
- Able to gain the fundamentals of polarizable solids.

ASSESSMENT PATTERN

S.No	Bloom's Taxonomy (New Version)	Test I[G]	Test II[G]	Model Examination[G]	Semester End Examination
1	Remember	25	25	20	20
2	Understand	25	25	25	25
3	Apply	20	20	20	20
4	Analyze	20	20	20	20
5	Evaluate	10	10	15	15
6	Create	-	-	-	-
Total		100	100	100	100

Remember

1. Mention the postulates of classical free electron theory.
2. State Wiedemann-Franz law.
3. Define the term Fermi energy and mention its importance.
4. Define drift velocity. How is it different from thermal velocity of an electron?
5. Explain the Fermi-Dirac distribution function of electrons. Illustrate graphically the effect of temperature on the distribution.
6. Define mean free path.
7. Distinguish between the p-type and n-type semiconductors.
8. What are donors and acceptors?
9. What is the meaning of band gap of a semiconductor?
10. Discuss the variation of Fermi level with temperature in the case of p-type and n-type semiconductors.
11. Explain the different types of polarization mechanisms in dielectrics and sketch their dependence on the frequency of applied electric field.
12. What is dielectric breakdown? Summarize the various factors contributing to breakdown in dielectrics.
13. Discuss the different modes of heat transfer and mention their special features.
14. Write a note on X-ray fluoroscopy.
15. Describe the construction and working of ultrasonic flaw detector. Also write merits and demerits.
16. What is the basic principle of liquid penetrant method?
17. Briefly discuss the different stages involved in LP testing.
18. What are the characteristics of the LP testing materials?

[*] The marks secured in Test I and II will be converted to 20 and Model Examination marks will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

Understand

1. Mention the salient features of the 'free electron gas' model. Obtain the Ohm's law based on it.
2. Mention the limitations of classical free electron theory.
3. Define density of states and also mention its uses.
4. Explain thermal conductivity and derive an expression for thermal conductivity of metals.
5. Derive an expression for density of states in a metal and hence obtain the Fermi energy in terms of density of free electrons.
6. Distinguish between relaxation time and collision time.
7. Why do you prefer extrinsic semiconductor over intrinsic semiconductor?
8. What is Hall effect? What is its use in semiconductors?
9. Deduce the relation for the local field of a dielectric material which is in cubic structure.
10. Deduce Clausius-Mosotti relation and explain its use in predicting dielectric constants of solids.
11. Distinguish between thermal conductivity and thermal diffusivity.
12. Explain the heat flow through compound media in series and parallel.
13. Explain the principle behind radiography.

Apply

1. Assuming the electron-lattice interaction to be responsible for scattering of conduction electrons in a metal, obtain an expression for conductivity in terms of relaxation time and explain any three drawbacks of classical free electron theory of metals.
2. Explain any two practical applications of conduction and convection.
3. Explain the thermal conductivity of rubber.
4. Elaborate how you will explore the defects in automotive parts?

Analyze/Evaluate

1. State the relation between thermal conductivity and electrical conductivity. Does it hold good for all types of materials?
2. Calculate the Fermi energy of copper at 0K. Atomic weight and density of copper are 63.54 and 8950 kg/m^3 respectively.
3. By how many orders of magnitude is the mean free path reduced in a certain metal when temperature increases from 0°C to 340°C? The temperature coefficient of resistivity $\alpha = 5x10^{-3}$.
4. Why do you prefer silicon for transistors and GaAs for laser diodes?
5. Sketch variation of conductivity with temperature incase of intrinsic and extrinsic semiconductors.
6. How will you determine the type of charge carriers present in a semiconductor?
7. Mention the limitations of LP testing.

Unit I

Electrical Properties of Metals

Introduction- Derivation of microscopic form of Ohm's law- postulates of classical free electron theory- derivation of electrical conductivity of metals (Drude- Lorentz theory)- merits and demerits. Derivation of thermal conductivity – Wiedemann-Franz law- verification. Electron energies in metal and Fermi energy- Fermi-Dirac distribution function and its variation with temperature- density of energy states- calculation of density of electron and fermi energy at 0K- average energy of free electron at 0K- Importance of fermi energy- problems.

Quantum free electron theory and Band theory of solids.

9 Hours

Unit II

Semiconducting Materials & Devices

Introduction - elemental and compound semiconductors - Intrinsic semiconductors: density of electrons - density of holes- determination of carrier concentration and position of Fermi energy- band gap energy determination (quantitative treatment). Extrinsic semiconductors: carrier concentration in p-type and n-type semiconductors. Hall effect- theory of Hall effect- experimental determination of Hall voltage- applications. Semi conducting devices: solar cells (Photovoltaic effect) – uses. Photo detectors: pin photo diodes – applications.

Variation of Fermi level with temperature and doping concentration in extrinsic semiconductors.

9 Hours

Unit III

Dielectrics

Introduction- fundamental definitions in dielectrics- expressions for electronic, ionic and orientation polarization mechanisms- space charge polarization- Langevin- Debye equation- frequency and temperature effects on

polarization- dielectric loss- internal field- expression for internal field (cubic structure)- derivation of Clausius-Mosotti equation – importance. Dielectric breakdown- various breakdown mechanisms with characteristics- applications of dielectric materials and insulating materials - problems.
Charging and discharging of capacitors.

9 Hours

Unit IV

Thermal Physics

Mode of heat transfer-thermal conductivity-thermal diffusivity-thermal conduction through compound media (bodies in series and parallel) - thermal conductivity of good conductor - Forbe's method-thermal conductivity of bad conductor- Lee's disc-radial flow of heat-expression for thermal conductivity of rubber-experimental determination-practical applications of conduction-problems.
Thermal and ventilation design of buildings .

9 Hours

Unit V

Non-Destructive Testing

Introduction - various steps involved in NDT process-X-ray radiographic technique -displacement method – merits, demerits and applications of X-ray radiography - X-ray fluoroscopy – liquid penetrant method-advantages, disadvantages and applications –ultrasonic flaw detector - block diagram - construction and working - merits and demerits. Thermography: types-block diagram - recording of thermal images - merits, demerits and applications.
Fluoroscopy or Real-time Radiography.

9 Hours
Total: 45 Hours

Textbook(s)

1. V. Rajendran, "*Engineering Physics"*, Tata McGraw-Hill, New Delhi, 2011.
2. M. Arumugam, "*Physics II"*, Anuradha Publications, Kumbakonam, 2005.

References

1. S. O. Pillai, "*Solid State Physics"*, New Age International Publications, New Delhi, 2006.
2. M.N. Avadhanulu and P.G. Kshirsagar, *"A Text Book of Engineering Physics"*, S. Chand & Company Ltd., New Delhi, 2005.
3. V. Raghavan, "*Materials Science and Engineering"*, Prentice Hall of India, New Delhi, 2009.
4. D.S Mathur, "*Elements of properties of matter"*, S.Chand Publications, New Delhi, Reprints 2010.
5. P.K. Palanisami, "*Physics For Engineers"*, Scitech Publications (India)Pvt. Ltd, Chennai, 2002

14U205- ENGINEERING MECHANICS
(Common to AU and ME- Regulation 2011)

3 0 0 3.0

Objectives

- To comprehend the static equilibrium of particles and rigid bodies, effect of friction on equilibrium, laws of motion, kinematics of motion and the interrelationship
- To gain knowledge on properties of surfaces and solids, learn the behaviour of particles and rigid bodies under motion
- To be able to write the equation for dynamic equilibrium
- All these should be achieved both conceptually and through solved examples

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

Course Outcomes (COs)

- Able to solve problems dealing with forces in a plane or in space and equivalent force systems.
- The student will be able to solve truss, beam, frame and cable problems and understand distributed force systems.
- The student shall be able to solve friction problems and determine moments of inertia and centroid using integration methods.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I*	Test II*	Model Examination*	Semester End Examination
1	Remember	20	20	10	10
2	Understand	30	20	20	20
3	Apply	30	20	30	30
4	Analyze	20	20	20	20
5	Evaluate	-	20	20	20
6	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is rigid body?
2. Name the system of units.
3. Mention the two systems of dimensions.
4. Give the dimension of acceleration under MLT system.
5. What is a force?
6. Define system of forces.
7. How is the force system classified?
8. Which is known as resultant force?
9. State Newton's three laws.
10. Name three graphical methods used to find the resultant of a system of forces.
11. Which are known as laws of mechanics?
12. What is dimensional homogeneity?
13. State parallelogram law of forces.
14. State Lami's theorem.
15. Define 'equilibrium'.

* The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

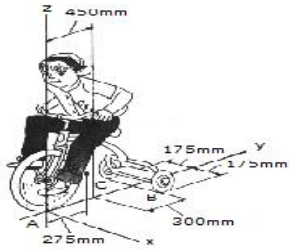
16. Define equilibrant.
17. What is a moment?
18. Define 'couple'.
19. What are the types of supports used in beams?
20. Name the types of loads applied onto a beam.
21. Give an example for coplanar concurrent system of forces.
22. What is a truss?
23. How are the forces in a truss analyzed?
24. Give the equations of equilibrium for particle in 2D and in space.
25. Write down the equations of equilibrium of a rigid body under 2D and 3D.
26. What is called as resolving a force?
27. Define friction.
28. How is the friction classified?
29. What is motion impending?
30. State the nature of friction force.
31. What is angle of friction?
32. What is cone of friction?
33. State the usage of wedge.
34. Give the condition for self-locking of screw jack.
35. What is polar moment of inertia?
36. State parallel axis theorem.
37. State perpendicular axis theorem.
38. Give the relation between area MOI and mass MOI.
39. Write down the formula to find centroid of right angled triangle.
40. State the law of conservation of momentum.
41. State the work-energy principle.
42. What is general plane motion?
43. Give the expression for Newton's laws of motion.
44. What is angular velocity?
45. What is angular acceleration?
46. Define displacement.
47. Define velocity.
48. Define acceleration.
49. What is linear motion?
50. Classify the motions of a rigid body.

Understand

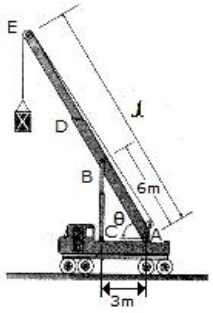
1. Differentiate unit and dimension.
2. How to get the net effect of forces acting simultaneously on a particle?
3. What does the principle of transmissibility imply?
4. State the difference between mass and weight.
5. At what situation Lami's theorem can be used?
6. When to apply parallelogram law or triangular law of forces?
7. Mention the relation between resultant force and an equilibrant.
8. Give two practical examples for application of moment.
9. Give two practical examples for application of couple.
10. How to convert a force into force couple system?
11. Which kind of support has maximum reactions and what are they?
12. Which law is applicable to analyze supports and reactions?
13. Which theorem helps to determine resultant of a parallel coplanar system of forces?
14. Differentiate moment from couple.
15. How will you identify whether the given system is under equilibrium or not?
16. Why force is called as a vector?
17. In problems involving three dimensions, which kind of approach is used to determine the resultant force? Why?
18. Give two practical situations where friction is considered as good.
19. Why friction force is not liked at some situations?
20. $F = \mu N$ is applied only during motion impending condition. State the reason.
21. How to decide whether a body is in motion or not?
22. When to include friction forces?

23. What is the difference between applied force and friction force?
24. When does centroid and centre of gravity will be same?
25. A jet is used to irrigate the plants in a lawn. How to get the maximum length of the jet?
26. A bobber plane is dropping a bomb on the enemy's target. Under which category the analysis can be carried out inorder to find the correct position of dropping?
27. A droplet of water is dropping from the tap. To find the distance between the drops, which laws could be used?
28. What is the use of radius of gyration?
29. How principal MOI differs from MOI?
30. At what situation conservation of momentum principle can be applied?
31. Differentiate distance from displacement.
32. Write the difference between moment and momentum.

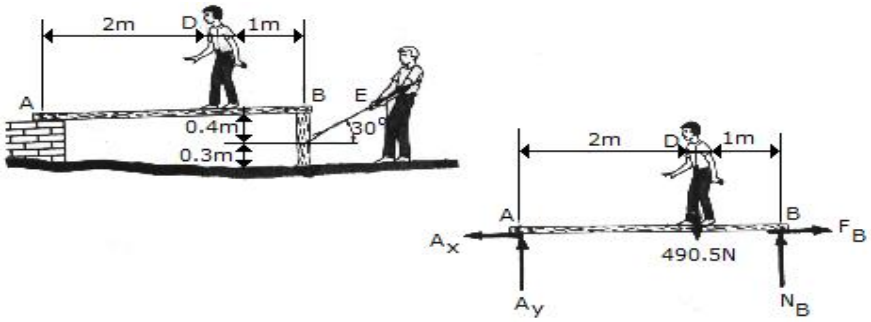
Apply / Evaluate

1. A boat is towed by two ropes making certain inclination from the boat axis. How to determine the resulting direction of boat movement?
2. A load is hanging through rope and a pulley fixed to the ceiling. Knowing the friction coefficient between rope and pulley and the magnitude of weight compute the effort and its direction required to hold the weight in equilibrium position.
3. Given the applied forces, frictional coefficient and weight of a block resting on a rough plane how to check the equilibrium condition of the block?
4. A non-coplanar parallel system of forces is acting on a structure. How to reduce it to a force-couple system?
5. In a 3D analysis of forces a ball and socket support is used. Give the procedure to determine the value of support reactions.
6. Knowing the friction co-efficients and position of the ladder compute the distance through which a man can climb on the ladder before the ladder starts slipping.
7. What is understood by calculating the effort applied to a screw jack to lift up and lower down the given amount of load? Justify the phenomenon.
8. In positioning a beam in a structure, always the depth portion is chosen greater than its width portion. Analyze and write down the reason.
9. Two trains are starting at different time from the same station. Assume that first train always moves with velocity less than that of second train and the acceleration pattern for both trains is different during start, motion and stop of the trains. Enumerate the approach of finding the distance at which second train overtake the first train
10. How to determine the velocity and direction of two bodies having an oblique central impact after the impact is over?
11. 

The girl has a mass of 17kg and mass center at G_g, and the tricycle has a mass of 10kg and mass center at G_t. Determine the normal reactions at each wheel for equilibrium. [N_A = 128.8 N, N_B = N_C = 68.0 N]
12. The crane provides a long-reach capacity by using the telescopic boom segment *DE*. The entire boom is supported by a pin at *A* and by the telescopic hydraulic cylinder *BC*, which can be considered as a two-forcemember. The rated load capacity of the crane is measured by a maximum force developed in the hydraulic cylinder. If this maximum force is developed when the boom supports a mass m = 6 Mg and its length is l =40 and θ = 60°, determine the greatest mass that can be supported when the boom length is extended to l = 50 m and θ = 45°. Neglect the weight of the boom and the size of the pulley at E. Assume the crane does not overturn. Note: when θ = 60° BC is vertical; however, when θ = 45° this is not the case. [m = 3.26 Mg]

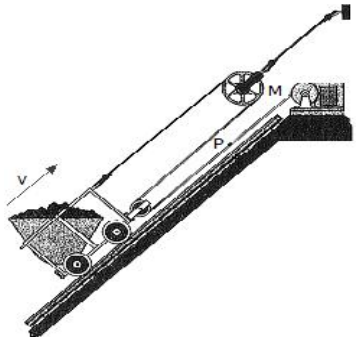


13.



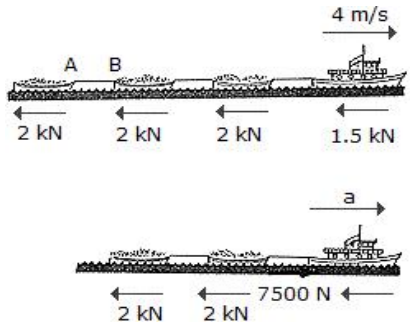
The boy at *D* has a mass of 50 kg, a center of mass at *G*, and stands on a plank at the position shown. The plank is pin-supported at *A* and rests on a post at *B*. Neglecting the weight of the plank and post, determine the magnitude of force *P* his friend (?) at *E* must exert in order to pull out the post. Take $\mu = 0.3$ and $\mu_C =$ 0.8. [P = 264 N]

14.



The mine car is being pulled up to the inclined plane using the motor *M* and the rope-and-pulley arrangement shown. Determine the speed v_p at which a point *P* on the cable must be traveling toward the motor to move the car up the plane with a constant speed of v = 5 m/s. [V_P = 15.00 m/s]

15.



Each of the three barges has a mass of 30 Mg, whereas the tugboat has a mass of 12 Mg. As the barges are being pulled forward with a constant velocity of 4 m/s, the tugboat must overcome the frictional

resistance of the water, which is 2 kN for each barge and 1.5 kN for the tugboat. If the cable between A and B breaks, determine the acceleration of the tugboat. [a = 0.0278 m/s2]

Unit I

Basics and Equilibrium of Particles

Introduction - Units and Dimensions - Laws of Mechanics – Parallelogram Law of forces – Vectors – Vectorial representation of forces -Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle under coplanar forces – Forces in space - Equilibrium of a particle in space

Equivalent force systems

9 Hours

Unit II

Equilibrium of Rigid Bodies

Free body diagram – Types of supports and their reactions – Moments and Couples – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – resolution of a given force into a force acting at a given point and a couple – reduction of a system of coplanar forces acting on a rigid body into a single force and a single couple - Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Problems involving ball and socket joint only

Internal forces in a member

9 Hours

Unit III

Friction

Frictional force – Laws of Coulomb friction – Angle of friction – cone of friction – Equilibrium of bodies on inclined plane – Ladder friction - Wedge Friction – Belt friction – Band brakes - Screw Jack - Self locking - Rolling Resistance –

Friction in journal bearing

8 Hours

Unit IV

Properties of Surfaces and Solids

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Mass moment of inertia – Relation with area MOI –

Mohr's circle to determine principal MOI

9 Hours

Unit V

Dynamics of Particles

Displacements, Velocity and acceleration, their relationship – Linear motion – Curvilinear motion (no derivations) – Newton's law – Work Energy Equation of particles – Principle of Impulse and Momentum – Impact of elastic bodies

Dependent motion between particles

10 Hours

Total: 45 + 15 Hours

Textbook(s)

1. F.P. Beer, and Jr. E.R Johnston, "*Vector Mechanics for Engineers – Statics and Dynamics"*, Tata McGraw-Hill Publishing Company, New Delhi, 2007
2. Dubey N. H., "Engineering Mechanics – Statics and Dynamics", Tata Mc-Graw Hill Education Pvt. Ltd.

References

1. Irving H. Shames, "*Engineering Mechanics - Statics and Dynamics"*, Pearson Education Asia Pvt. Ltd., 2006
2. R.C.Hibbeller, "*Engineering Mechanics: Combined Statics & Dynamics"*, Prentice Hall, 2009
3. D. P. Sharma, "*Engineering Mechanics"*, Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2010
4. S. Rajasekaran and G. Sankarasubramanian, *"Fundamentals of Engineering Mechanics"*, Vikas Publishing House Pvt. Ltd., New Delhi, 2005
5. Robert W. Soutas-Little, Daniel J. Inman and Daniel S. Balint, "*Engineering Mechanics - Statics and Dynamics"*, Cengage LearningIndia Private Limited, New Delhi, 2009

6. *www.**nptel**.iitm.ac.in/video.php?subjectId=112103108*
7. www.**nptel**.iitm.ac.in/video.php?subjectId=122104015

14U206 MANUFACTURING TECHNOLOGY

3 0 0 3.0

Objectives

- To learn various techniques available to make shapes and designs in various Materials
- To make students understand requirements and methodologies to be followed in casting, fabrication and forming of engineering materials

Program Outcomes (POs)

g) Graduates will demonstrate skills to use modern engineering and information technology tools necessary for engineering practice

Course Outcomes (COs)

- Able to know about the different types of Metal casting processes, Welding processes, Bulk deformation processes, Sheet metal processes and Shaping of plastic materials.
- Able to know the application and advantages of varies manufacturing processes.
- Able to select best manufacturing processes for the products.

ASSESSMENT PATTERN

S. No	Bloom's Taxonomy (New version)	Test I*	Test II*	Model Examinations*	Semester End Examination
1	Remember	25	25	25	25
2	Understand	25	25	25	25
3	Apply	20	20	20	20
4	Analyze	10	10	10	10
5	Evaluate	20	20	20	20
6	Create	-	-	-	-
	Total	100	100	100	100

Remember

1. Define casting
2. What is meant by pattern?
3. List out various types of patterns
4. Define solidification.
5. Define core print.
6. List out various types of pattern allowances.
7. What are the various methods of special casting process?
8. Define centrifugal casting
9. What do you mean by lost wax process?
10. What are the defects of casting?
11. Define welding.
12. List the various types welding process
13. What are the different types of electrodes used in arc welding?
14. What are the different types of flames available in gas welding?
15. Define brazing and soldering.
16. Define recrystalization
17. What is meant by hot working and cold working?
18. What is meant by plastic deformation?
19. Define metal forming.
20. Define blanking and piercing.
21. What is meant by trimming and nibbling?
22. Define embossing and coining?
23. What is meant by stretch forming?
24. What is meant by high energy rate forming?
25. Give some application of metal spinning process and explosive forming.

*The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

26. List the various types of plastics
27. What is meant by thermoplastic and thermosetting plastic?
28. Name some applications of Blow molding process.
29. What is meant by rotational molding?
30. List various cutting tool materials
31. List various cutting tool characteristics.
32. List out the basic parts of plain milling machine.
33. What is indexing?
34. Define grinding process
35. What prompted the development of unconventional machining process?
36. List out the main criteria for selecting the electrolyte in electro chemical machining
37. Name the abrasive materials used in abrasive water jet machining.

Understand

1. What are the functions of a binder in moulding sand?
2. Why are the cores reinforced?
3. What are the special features of "resistance projection welding"?
4. What effect does carbon content of steel have on weldability?
5. What is arc Stability? How is it achieved?
6. What is press forging? How does it differ from drop forging?
7. What is purpose of heat treatment of forgings?
8. Write down the significance of parison.
9. How the size of grinding machine is specified?
10. Why a grinding wheel is to be balanced?
11. Why tool fails during cutting?
12. What are the factors that affect tool life?
13. List the reasons for tool wear.
14. How the milling machine is specified?
15. Where rough and finish turning are used?
16. How the jobs are held during surface grinding operation?
17. List out the difference between capstan , turret , and centre lathe
18. What are the different methods of production of gears?
19. Why surface finish is an important in manufacturing process?
20. Why surface finish is an important in manufacturing process?
21. State the advantages of CNC machines over conventional machines

Apply / Evaluate

1. Can the ferrous metals be cast by die-casting method? If yes, then how?
2. Why permanent moulds are preheated before operation?
3. How are the dies for die casting manufactured?
4. Why the cleaning of a joint is important before welding?
5. Why tungsten is preferred for non-consumable electrodes?
6. Why cold worked metal is annealed?
7. Why four high rolling mill is usually used for cold rolling?
8. How are the moulds for plastic parts manufactured?
9. How are the injection moulding machines rated?
10. What are the applications of investment casting?

Unit I

Casting

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

9 Hours

Unit II

Welding

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

9 Hours

Unit III

Machining

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

9 Hours

Unit IV

Forming and Shaping of Plastics

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

9 Hours

Unit V

Metal Forming and Powder Metallurgy

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

9 Hours

Total: 45 Hours

Textbook(s)

1. Hajra Choudhury, “Elements of Workshop Technology”, Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
2. Nagendra Parashar B.S. and Mittal R.K., “Elements of Manufacturing Processes”, Prentice- Hall of India Private Limited, 2007
3. J. P. Kaushish, Manufacturing Processes, PHI Learning Pvt. Ltd., New Delhi, 2010

References

1. Serope Kalpajian, Steven R.Schmid, “Manufacturing Processes for Engineering Materials”, 4/e, Pearson Education, Inc. 2007.
2. Jain. R.K., and S.C. Gupta, “Production Technology”, 16th Edition, Khanna Publishers, 2001.
3. “H.M.T. "Production Technology – Handbook”, Tata McGraw-Hill, 2000.
4. Roy. A. Linberg, “Process and Materials of Manufacture”, PHI, 2000.

14U207 MANUFACTURING TECHNOLOGY LABORATORY

0 0 2 1.0

Objectives

- To study about manufacturing processes used for converting raw materials into finished products. Various processes, machinery, and operations will be examined with emphasis placed on understanding engineering materials and processing parameters that influence design considerations, product quality, and production costs
- To develop basic machinability concepts and improve to your teamwork and entrepreneurial skills

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to work in a centre lathe.
- Able to do Facing, Turning, Boring, Knurling, Grooving, Chamfering and Drilling operations in a given component as per the drawing.
- Able to calculate angle and to make taper in a given component as per the drawing.
- Able to calculate gear trains and to cut external thread in a given component as per the drawing.

ASSESSMENT PATTERN

	Internal Assessment	Semester end examination
Preparation • Remember • Understand • Apply	20	25
Observation and results • Analyze • Evaluate	15	15
Record	5	--
Mini project / Model Examination / Viva-Voce	10	10
Total	**50**	**50**

Remember

1. Lathe specification
2. What are the parts present in lathe?
3. Write down the names of any four lathe accessories
4. Lathe bed material
5. Difference between 3 jaw and 4 jaw chuck?
6. What are the operations performed in lathe machine?
7. What is the purpose of dead centre?
8. What is the purpose of tail stock?
9. What is meant by orthogonal cutting?
10. Give two examples for orthogonal cutting
11. What are the four important characteristics of materials used for cutting tools?
12. What is the purpose of chamfering and boring?
13. Types of knurling
14. Types of threads with suitable angles

15. Define the term 'Thread cutting'
16. Give the HSS composition
17. Define feed and depth of cut.
18. What is meant by tool signature?
19. What is side rake angle? And mention its effects?
20. What is clearance angle? And mention its types?
21. What is meant by nose radius?
22. What is function of chip breakers?
23. Name the factors that contributes to poor surface finish in cutting
24. What are the functions of cutting fluids?
25. What is meant by milling?
26. What is the purpose of end milling cutter
27. What is the purpose of flute in drill tool
28. State the drill tool point angle
29. Name the taper turning methods used in lathe
30. Purpose of swivel base in lathe machine
31. Define tolerance
32. Difference between unilateral and bilateral tolerance
33. Define pitch
34. Define clearance
35. List out some quality symbols
36. Types of jigs and fixtures used in lathe machine

Understand

1. Name the various cutting tool materials.
2. List the various type of feed mechanisms
3. Name the various tool parts of a single point cutting tool
4. What are the standard angles of cutting tool?
5. What is the application of air operated chuck?
6. Write down the formula for calculating taper turning angle by compound rest method.
7. Merits on automatic machine.
8. What are the advantages of automatic lathes?
9. How surface finish obtained in lathe machine?
10. How quality components acquired in lathe machine?

Apply/ Evaluate

1. To find cutting forces are calculated?
2. How taper angle are calculated?
3. Write the formula for tail stock set over method

List of Experiments

1. Exercise on Simple Facing & Turning
2. Exercise on Step Turning using four jaw chuck
3. Exercise on Taper turning Model
4. Exercise on Knurling & Grooving
5. Exercise on Boring & Chamfering
6. Exercise on External thread cutting.
7. Exercise on Drilling using lathe
8. Study on semiautomatic & automatic lathes
9. Design experiment
10. Application oriented experiment

Practical schedule **Total: 45 Hours**

Sl.No	Experiment	Hours
1.	Introduction to Lathe Laboratory	6
2.	Exercise on Simple Facing & Turning	3
3.	Exercise on Step Turning using four jaw chuck	6

4.	Exercise on Taper turning Model	3
5.	Exercise on Knurling & Grooving	3
6.	Exercise on Boring & Chamfering	3
7.	Exercise on External thread cutting	3
8.	Exercise on Drilling using lathe	3
9.	Exercise on Surface Milling.	3
10.	Exercise on Gear Cutting.	6
11.	Exercise on Cutting Key Ways.	6

14U208 'C' PROGRAMMING LABORATORY

2 0 3 3.5

Objectives

- To know the basic concepts problem solving.
- To understand the basic concepts of C.
- To develop the programming skills of students in C.

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment
g) Graduates will demonstrate skills to use modern engineering and information technology tools necessary for engineering practice

Course Outcomes (COs)

- Able to develop programming ability.
- Able to develop applications for real world problems.

ASSESSMENT PATTERN

S. No	Bloom's Taxonomy (New version)	Test I*	Test II*	Model Examinations*	Semester End Examination
1	Remember	20	20	20	20
2	Understand	20	20	20	20
3	Apply	30	30	30	30
4	Analyze/Evaluate	30	20	20	20
5	Create	-	10	10	10
	Total	100	100	100	100

Remember

1. What is the general structure of a C program?
2. List the rules for defining a variable.
3. What are the I/O functions in C?
4. What is a header file?
5. State the associativity property of an operator.
6. Define a ternary operator. Give example
7. What is an array and a pointer?
8. What is the significance of function?
9. Define a structure.
10. What are bit-wise operators?

Understand

1. Compare while loop with do – while Loop.
2. What are the advantages of using Macro?
3. Explain how recursive functions affect the run time efficiency.
4. Differentiate between Structure and Union in C.
5. How is memory managed in C?
6. How garbage collection is done in C?

Apply

1. Write a recursive function to calculate the factorial of number.
2. Write a C program to check whether the given number is palindrome or not
3. Write a program to check whether the given number is prime or not.
4. Write a C program to find the roots of quadratic equation $ax^2+bx+c=0$.
5. Write a C program to find average of *'n'* numbers.
6. Write a program to generate the pay slip of an employee using Structure.
7. Write a C program to search for a specified element in an array.
8. Write a program to compute Matrix Multiplication.

Analyze

1. Explain the difference between **while** and **do-while** statements
2. Why are pointers so powerful? Analyze their efficiency giving an example?
3. Is there any advantage of using recursion over looping control structures? Give a suitable example.
4. Illustrate the **Limitation of array of pointers to strings** using a sample example.

Evaluate

1. Differentiate the keywords **BREAK** and **CONTINUE**.
2. Justify the need for **Type Casting** over **Type Conversion**.
3. Compare and contrast **I/O mapped I/O** with **Memory mapped I/O**.
4. Summarize the various built in **String** functions.

Create

1. Create a structure to store the following details: Rollno, Name, Mark1, Mark2, Mark3, Total, Average, Result and Class. Write a program to read Rollno, name and 3 subject marks. Find out the total, result and class as follows:
   a) Total is the addition of 3 subject marks.
   b) Result is "Pass" if all subject marks are greater than or equal to 50 else "Fail".
   c) Class will be awarded for students who have cleared 3 subjects
      i. Class "Distinction" if average >=75
      ii. Class "First" if average lies between 60 to 74 (both inclusive)
      iii. Class "Second" if average lies between 50 & 59 (both inclusive)
   d) Repeat the above program to manipulate 10 students' details and sort the structures as per rank obtained by them.

Unit I

Fundamentals of C

History of C-Importance of C-Basic structure of C programs-Programming style-Executing a C program-Character set-C tokens-Keywords and identifiers-Constants (Declaration, Definition)-Variables (Declaration)-Data types.

6 Hours

Unit II

Operators and Expressions

Arithmetic operators-Relational operators-Logical operators-Assignment operator-Increment and decrement operator-Conditional operator-Bitwise operator-Arithmetic expressions-Evaluation of expressions-operator precedence-Managing I/O operations.

6 Hours

Unit III

Branching and Looping

Decision making - IF statement-IF-ELSE-Nested IF-ELSE, ELSE-IF Ladder-Switch statement-GOTO statement-?: operator-While statement-DO statement-FOR statement-Jumps in loops.

6 Hours

Unit IV

Arrays and Strings

One dimensional, two dimensional, multi dimensional arrays-Initialization and declaration-Dynamic arrays-Strings-Declaring-Initializing-Reading-Writing strings-Arithmetic operations on characters-string comparison-string handling functions.

6 Hours

Unit V

Functions, Structures and Pointers

User defined function-Declaration-Definition of function-function calls-category of functions-Nesting of functions-Recursion-Structures-Definition, Declaration, Accessing structure members-Pointers-Declaration, Initialization, Accessing.

6 Hours

List of Exercises

1. Simple C programs.
2. Program using operators and expressions.
3. Programs to implement Looping and decision statements.
4. Write a C program to copy the content of one array into another array in reverse order.
5. Write a C program to reverse a string and check whether the string is a palindrome or not.
6. Write a C program to illustrate the concept of Call by Value and Call by Reference.
7. Write a C Program to find factorial of given N numbers with recursion function.
8. Simple programs using structures and pointers

Total: 30+45 Hours

Textbook(s)

1. E.Balagurusamy, *"Programming in ANSI C"*, Fourth Edition, Tata McGraw Hill,2007

References

1. Behrouz A.Forouzan and Richard F. Gilberg, "*Computer Science: A Structure program approach using C,"* Cengage learning –India edition. 2008
2. Ritchie D.M, Kernighan B.W, *"C Programming Language"*, PHI, 2000.

11O109 ENGINEERING CHEMISTRY LABORATORY
(Common to all branches)

0 0 2 1.0

Objectives

- Imparting knowledge on basic concepts and its applications of chemical analysis
- Training in chemical and instrumental methods
- Develop skills in estimation of a given sample by chemical and instrumental methods

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to analyze and assess various parameters such as hardness, TDS, pH and alkalinity in the given water samples.
- Able to perform experiments to verify the molecular weight of a polymer using viscometry and to analyze rate of corrosion and inhibition efficiency by weight loss measurements.
- Able to apply contextual knowledge of electrodes such as calomel, glass for determination of ferrous ions and pH of a solution.

ASSESSMENT PATTERN

	Internal Assessment	Semester End Examination
Preparation	10	15
Execution	10	15
Observation & Results	10	15
Record	5	-
Model Examination	10	-
Viva Voce	5	5
Total	**50**	**50**

List of Experiments (Any ten experiments)

1. Preparation of molar and normal solutions of the following substances – oxalic acid, sodium carbonate, sodium hydroxide, hydrochloric acid.
2. Determination of alkalinity in a water sample.
3. Determination of molecular weight of a polymer by viscometry method.
4. Determination of total, temporary and permanent hardness of water by EDTA method.
5. Conductometric titration of mixture of acids.
6. Determination of strength of iron by potentiometric method using potassium dichromate.
7. Estimation of iron (thiocyanate method) in the given solution by spectrophotometric method.
8. Determination of strength of hydrochloric acid by sodium hydroxide using pH meter.
9. Determination of sodium and potassium ions in water sample by flame photometric method.
10. Determination of corrosion rate by weight loss measurements.
11. Comparison of alkalinities of the given water samples.
12. Comparison of total dissolved solids (TDS) and hardness of water in Bhavani river and Bannari Amman Institute of Technology campus.

Practical Schedule **Total: 30 Hours**

S.No	Experiment	Hours
1	Preparation of molar and normal solutions of the following substances – oxalic acid, sodium carbonate, sodium hydroxide, hydrochloric acid.	3
2	Determination of molecular weight of a polymer by viscometry method.	3
3	Conductometric titration of mixture of acids.	3
4	Determination of strength of iron by potentiometric method using potassium dichromate.	3
5	Estimation of iron (thiocyanate method) in the given solution by spectrophotometric method.	3
6	Determination of strength of hydrochloric acid by sodium hydroxide using pH meter.	3
7	Determination of sodium and potassium ions in water sample by flame photometric method.	3
8	Determination of corrosion rate by weight loss measurements.	3
9	Comparison of alkalinities of the given water samples.	3
10	Comparison of total dissolved solids (TDS) and hardness of water in Bhavani river and Bannari Amman Institute of Technology campus.	3

11O301 ENGINEERING MATHEMATICS III

(Common to all branches Except CSE and BT)

3 1 0 3.5

Objectives

- To obtain the knowledge of expressing periodic functions as Fourier series, Fourier transform and Z transform which is used to analyze signals in signal processing.
- Ability to solve boundary value problems in heat and wave equation using partial differential equations.

Programme Outcomes (POs)

a) Graduates will demonstrate skills to use modern engineering and information technology tools necessary for engineering practice
b) Graduates will be able to identify, formulate and solve automobile engineering problems

Course Outcomes (COs)

- Able to understand the basic concepts of engineering mathematics.
- Able to improve problem evaluation technique.
- Able to choose an appropriate method to solve a practical problem.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	20	20	20	20
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze / Evaluate	10	10	10	10
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. State the Dirichlet's Conditions.
2. Define even and odd function graphically.
3. Write down the complex Fourier transform pair.
4. State convolution theorem in Fourier transform.
5. Define unilateral and bilateral Z-transform of {f(n)}.
6. State initial value theorem in Z-transform.
7. Define complete solution of a partial differential equation.
8. Write the complementary function of non homogeneous second order equations of distinct and repeated roots.
9. What does a^2 represent in the equation $y_{tt} = a^2 y_{xx}$?
10. Write any two solutions of the Laplace equation obtained by the method of separation of variables.

Understand

1. Find the general solution of $x\left(z^2-y^2\right)p+y\left(x^2-z^2\right)q=z\left(y^2-x^2\right)$.
2. Solve $\left(D^2+2DD'+D'^2\right)z=x^2y+e^{x-y}$.
3. Find the half-range cosine series for the function $f(x)=x,\ 0<x<\pi$ and hence deduce the sum of the series $\sum_{n=0}^{\infty}\frac{1}{(2n+1)^4}$.

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

4. Find the Fourier series of period 2 for the function $f(x)=\begin{cases}®x & 0\le x\le 1\\ ®(2-x) & 1\le x\le 2\end{cases}$ Deduce the sum of $\sum_{n=1,3,5,..}^{\infty}\frac{1}{n^2}$.

5. Find the Fourier transform of $f(x)=\begin{cases}1-|x| & \text{for } |x|\le 1\\ 0 & \text{for } |x|>1\end{cases}$.
Hence evaluate $\int_0^{\infty}\left(\frac{\sin x}{x}\right)^2 dx$ and $\int_0^{\infty}\left(\frac{\sin x}{x}\right)^4 dx$.

6. Solve the integral equation $\int_0^{\infty} f(x)\cos \sim x\ dx = e^{-\sim}$.

7. Find inverse Z transform $\frac{4z^3}{(2z-1)^2(z-1)}$

8. Find Z –transform of $\frac{2n+3}{(n+1)(n+2)}$.

9. Use convolution theorem to find the inverse Z –transform of $\frac{8z^2}{(2z-1)(4z+1)}$

10. Give a function which is self reciprocal under Fourier sine and cosine transform.

Apply

1. Find the PDE of all planes having equal intercepts on the x and y axis.
2. Form the PDE of all planes passing through the origin.
3. Expand the function $f(x)=|\cos x|$ *in* $(-®,®)$ as a Fourier series of periodicity 2π.
4. A function y=f(x) is given by the following table of values. Make the harmonic analysis of the function in (0,T) up to the second harmonic.

x	0	T/6	T/3	T/2	2T/3	5T/6	T
y	0	9.2	14.4	17.8	17.3	11.7	0

5. Obtain the constant term and the first harmonic in the Fourier series expansion in (0,12) for the function y = f(x) defined by the table below

x	0	1	2	3	4	5	6	7	8	9	10	11
f x)	1.8	1.1	0.3	0.16	0.5	1.5	2.16	1.88	1.25	1.30	1.76	2.00

6. A taut string of length L is fastened at both ends. The midpoint of the string is taken to a height of b and then released from rest in this position. Find the displacement of the string at any time t.
7. A string is stretched between two fixed points at a distance 2L apart and the points of the string are given initial velocities v where
v = cx /L $0 < x < L$
= c (2L - x) /L L < x < 2L . x being the distance from an end point. Find the displacement of the string at any subsequent time.
8. A rod 30 cm long, has its ends A and B at 20ºC and 80ºC respectively, until steady state conditions prevail. The temperature at the end B is then suddenly reduced to 60º C and at the end A is raised to 40º C and maintained so. Find the resulting temperature u (x,t).
9. A rectangular plate with insulated surface is 10 cm wide so long compared to its width that it may be considered infinite length .If the temperature along the short edge y=0 is given by $8\sin(\frac{®x}{10})$, while the two long edges x= 0 and x=10 as well as the other short edge are kept at 0^0c . Find the steady state temperature.
10. Solve the equation $y_{n+2}-7y_{n+1}+12y_n=2^n$, *given that* $y_0=y_1=0$.

Analyze/ Evaluate

1. Solve $(D^2-5DD'+6D'^2)\ z= y \sin x$.
2. Solve $(4D^2-4DD'+D'^2)z = 16 \log(x+2y)$.
3. Solve $z = p\,x + q\,y + p^2 q^2$.
4. Evaluate $\int_0^\infty \frac{dx}{(x^2+a^2)(x^2+b^2)}$ using transform method.
5. Evaluate $\int_0^\infty \frac{dx}{(x^2+a^2)^2}$ and $\int_0^\infty \frac{x^2 dx}{(x^2+a^2)^2}$.
6. Find Fourier sine transform of $\frac{e^{-ax}}{x}$, a >0.
7. Find Fourier sine and cosine transform of e^{-ax}, a > 0 and hence find Fourier sine and cosine transform of $x\,e^{-ax}$.
8. Find Fourier transform of $e^{-a^2x^2}$, a > 0 and hence find Fourier transform of $e^{-\frac{x^2}{2}}$.
9. Find Fourier sine and cosine transform of x^{n-1}.

Unit -I

Fourier Series

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range cosine and sine series – Parseval's Identity - Harmonic Analysis- Application to engineering problems.

9 Hours

Unit –II

Fourier Transform

Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem - Parseval's Identity-Finite Fourier Transform- Application to engineering problems.

9 Hours

Unit – III

Z -Transform and Difference Equations

Z-transform - Elementary properties – Inverse Z-transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z- transform - Application to engineering problems.

9 Hours

Unit-IV

Partial Differential Equations

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations (excluding reducible to standard forms – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

9 Hours

UNIT –V

Boundary value problems

Classification of second order quasi linear partial differential equations – Fourier series solutions of one dimensional wave equation – One dimensional heat equation (Insulated ends excluded) – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates .

9 Hours

Total: 45+15Hours

Textbook (s)

1. B. S .Grewal , *"Higher Engineering Mathematics"* , Khanna Publications , New Delhi ,2000.

2. K. Megalai, P. Geetha and D. Jayanthi , *"Mathematics for Engineers"*, Volume III, Vikas Publishing House, New Delhi,2008.

References

1. P. Kandasamy, K. Gunavathy and K. Thilagavathy, *"Engineering Mathematics"* ,Volume III , S. Chand & Co., New Delhi, 2008.
2. E. Kreyszig. *"Advanced Engineering Mathematics"* , 8th Edition , John Wiley & Sons, Inc,Singapore (2008).
3. T. Veerarajan , *"Engineering Mathematics*" ,Tata McGraw Hill

14U302-ENGINEERING MATERIALS AND METALLURGY
(Common to AU and ME- Regulation 2011)

3 0 0 3.0

Objectives

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials
- To acquire overall sound knowledge in metallurgy and materials engineering
- To predict and control material properties through an understanding of atomic, molecular, crystalline, and microscopic structures of engineering materials

Program Outcome (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

i) Graduates will have solid foundation for succeeding in competitive examinations

Course Outcomes (COs)

- Able to acquire knowledge of the major types of materials and how their properties can be calculated or determined experimentally;
- Able to design, perform and analyze experiments to characterize materials and devices;
- Able to develop practical laboratory skills, together with relevant knowledge of health and safety

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	30	30	30	30
3	Apply	30	30	30	30
4	Analyze / Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define alloy and steel.
2. What are cooling curves?
3. What is an equilibrium phase diagram?
4. How are the materials classified?
5. Define the term heat treatment.
6. List the various stages of heat treatment processes.
7. List some quenching medium generally used in industries.
8. What is TTT and CCT diagram?
9. How can you classify iron and steel?
10. List the bearing materials that commonly used.
11. What are HSLA and maraging steels?
12. Define the term degree of polymerization
13. Name any four thermosetting and thermoplastics.
14. Define engineering ceramics and composites.
15. List the various matrix materials used.
16. What are the factors affecting mechanical properties.
17. Define the term slip and twinning
18. What is meant by fatigue and creep fracture?
19. What are the properties that can be determined by tensile test.
20. How the Brinell hardness number is calculated?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

Understand

1. When do the materials attain their required properties?
2. How cast iron differ from steel in carbon content?
3. What are the types of testing carried out to test the mechanical properties?
4. How does the deformation of materials take place?
5. How are the ceramics manufactured by various processes?
6. How are the ceramics and composites manufactured?
7. How the hardness is achieved by various heat treatment processes?

Unit I

Constitution of Alloys and Phase Diagrams

Phase diagram – Solid solutions – Substitutional and interstitial–- intermetallic compound – cooling curves, phase rule, lever rule, equilibrium diagrams– Isomorphous, and eutectic, peritectic, and eutectoid reactions with examples – Iron – Iron carbon equilibrium diagram

Study on microstructure of iron in various transformation phase

9 Hours

Unit II

Heat Treatment

Heat treatment of steel, annealing – stress relief, recrystallisation and spheroidizing – normalizing, hardening and Tempering of steel – TTT Diagram - Isothermal transformation diagrams – cooling curves superimposed on TT diagram, CCR – Austempering, martempering, ausforming – Hardenability, Jominy end quench test, Case hardening processes – Carburising, Nitriding, Cyaniding, Carbonitriding – Flame and Induction hardening.
Testing of salt content in bath, sub zero treatment, Cryogenic treatment

9 Hours

Unit III

Metals and Alloys

Classification of steel and cast iron -- properties and application. Gray, White, Malleable, Spheroidal Graphite – alloy cast irons – Effect of alloy additions on steel (Mn, Si, Cr, Mo, V Ti & W) – Stainless and tool steels, HSLA, Maraging steels Alloys of copper, aluminum, magnesium, nickel and zinc – composition and their uses – Bearing materials – precipitation treatment – Alloys for brazing and soldering

Extraction of copper by Smelting process and aluminum by Bayer's process

9 Hours

Unit IV

Non Metallic Materials

Polymers – types, Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers – Rubber and its types- Metal matrix composites – manufacturing, properties and applications - Ceramics – Properties and applications of Al_2O_3, SiC, SiN_3, PSZ and Sialon, ceramic composites

Smart materials such as shape memory alloys

9 Hours

Unit V

Mechanical Properties and Testing

Mechanism of elastic and plastic deformation, slip and twinning – tensile test, stress strain curve for ductile and brittle materials – Compression test – Hardness tests – Impact test – Creep test – fatigue test, endurance limit S – N Curve, fatigue limit, Fracture – Types - ideal fracture stress, Fracture toughness, ductile failure - cup and cone type fracture

Metallurgical testing-spectrometer, Strolin apparatus - NDT - Dye Penetrant Test

9 Hours
Total: 45 Hours

Textbook(s)

1. William D Callister, "*Material Science and Engineering"*, John Wiley and Sons, Singapore, 2007

References

1. Kenneth G Budinski and Michael K Budinski, "*Engineering Materials*", Prentice-Hall of India, New Delhi , 2002.
2. V. Raghavan, "*Materials Science and Engineering*", Prentice Hall of India, New Delhi 2009.
3. Sydney H Avner, "*Introduction to Physical Metallurgy*", Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi 1994.
4. P. Khanna, "*Text Book of Material Science and Metallurgy*", Dhanpat Rai Publication (P) Ltd., New Delhi, 2007.
5. G. E. Dieter, "*Mechanical Metallurgy*", Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, 2007.
6. http://freevideolectures.com/Course/3104/Principles-of-Physical-Metallurgy
7. http://freevideolectures.com/Course/3058/Advanced-Materials-and-Processes

14U303- AUTOMOTIVE ENGINES

3 0 0 3.0

Objectives

- To understand the basic principles of engines used for automobiles and different systems.
- To acquire overall sound knowledge on various engine systems.

Program Outcome (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to acquire knowledge in automotive engine
- Able to understand the detailed concept, construction and principle of operation of engine and various engine components, combustion, cooling and lubrication systems will be taught to the students.
- Able to have a command over automotive engines and the recent development in the area of engines.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	30	30	30	30
3	Apply	20	20	20	20
4	Analyze / Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Write a note about SI engine.
2. Distinguish SI engine and CI engine.
3. Why is spark plug used in SI engine?
4. How to find the air fuel ratio of a vehicle?
5. What is firing order?
6. Write the firing order for a 8 cylinder engine.
7. Describe the needs of a governor.
8. Define knocking.
9. List the types of nozzle used in an engine.
10. Discuss the function of carburetor in petrol engine.
11. What is supercharging?
12. Classify the types of cooling system.
13. Define brake thermal efficiency.
14. Why isn't supercharger used in recent car?
15. List the property of lubricants.

Understand

1. Discuss about two stroke SI and CI engine.
2. Why is common rail system used in CI engine?
3. What is the purpose of distributor in Petrol engine?
4. Distinguish Two stoke engine and Four stroke engine.
5. Compare SI engine and CI engine.
6. What is the purpose of pertoil in two stroke engine?
7. Classify the types of carburetor.
8. Describe the function of lubrication system.
9. List the types of injection system.

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

Apply

1. Write the construction details of four stroke petrol engine.
2. Discuss the working principle of four stroke diesel engine with sketch.
3. How does carburetor function in a vehicle?
4. Explain the types of carburetor used in petrol engine.
5. Draw the diagram of governor and explain it.
6. Classify types of pump.
7. Compare air and liquid cooling system.
8. What is the importance of turbulence, Swirl , Squish?
9. What is the difference between unit injection and common rail system?
10. Write the working of a simple fixed venturi carburetor in details.

Unit I

Construction and Operation

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 enignes and four stroke and two stroke engines. Engine classifcation, firing order.

9 Hours

Unit II

Fuel Systems

Air fuel ratio requirements of SI engines, Air fuel ratio and emissions, Working of a simple fixed venturi carburetor, Constant vacuum carburetor. Diesel fuel injection systems-Jerk pumps, distributor pumps, pintle and multihole nozzles, Unit injector and common rail injection systems. Injection pump calibration. Need for a governor for diesel engines. Description of a simple diesel engine governor.

9 Hours

Unit III

Combustion and Combustion Chambers

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.

9 Hours

Unit IV

Supercharging, Turbo charging and Engine Testing

Supercharging and Turbocharging, Different methods of turbocharging, Intercooling, Turbocharger controls including, waster gate, variable geometry, variable nozzle types. Dynamometers, Indicated thermal, brake thermal and volumetric efficiencies. Measurement of friction, Cylinder pressure measurement. Engine performance maps, Engine testing standards

9 Hours

Unit V

Cooling and Lubrication Systems

Need for cooling, types of cooling systems- air and liquid cooling systems. Thermo syphon and 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.

9 Hours

Total: 45 Hours

Textbook(s)

1. Ganesan. V, “Internal Combustion Engineering”, Tata McGraw-Hill Publishing Co., New Delhi,2012.
2. Ramalingam K.K., “Internal Combustion Engines”, Sci-Tech Publications, 2005.

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. M.L., Sharma. R.P. “A course in internal combustion engines”, Dhanpatrai publication, 2010.
5. John B. Heywood, “Fundamentals of Internal Combustion Engines”, 1988

14U304-ENGINEERING THERMODYNAMICS
(Common to AU and ME- Regulation 2011)

3 1 0 3.5

Objectives

- To acquire knowledge about the fundamentals of thermodynamic laws, concepts, principles and mechanism in accounting for the macroscopic physical systems
- To study and understand the concepts and working of power generating equipments
- To apply the thermodynamic concepts in various applications like IC engines and Air conditioning systems

Program Outcomes (POs)

b) Graduates will be able to identify, formulate and solve automobile engineering problems
i) Graduates will have solid foundation for succeeding in competitive examinations

Course Outcomes (COs)

- Able to understand the first and second laws of thermodynamics and their application to a wide range of systems.
- Able to evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
- Able to understand various Gas laws & ideal gas processes

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test 1*	Test 2*	Model Examination*	Semester End Examination
1	Remember	20	20	20	20
2	Understand	20	20	20	20
3	Apply	30	30	30	30
4	Analyze / Evaluate	30	30	30	30
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define entropy.
2. Define enthalpy.
3. Define refrigerator.
4. Define heat engine.
5. Define internal energy.
6. Define property and state.
7. Define path, process, cycle.
8. Define Coefficient of Performance.
9. State Clausius statement of second law of thermodynamics
10. State Kelvin-plank statement of second law of thermodynamics.
11. Define volumetric efficiency and clearance ratio
12. Define Avagadro's law.
13. Define Dalton's law of partial pressure

Understand

1. Identify a steady flow system and indicate the expressions.
2. Give examples for open system and closed system
3. Justify the limitations for first law of thermodynamics
4. Name the various gas power cycles.
5. How is vapour power cycle suited for three phase flow? Give some examples.
6. Sketch the p-V and T-s diagram for Carnot cycle.
7. Why we apply Maxwell relations?
8. Indicate the importance of work ratio in vapour cycles?
9. What is the effect of Cut-off ratio in the efficiency of a Diesel cycle?

* The marks secured in Test 1 and Test 2 will be converted to 20 and Model examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

10. Sketch the P-V diagram of dual cycle and mark the processes
11. Differentiate 2-stroke and 4-stroke engines based on construction.

Apply/Evaluate

1. What is meant by reversible process? Brief with examples.
2. Write down the continuity equation for the flow process. Explain the various applications.
3. Give the limitations of critical point for pure substances.
4. With suitable examples explain the term wet, dry and saturated and super heat.
5. Mention the relation between heat and work transfer for a flow and non flow process.
6. Relate the terms enthaphy, entropy, internal energy for a thermodynamic system.
7. Prove that the difference in specific heat capacities equal to Cp-Cv = R and $Cp-Cv = TV\beta 2 / k_T$
8. Evaluate clausius inequality with its p-V diagram.
9. How will you differentiate dual cycle with diesel cycle in IC engines?
10. How the ignition takes place in C.I.Engine?

Unit I

Concepts and First Law of Thermodynamics

Basic Concepts – concept of continuum – Macroscopic approach – Thermodynamic systems – Closed Open – Control volume – Thermodynamic properties and equilibrium state of a system – Path and process – Quasi Static process – Modes of work – Zeroth law of thermodynamics – Concept of temperature and heat – Concept of ideal and real gases. First law of thermodynamics – Applied to closed and open systems – Internal energy – Specific heat capacities C_v and C_p – Enthalpy.

Study on Perpetual motion machine of the first kind

9 Hours

Unit II

Second Law of Thermodynamics

Second law of thermodynamics – Kelvin Planck and Clausius statements – Reversibility and Irreversibility – Clausius inequality – Entropy concept efficiency – COP – Principle of increase of entropy - Change of Entropy – Carnot theorem – Absolute entropy – Availability.

Third law of Thermodynamics and Postulatory Thermodynamics

9 Hours

Unit III

Properties of Pure Substances

Thermodynamic properties of pure substances in solid , liquid and vapour phases, P-V, P-T, T-V, T-S, H-S diagrams – Thermodynamic properties of steam – Calculations of work done and heat transfer in non – flow and flow process.
Measurements of steam quality

9 Hours

Unit IV

Properties of Gases, Thermodynamic Relations

Properties of ideal and real gases - equation of state - Avagadro's law - Vander Waal's equation of states - Dalton's law of partial pressure - Properties of mixture of Gases - Maxwell relations - T- dS equation - Clausius Clayperon equations - Joule Thomson Coefficient.
Conditions of stability

9 Hours

Unit V

Air Standard Cycles and Psychrometry

Air standard cycles – Otto, Diesel and Dual – Calculation of mean effective pressure and Air standard efficiency - Concepts of Stirling cycle and Ericsson cycle - Psychrometric properties and processes - Psychrometric chart.
Adiabatic flame Temperature

9 Hours

Total: 45 + 15 Hours

Textbook(s)

1. Y. Cengel and Boles, "Thermodynamics - An Engineering Approach", Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2003.

References

1. R.K.Rajput, "Engineering Thermodynamics", Laxmi Publications Pvt.Ltd., New Delhi, 2011
2. R. S. Khurmi, "*Steam table with Psychometric chart"*, S. Chand Publications, New Delhi 2009

3. J. P. Holman, "*Thermodynamics"*, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi 2002
4. Vanwylen and Sontag, "*Classical Thermodynamics"*, Wiley Eastern, 1987
5. C. P. Arora, "*Thermodynamics"*, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, 2003
6. C. Merala, Pother, W. Craig and Somerton, "*Thermodynamics for Engineers"*, Schaum Outline Series, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, 2004

14U305- FLUID MECHANICS AND MACHINERY
(Common to AU and ME- Regulation 2011)

3 1 0 3.5

Objectives

- To understand the application of fluid in various engineering requirements
- To make familiar with calculation of forces in fluid structure interaction

Program Outcomes (POs)

b) Graduates will be able to identify, formulate and solve automobile engineering problems
i) Graduates will have solid foundation for succeeding in competitive examinations

Course Outcomes (COs)

- Able to get knowledge on about the importance of fluid their properties and its effects.
- Understand the principles of continuity, Momentum and energy as applied to fluid Motions.
- Able to recognize these principles written in form of Mathematical Equation.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test 1*	Test 2*	Model Examination*	Semester End Examination
1	Remember	30	30	30	30
2	Understand	20	20	20	20
3	Apply	25	25	25	25
4	Analyze/ Evaluate	25	25	25	25
6	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What are the properties of fluid?
2. What are the types of fluid?
3. Write Pascal Law.
4. What are the methods of measuring pressure?
5. Write an equation to measure pressure using Manometer.
6. What are the types of fluid flow?
7. Write two and three dimensional continuity equation.
8. State Euler and Bernoulli's equation.
9. State momentum principle.
10. Write the methods of measurement of flow of fluid.
11. Write equation to find loss of pressure due to friction.
12. Write various minor Losses.
13. Write equations to find loss of pressure due to minor losses.
14. State the concepts of branched pipe flow.
15. Write the dimensions of physical quantities used in fluid mechanics in terms of fundamental dimensions.
16. What is dimensional homogeneity?
17. State Buckingham's pi theorem.
18. What are dimensionless numbers?
19. State model laws.
20. Write the concepts of boundary layer.
21. What are boundary layer thicknesses?
22. Define boundary layer separation.
23. Write equations to find drag and lift.
24. What are the types of turbo machineries?
25. Write the concept of velocity triangle.
26. Write equations to find work done on turbine.
27. Write equations to find efficiency of various turbines.

* The marks secured in Test 1 and Test 2 will be converted to 20 and Model examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

28. What are types of positive displacement pumps?
29. What are the types of draft tubes?
30. What are unit quantities?
31. Write equation to calculate work done by the centrifugal pump.
32. What is Cavitations in pumps?

Understand

1. How important are the various fluid properties in engineering application?
2. What is the application of different types of fluid?
3. Why Concepts of measuring pressure important?
4. How manometers work?
5. Why types of flow important in engineering application?
6. How are Continuity equations applied in real world application?
7. How is Bernoulli's equation useful to fluid mechanics?
8. How important is knowledge on fluid forces and momentum principle for an engineer?
9. How important is fluid flow losses in designing fluid circuits?
10. How to form governing equations using dimensionless analysis?
11. How important are dimensionless numbers?
12. Why concept on boundary layer is important?
13. How to differentiate turbines based on the working principle?
14. How pumps are selected with respect to their working principle?

Apply/Evaluate

1. Find various properties of given fluid
2. Create various types of flow using given fluid and pump
3. Designing manometers for various applications
4. Applying Bernoulli's equation and finding flow of given fluid flow
5. Calculation and verification of losses of fluid flow in given pipe system
6. Writing governing equation for a pipe system using dimensional analysis
7. Designing a model for a real world prototype using dimensionless numbers
8. Finding the significance of boundary layer in a fluid structure interaction
9. Suggesting a suitable turbine for the given environment
10. Designing of turbine for given environment
11. Suggest suitable pump for given application
12. Designing a pump for given application

Unit I

Introduction to Fluid and Fluid Motions

Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws. Three dimensional Continuity equation in Cartesian and polar coordinates, Bernoulli equation, energy equation, momentum equation and moment of momentum equation, Measurement of Pressure using Manometers

Capillarity and surface tension

9 Hours

Unit II

Internal and External Flow

Laminar flow in pipe, between parallel plates - Turbulent Flow in a pipe – Flow Separation, Lift and Drag on Airfoils – Boundary layer thickness and boundary layer Theory - Losses in pipe system, Darcy – Weisbach equation - Friction factor - Flow through pipes in series and in parallel, Moody diagram

Minor Losses

9 Hours

Unit III

Dimensional Analysis and Similitude

Dimension and Units: Buckingham's π theorem. Discussion on dimensionless parameters. - Dimensionless parameters –Reynold's Number, Froude's Number, Euler's Number, Weber's Number, Mach's Number - Laws of Models and similitude – Reynold's model law – Froude Model Law

Classification of Models

9 Hours

Unit IV

Hydraulic Turbine

Fluid machines: definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagram's - head and specific work - degree of reaction.

Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed – efficiencies

Performance Curves for Turbine

9 Hours

Unit V

Hydraulic Pump

Pumps: definition and classifications - Centrifugal pump: classifications, working principles, velocity triangles, specific speed, efficiency and performance curves - Reciprocating pump: classification, working principles, indicator diagram, work saved by air vessels - cavitations in pumps - rotary pumps: working principles of gear and vane pumps

Characteristics curve for centrifugal pump

9 Hours

Total: 45 + 15 Hours

Textbook(s)

1. R.K.Bansal, *"Fluid Mechanics and Hydraulic Machinery"*, Laxmi Publications, NewDelhi, Ninth Edition 2010.

References

1. Streeter and L. Victor, *"Fluid Mechanics"*, Tata McGraw Hill Publishing Company Pvt Ltd., New York, 1975
2. Bruce R Munson , Donald F Young, Theodore H Okiishi and Wade W. Huebsch, *"Fundamentals of Fluid Mechanics"*, John Wiley & Sons, 2009
3. Pijush K Kundu and Ira M Cohen, *"Fluid Machines"*, Academic Press, Burlington, USA, 2010
4. Yunus Cengel and John Cimbala, *"Fluid Mechanics Fundamentals and Application"*, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi 2009
5. Robert and W Fox, "Introduction *to Fluid Machines"*, 6th ed., John Wiley Eastern Pvt. Ltd., New Delhi 2006
6. Frank.M.white, "Fluid mechanics", 7th ed., Tata McGraw Hill Publishing Company Pvt Ltd,New Delhi

14U306- ELECTRICAL MACHINES AND DRIVES

(Common to AU and ME- Regulation 2011)

3 0 0 3

Objectives

- To understand the working principle, performance characteristics of DC Generator and DC Motor
- To understand the working principle, operation of 3-phase and 1-phase Induction motor and synchronous motor
- To provide knowledge in the area of electrical dives and their control techniques.
- To impart knowledge on
  - Basics of electric drives and their characteristics
  - Different speed control methods
  - Various motor starters
  - Applications of electrical machines

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

Course Outcomes (COs)

- Able to determine the generated EMF, Speed of DC Generator.
- Able to Construct of DC machines and AC machines.
- Able to demonstrate the different speed control methods of DC and AC drives.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I*	Test II*	Model Examination*	Semester End Examination
1	Remember	20	20	20	20
2	Understand	30	30	30	30
3	Apply	20	20	20	20
4	Analyze / Evaluate	30	30	30	30
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is the function of carbon brush and commutator used in DC generator?
2. Write the number of parallel paths in a lap and wave connected windings
3. Name the types of DC generators.
4. What is meant by self excited and separately excited dc generator?
5. What is the basic difference between dc generator and dc motor?
6. What are open circuit characteristics of DC shunt generator?
7. How can one differentiate between long shunt compound generator and short shunt compound generator?
8. Why is the emf not zero when the field current is reduced to zero in a dc generator?
9. On what occasions dc generators may not have residual flux?
10. Define the term armature reaction in dc machines.
11. What is the basic principle of operation of DC motor?
12. How does a DC motor differ from DC generator in construction?
13. How will you change the direction of rotation of a DC motor?
14. What is back emf in DC motors?
15. Write down the equation for back emf of DC motor.
16. Write down the equation for torque developed in DC motor.
17. Why is the starting current high in a DC motor?
18. What is the need for starter in a DC motor?
19. What is the function of over-load release coil provided in a DC motor starter?
20. What is the function of a no-voltage release coil provided in a DC motor starter?

* The marks secured in Test 1 and Test 2 will be converted to 20 and Model examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

21. How does 4 point starter differ from 3 point starter?
22. Enumerate the factors on which the speed of a DC motor depends.
23. Write the two extra features of slip ring induction motors.
24. What are slip rings?
25. State the difference between slip ring rotor and cage rotor of an induction motor?
26. Write an expression for the slip of an induction motor
27. Define slip of induction motor?
28. What are the advantages of cage motor?
29. What is Rotating magnetic field?
30. Write down the equation for frequency of emf induced in an alternator
31. List the different methods of speed control employed for DC motors.
32. List the different methods of speed control employed for AC motors.
33. What is meant by solid state speed control?
34. What is meant by dc chopper?
35. Write down the main feature of v/f control?
36. What is stator voltage control?
37. Write the output voltage equation for single phase full converter and half converter.
38. Define slip power.
39. What are the slip power recovery schemes?
40. Define power factor.

Understand

1. Draw the performance characteristics curve of DC shunt, series, and compound generator.
2. Derive the EMF equation of DC generator.
3. Explain the different types of DC generators.
4. Derive the equation for torque developed in DC motor
5. Describe the working of three point starter and four point starter
6. How will you control the speed of DC shunt and series motor?
7. What are the various method used for selection of drives?
8. Draw the slip-torque characteristics curve of three phase induction motor
9. Explain the different types of induction motor.
10. Derive the equation for torque developed in induction motor
11. Explain the operation of synchronous motor.
12. Describe the working of alternator
13. What are the different types of speed control of three phase induction motor? Explain
14. Describe the operation of Kramer's system & Scherbius system
15. Explain in details about single phase half full converter drive speed control for DC drive
16. Explain in detail about V/F control?
17. Explain in detail about Ward Leonard drives.
18. What are the different power factor correction methods?

Apply

1. Why are carbon brushes preferred for dc machines?
2. Why DC motors are not operated to develop maximum power in practice?
3. Why starter is necessary for DC motors?
4. Why a differentially compound motor is not used in practice?
5. Why an induction motor is called rotating transformer?
6. Why an induction motor will never run at its synchronous speed?
7. Why starter is necessary for the induction motor?
8. Why the Chopper controlled DC drives are used?
9. Why the static Rotor resistance control is used?
10. Why the slip power recovery schemes are used?

Analyze / Evaluate

1. Formulate the relation between speed and torque of DC motor.
2. For a given DC machine, evaluate the drop across the armature and field.
3. Construct the equivalent circuit diagram of Induction motor.
4. Analyze the Control of DC drives using controlled rectifiers and chopper.

Unit I

DC Machines

Constructional details of DC Generator – Emf equation – Types of DC Generators – Characteristics of DC generators – Principle of operation of DC motor – Back emf and torque equation – Characteristics of DC motors - Starting of D.C. motors – Types of starters.

9 Hours

Unit II

AC Machines and Transformers

Construction of AC machines – Types – Principle of operation of three phase induction motor – Equivalent circuit – Speed torque characteristics– Single phase induction motors – Principle of operation – Starters for induction motor – Construction of synchronous machines – types – Induced emf – Voltage regulation – Principle of operation of synchronous motor – Starting of synchronous motor – Three phase Transformer, construction, principle of operation.

9 Hours

Unit III

Drive Characteristics

Types of electrical drives –Advantages of electrical drives- Factors influencing the choice of electrical drives, heating and cooling curves – Loading conditions and classes of duty – Braking – Types of braking – Braking characteristics for DC drive and AC drive.

9 Hours

Unit IV

Conventional and Solid State Speed Control of DC Drives

Speed control of DC series and shunt motor using armature control, field control and Ward - Leonard control system – Speed control characteristics – Control of DC drives using controlled rectifiers and choppers – Applications.

9 Hours

Unit V

Conventional and Solid State Speed Control of AC Drives

Control of three phase induction motors using stator voltage and frequency control – static rotor resistance control – Slip power recovery schemes – Static Kramer control method – Static Scherbius control method – Power Factor correction-Applications.

9 Hours

Total: 45 Hours

Textbook(s)

1. G. K. Dubey, "*Fundamentals of Electrical Drives"*, Wiley Eastern Ltd., New Delhi, 2007.
2. D. P. Kothari and I. J. Nagrath, "*Basic Electrical Engineering"*, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, 2007.

References

1. S. K. Pillai, "*A First Course on Electrical Drives"*, Wiley Eastern Ltd., New Delhi, 2008
2. M. D. Singh and K. B. Khanchandani, "*Power Electronics"*, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, 2007
3. Vedam Subrahmaniam, "*Electric Drives (concepts and applications)"*, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2007

14U307- FLUID MECHANICS AND MACHINERY LAB
(Common to AU and ME- Regulation 2011)

0 0 3 1.5

Objectives

- To reinforce and enhance the understanding of the fundamentals of Fluid mechanics and Hydraulic machines
- To introduce a variety of classical experimental and diagnostic techniques, and the principles behind these techniques
- To provide practice in making engineering judgments, estimates and assessing the reliability of your measurements, skills which are very important in all engineering disciplines

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment
i) Graduates will have solid foundation for succeeding in competitive examinations
k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to measure and differentiate absolute, differential, and gauge pressure, make basic pressure and velocity measurements.
- Able to determine the practical understanding of Friction losses, Boundary layer separation, lift, drag.
- Able to calculate flow characteristics such as Reynolds number, friction factor, pressure and drag coefficient from laboratory measurements.
- Able to know the characteristics of pump by measuring their parameters to calculate its efficiency.

ASSESSMENT PATTERN

	Internal Assessment	Semester End Examination
Preparation Remember Understand Apply	15	15
Observation and Results Analyze Evaluate	15	25
Record	5	-
Mini-Project/Model Examination/Viva-Voce	15	10
Total	**50**	**50**

Remember

1. Define fluid statics.
2. What is fluid mechanics?
3. What is fluid kinetics?
4. Define Viscosity.
5. What are Newtonian and non-Newtonian fluids?
6. Define Surface Tension
7. What is meant by transition state?
8. Define Pascal's law
9. What is meant by energy lines?
10. Define the term drag
11. What is boundary layer?
12. Define energy thickness.
13. State the methods of dimensional analysis
14. Define density.
15. Define Specific volume.
16. List the types of fluid
17. Define Pascal Law

18. Mention the methods of measuring pressure
19. Write equation to measure pressure using Manometer
20. Mention types of fluid flow
21. Mention two and three dimensional continuity equation
22. Write Euler and Bernoullis equation
23. Define Momentum principle
24. Write Equation to find loss of pressure due to friction
25. Mention Various minor Losses
26. Equations to find loss of pressure due to minor losses
27. Write the Concepts of branched pipe flow
28. Define Dimensional homogeneity
29. Define Buckingham's pi theorem
30. Define Dimensionless numbers
31. Define Model laws
32. Write the Concepts of boundary layer
33. Define boundary layer thicknesses
34. What is meant Boundary layer separation
35. Write equations to find drag and lift
36. Mention the types of turbo machineries
37. Define Velocity triangle
38. Write the equations to find work done on turbine
39. Write the equations to find efficiency of various turbines
40. Mention types of positive displacement pumps
41. Mention types of draft tubes
42. Mentions Unit quantities
43. Write Equation to calculate work done by the centrifugal pump
44. Define Cavitation in pumps

Understand

1. What are the similarities between model and prototype?
2. When will you select a reciprocating pump?
3. Compare the viscosity of the different fluid.
4. Difference between the laminar and turbulent flow.
5. How are Continuity equations applied?
6. How to apply Bernoulli's equation for incompressible fluid.
7. Difference between Fluid forces and momentum principle
8. Why fluid flow losses in designing fluid circuits
9. At what conditions, the laminar flow becomes turbulent flow?
10. Difference between pump and turbine.

Apply/Evaluate

1. Calculation and verification of losses of fluid flow in given pipe system.
2. Writing governing equation for a pipe system using dimensional analysis.
3. Designing a model for a real world prototype using dimensionless numbers.
4. Finding the significance of boundary layer in a fluid structure interaction.
5. Suggesting a suitable turbine for the given environment.
6. Designing of turbine for given environment.
7. Suggestion of pump for given application.
8. Designing a pump for given application.
9. Find various properties of given fluid.
10. Create various types of flow using given fluid and pump.
11. Designing manometers for various applications.
12. Applying Bernoulli's equation and finding flow of given fluid flow.

List of Experiments

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.

5. Conducting experiments and drawing the characteristic curves of centrifugal pump/Submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.
11. Conducting experiments to find the Lift and Drag of a given Aerofoil using wind tunnel.
12. Demonstrating and measuring the boundary layer formation using various cross sectional objects in a open channel flow.
    - Design Experiments
    - Application oriented experiments
    - Mini Project

Practical Schedule **Total: 45 Hours**

Sl. No.	Experiment	Hours
1	Determination of the Coefficient of discharge of given Orifice meter.	3
2	Determination of the Coefficient of discharge of given Venturi meter.	3
3	Calculation of the rate of flow using Rota meter.	3
4	Determination of friction factor for a given set of pipes.	3
5	Conducting experiments and drawing the characteristic curves of centrifugal pump/Submergible pump	3
6	Conducting experiments and drawing the characteristic curves of reciprocating pump.	3
7	Conducting experiments and drawing the characteristic curves of Gear pump.	3
8	Conducting experiments and drawing the characteristic curves of Pelton wheel.	3
9	Conducting experiments and drawing the characteristics curves of Francis turbine.	3
10	Conducting experiments and drawing the characteristic curves of Kaplan turbine	3
11	Conducting experiments to find the Lift and Drag of a given Aerofoil using wind tunnel.	3
12	Demonstrating and measuring the boundary layer formation using various cross sectional objects in an open channel flow.	3
13	Design Experiments	3
14	Application oriented experiments	3
15	Mini Project	3

14U308-AUTOMOTIVE COMPONENTS LABORATORY

0 0 3 1.5

Objectives

- To experience the skill of dismantling and assembling of engines
- To have a detailed study about Engine parts
- To examine the malfunctioning of the system
- To understand the mounting of components, the basic working principle of components with the engine for accurate operations

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment
i) Graduates will have solid foundation for succeeding in competitive examinations
k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to completely dismantle and assemble the engines.
- Able to calculate the Engine displacement by measuring the Stroke length, bore
- Able to inspect visually for wear and tear in the components

ASSESSMENT PATTERN

	Internal Assessment	Semester end Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	25	25
Record	5	-
Mini- Project / Model Examination / Viva-voce	10	10
Total	**50**	**50**

List of experiments

1. Dismantling and study of Multi-cylinder Petrol Engine
2. Assembling of Multi-cylinder Petrol Engine
3. Dismantling and study of Multi-cylinder Diesel Engine
4. Assembling of Multi-cylinder Diesel Engine
5. Study of petrol engine fuel system
6. Study of diesel engine fuel system
7. Study and measurement of light and heavy commercial Vehicle Frame
8. Study, dismantling and assembling of front and rear Axles
9. Study, dismantling and assembling of differential
10. Study, dismantling and assembling of Clutch
11. Study, dismantling and assembling of Gear Box
12. Study of steering system

Practical Schedule

Sl. No.	Experiment	Hours
1	Dismantling and study of Multi-cylinder Petrol Engine	3
2	Assembling of Multi-cylinder Petrol Engine	3
3	Dismantling and study of Multi-cylinder Diesel Engine	3
4	Assembling of Multi-cylinder Diesel Engine	3
5	Study of petrol engine fuel system	3
6	Study of diesel engine fuel system	3
7	Study and measurement of light and heavy commercial Vehicle Frame	3
8	Study, dismantling and assembling of front and rear Axles	3
9	Study, dismantling and assembling of differential	3
10	Study, dismantling and assembling of Clutch	3
14	Study, dismantling and assembling of Gear Box	3
12	Study of steering system	3

14U309 ELECTRICAL MACHINES LABORATORY
(Common to AU and ME- Regulation 2011)

0 0 3 1.5

Objectives

- To understand the working principle, performance characteristics of DC Generator and DC Motor
- To understand the different types of Transformers, working principle and their performance
- To estimate the various losses taking place in DC machines and Transformers and apply the different testing methods to arrive their performance

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to analyze the characteristics of DC and AC machines.
- Able to understand and conduct experimental testing on different types of electrical machines.
- Able to analyze the operation of electric machines under different loading conditions.

ASSESSMENT PATTERN

	Internal Assessment	Semester End Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	15	20
Record	10	-
Mini-Project/Model Examination/Viva-Voce	15	15
Total	**50**	**50**

Remember

1. What is the function of carbon brush used in DC generator?
2. Distinguish between lap winding and wave winding used in dc machine.
3. Write the number of parallel paths in a lap and wave connected windings
4. Name the three things required for the generation of emf.
5. What is meant by self excited and separately excited dc generator?
6. What is the basic difference between dc generator and dc motor?
7. Write down the emf equation of dc generator. Give the meaning of each symbol
8. What is pole pitch?
9. How can the voltage in a DC generator be increased?
10. What is critical resistance of a DC shunt generator?
11. What are the conditions to be fulfilled for a shunt generator to build up voltage?
12. What do you mean by residual flux in DC generator?
13. A DC generator fails to self excite. List the cause for the failure for the failure.
14. What are open circuit characteristics of DC shunt generator?
15. How can one differentiate between long shunt compound generator and short shunt compound generator?
16. Why is the emf not zero when the field current is reduced to zero in a dc generator?
17. Define the term ‘critical speed’ in dc shunt generator.
18. On what occasions dc generators may not have residual flux?
19. How the critical field resistance of a dc shunt generator is estimated from its OCC?
20. Define the term armature reaction in dc machines.
21. What are the two unwanted effects of armature reaction?
22. Differentiate between geometric neutral axis (GNA) and magnetic neutral axis (MNA).
23. In which part of the dc machine is the compensating winding situated?
24. What are the various types of commutation?

25. Name the two methods of improving commutation.
26. What is reactance emf in dc machine?
27. Define the term commutation in dc machines.
28. How and why the compensating winding in dc machine excited?
29. How is the interpole winding in dc machine excited?
30. To what polarity are the interpoles excited in dc generators?
31. What is the basic difference between DC generator and DC motor?
32. What is the basic principle of operation of DC motor?
33. What is torque proportional to?
34. Distinguish between shunt and series field coil constructions.
35. How does a DC motor differ from DC generator in construction?
36. How will you change the direction of rotation of a DC motor?
37. What is back emf in DC motors?
38. Write down the equation for back emf of DC motor.
39. Write down the equation for torque developed in DC motor.
40. Under what condition the mechanical power developed in a DC motor will be maximum?
41. Why shaft torque is always less than that developed inside the armature in a DC motor?
42. Why is the starting current high in a DC motor?
43. What is the need for starter in a DC motor?
44. What is the function of over-load release coil provided in a DC motor starter?
45. What is the function of a no-voltage release coil provided in a DC motor starter?
46. How does 4 point starter differ from 3 point starter?
47. Enumerate the factors on which the speed of a DC motor depends.
48. List the different methods of speed control employed for DC series motor.
49. Draw the N Vs Eb characteristics of a dc motor for two different field currents.
50. What is the relation between electrical degree and mechanical degree?
51. What is the meaning of electrical degree?
52. List some examples of prime movers.
53. Give some applications of DC motor.
54. State one advantage and disadvantage in the application of each of the three basic types of DC motors.
55. List the important information on name plate of a DC motor.
56. Why field control is considered superior than armature control method of DC shunt motor?
57. State the principle of operation of a transformer.
58. What are the main parts of a transformer?
59. The efficiency of a transformer is always higher than that of rotating electrical machines. Why?
60. List the advantages of stepped core arrangement in a transformer.
61. Why are breathers used in transformers?
62. When will a Bucholz relay operate in a transformer?
63. What is the function of transformer oil in a transformer?
64. What are the applications of step-up and step-down transformers?
65. State the condition for maximum efficiency.
66. State the advantages of Swinburne's test.
67. Is it possible to conduct Swinburne's test on DC series motor? Justify.
68. Does the transformer draw any current when secondary is open? Why?
69. What is meant by no-load current of a transformer?
70. What are the functions of no-load current in a transformer?
71. How does change in frequency affect the operation of a given transformer?
72. How will you transfer the quantities from one circuit to another circuit in a transformer?
73. Define voltage regulation of a transformer
74. Can the voltage regulation of a transformer go to negative? If so under what condition?
75. Full load copper loss in a transformer is 1600 watts. What will be the loss at half load?
76. What is the angle by which no-load current will lag the ideal applied voltage?
77. Distinguish between power transformer and distribution transformer.
78. What is the purpose of providing 'taps' in transformer and where these are provided?
79. What are the advantages of 3-phase transformers over 3 numbers of single phase transformers?
80. State the conditions under which OC and SC tests are conducted in a transformer.
81. What is the purpose of conducting OC test on a transformer?
82. What is the purpose of conducting SC test on a transformer?
83. What are the advantages of OC and SC tests of a transformer over the load test?
84. What is the condition for obtaining maximum efficiency of a transformer?

85. What is meant by all-day efficiency?
86. List the merits of an autotransformer.
87. What are the components of magnetic losses in transformer and on what factors they depend?

Understand

1. Draw the performance characteristics curve of DC shunt, series, and compound generator.
2. Derive the EMF equation of DC generator.
3. Explain the different types of DC generators.
4. Derive the equation for torque developed in DC motor
5. Draw the mechanical and electrical characteristics of DC shunt, series, compound motors.
6. What are the effects caused by armature reaction?
7. Explain the different methods of commutation.
8. Explain the parallel operation of two DC generators.
9. Describe the working of three point starter and four point starter
10. How will you control the speed of DC shunt and series motor?
11. Derive an expression for EMF induced in single phase transformer.
12. What are the differences between two winding transformer and auto transformer?
13. Explain the different types of instrumentation transformers?
14. Derive the equivalent circuit of single phase transformer.
15. What are the various losses that occur in DC machines?
16. Give the conditions for maximum efficiency in DC machines.
17. What are the various losses that occur in transformer?
18. Explain the different ways of connecting the three phase transformer.

Apply / Analyze / Evaluate

1. Why are carbon brushes preferred for dc machines?
2. Why DC motors are not operated to develop maximum power in practice?
3. Why a differentially compound motor is not used in practice?
4. Why the iron losses in a transformer are independent of the load current?
5. Why is the rating of a transformer given in kVA?
6. Why OC test is generally performed on LV side of a transformer?
7. Why SC test is generally performed on HV side of a transformer?
8. Why are iron losses considered as constant losses in transformer?
9. Why the range of efficiency of transformers higher than those of other electrical machines?
10. A d.c series motor having a resistance of 1 ohm drives a fan for which the torque varies as the square of the speed. At 220 V the set runs at 350 rpm and takes 25 A. The speed is to be raised to rpm by increasing the voltage. Determine the necessary voltage and the corresponding current assuming the field to be unsaturated.
11. Two series motors run at the speed of 500 rpm and 550 rpm respectively when taking 50 A at 500 V. The terminal resistance of each motor is 0.5 ohm. Calculate the speed of the combination when connected in series and coupled mechanically. The combination is taking 50A on 500V supply.
12. A 4 pole 240 V, wave connected shunt motor given 1119 kW when running at 1000 rpm and drawing armature and field current of 50 A and 0.1 A respectively. It has 540 conductors. Its resistance is 0.1 ohm. Assuming a drop of 1 volt/brush, find (a) Total torque. (b) Useful Torque. (c) Useful flux/pole. (d) Rotational Losses. (e) Efficiency
13. A 45 kW, 250 V, 4 pole, lap connected dc shunt motor has 32 slots with 10 conductors/slot. The armature and shunt field resistance are 0.05 ohm and 125 ohm respectively. The flux/pole is 0.03 Wb. If the full load efficiency is 85% find at full load. (a) Useful torque at shaft. (b)The speed
14. A 1500 kW, 550 V,16 pole generator run at 1500 rpm.What must be the useful flux per pole if there are 2500 conductor in the armature of the winding is lap connected and full load armature copper loss in 25 kW? Calculate the area of the pole shoe if the gap flex density has a uniform value of 0.9Wb/m^2, Also find the no load terminal voltage. Neglect change in speed.
15. Formulate the relation between losses and efficiency of DC machines.
16. For a given DC machine, how to evaluate the constant and variable losses.
17. Analyze the performance of given transformer and evaluate the core loss and cu loss occurring in it.

List of Experiments

1. Load test on DC Shut & DC Series motor

2. O.C.C & Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt ,motor (Armature, Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. Load test on single phase alternator
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Load test on single phase induction Motor.
11. Study of DC & AC Starters
    - Design experiment
    - Application oriented experiment

Practical Schedule **Total: 45 Hours**

Sl. No.	Experiment	Hours
1	Load test on DC Shut & DC Series motor	3
2	O.C.C & Load characteristics of DC Shunt and DC Series generator	3
3	Speed control of DC shunt ,motor (Armature, Field control)	3
4	Load test on single phase transformer	3
5	O.C & S.C Test on a single phase transformer	3
6	Regulation of an alternator by EMF & MMF methods.	3
7	Load test on single phase alternator	3
8	Load test on three phase squirrel cage Induction motor	3
9	Speed control of three phase slip ring Induction Motor	3
10	Load test on single phase induction Motor.	3
11	Study of DC & AC Starters	3
12	Design experiment	6
13	Application oriented experiment	3

11O401- NUMERICAL METHODS
(Common to all branches of B.E/B. Tech except BT and CSE)

3 1 0 3.5

Objectives

- To acquire the knowledge of finding approximate solutions of algebraic, transcendental, differential and integral equations by numerical methods and interpolating the values of a function using Lagrange's and Newton's polynomial approximations.
- To find solution of initial and boundary value problems using multi step approximations and ability to solve boundary value problems using finite difference methods.

Programme Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
b) Graduates will be able to identify, formulate and solve automobile engineering problems

Course Outcomes (COs)

- Able to acquire more knowledge in basic concepts of engineering mathematics.
- Able to improve problem evaluation technique.
- Able to choose an appropriate method to solve a practical problem.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	20	20	20	20
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze / Evaluate	10	10	10	10
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. State the Fundamental theorem of algebra.
2. Define Algebraic and Transcendental equations.
3. Write the formula for Regula Falsi method .
4. What is meant by Interpolation?
5. State the derivatives of Newton's Forward and Backward Interpolation formula.
6. Write the conditions for applying Trapezoidal and Simpson's rules.
7. Write the formula for two point and three point Gaussian quadrature.
8. Mention the multistep methods available for solving ordinary differential equation.
9. Write the Bender schmidt Scheme for solving one dimensional heat equation.
10. Write the explicit formula for one dimensional wave equation.

Understand

1. Give an example of a transcendental equation?
2. Write the condition of convergence of Iteration method.
3. What is the order of convergence of Newton - Raphson method?
4. Write the differences between Direct and Iterative method.
5. State the sufficient condition for solving Gauss Jacobi and Gauss Seidel method.
6. Using Lagrange's interpolation, find the polynomial through (0,0), (1,1) and (2,2).
7. What is meant by power method.
8. State the way in which you can find the solution for Laplace equation.
9. Write Milne's & Adam's Predictor and Corrector formula.
10. What are the methods used for solving simultaneous algebraic equations.

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

Apply

1. Obtain by power method, the numerically largest eigen value of the matrix $A=\begin{bmatrix} 15 & -4 & -3 \\ -10 & 12 & -6 \\ -20 & 4 & -2 \end{bmatrix}$ with the starting vector $x^{(0)}=\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$. Perform only 4 – iterations.
2. Explain briefly Gauss Elimination Iteration to solve simultaneous equations.
3. If $f(x)=\frac{1}{x^2}$, find the divided difference f (a, b).
4. What is the relation between divided differences and forward differences ?
5. Find the value of $f'(8)$ from the table given below

x:	6	7	9	12
$f(x)$:	1.556	1.690	1.908	2.158

6. The following data gives the velocity of a particle for 20- secs at an interval of 5-secs.
   Find the acceleration for the following data

$time(\text{sec})$:	0	5	10	15	20
$velocity(m/s)$:	0	3	14	69	228

7. If $y' = xy^{\frac{1}{3}}$, y (1) = 1, find y (1.1) using Taylor's method.
8. If $y' = x^2 + y^2$, y (0) =1 find y (0.1) by Euler's method.
9. For which points of x and y, the equation $x f_{xx} + y f_{yy} = 0$, x > 0, y > 0 is elliptic.
10. Name at least two numerical methods that are used to solve one dimensional diffusion equation.

Analyze / Evaluate

1. Using Newton's method, find the positive root of cos x = 3x – 1.
2. Solve by Gauss-Elimination method : 6x + 3y +12z = 36 ; 8x -3y +2z = 20; 4x +11y – z =33 .
3. Using Power method, find all the Eigen values of A = $\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$.
4. Use Lagrange's interpolation formula to find the value of x when y = 20 for the following data .

X :	1	2	3	4
Y :	1	8	27	64

5. Given 5 x y' + y^2 – 2 = 0 ; y (4)= 1; y (4.1) = 1.0049 find
   i)y (4.2) by Euler's method ii) y (4.3) by Runge-kutta method
   iii)y (4.4) by Adam's method.
6. Using Taylor series method, find the value of y(0.1) , given dy /dx = x + y and y (0) =1 and correct to 3 decimal places.
7. Using Bender-Schmitt formula, solve
   $\frac{\partial^2 u}{\partial x^2}=\frac{\partial u}{\partial t}$, u (0,t) =0, u (5,t) = 0 , u (x,0) = $x^2 (25 - x^2)$.
   Assume Δx =1. Find u(x, t) up to t=5.
8. Solve $\frac{\partial^2 u}{\partial t^2}=\frac{\partial^2 u}{\partial x^2}$, 0 < x < 1, t >0; u (x,0) = 100 $(x-x^2)$, u_t (x,0) = 0,
   u (0,t) = 0, u (1,t) = 0.
9. Solve $u_{xx}+u_{yy}=0$ over the square mesh of side 4 units, satisfying the following conditions u (x,0) = 3x for 0 ≤ x ≤4 ; u (x,4) = x^2 for 0 ≤ x≤4; u (0,y)= 0 for 0 ≤y ≤4 ; u (4,y) =12 + y for 0 ≤ y ≤ 4.
10. Evaluate $\int_{2}^{2.2}\int_{1}^{2.6}\frac{dydx}{x^2+y^2}$ using Trapezoidal formula.

Unit I

Solution of Equations and Eigen Value Problems

Solution of Algebraic and Transcendental equations by the method of False position – Newton- Raphson method- Solution of system of linear equations : Gauss- elimination method and Gauss-Jordan method - Iterative method: Gauss – Seidel method- Inverse of a matrix by Gauss-Jordan method. Eigen value of a matrix by power method.

9 Hours

Unit II

Interpolation and Curve Fitting

Newton 's Forward and Backward interpolation. Newton's Divided difference interpolation formula – Lagrange's interpolation formula – Fitting of curves by the method of Least squares: Straight line,Parabolic curves and the conversion of equations of the curves in the form of straight lines.

9 Hours

Unit III

Numerical Differentiation and Integration

Derivatives from difference table – Numerical differentiation using Newton 's forward and backward interpolation formulae - Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules - Romberg's method - Two and three point Gaussian quadrature formulae - Double integrals using Trapezoidal and Simpson's rules.

9 Hours

Unit IV

Initial Value Problems for Ordinary Differential Equations

Single step Methods : Taylor Series method for solving first and second order equations - Euler's and Modified Euler's methods - Fourth order Runge-Kutta method for solving first order equations - Multistep methods –Milne's and Adam's predictor and corrector methods.

9 Hours

Unit V

Boundary Value Problems

Finite difference solution for the second order ordinary differential equations- Finite difference solution for one dimensional heat equation by implicit and explicit methods - one dimensional wave equation and two dimensional Laplace's and Poisson's equations**.**

9 Hours

Total: 45+15 Hours

MAT LAB: Invited Lectures on Mat lab and its applications on Numerical methods.

Textbook(s)

1. P. Kandasamy, K. Gunavathy and K. Thilagavathy, "*Numerical Methods"*, S.Chand and Co. New Delhi, 2009.
2. B.K. Moorthy, P.Geetha, "*Numerical Methods"* ,Tata McGraw-Hill Publication company Ltd, New Delhi 2010, First Edition

References

1. R. L Burden, and T.D Faries, "*Numerical Analysis"*, Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
2. K. Sankara Rao , "*Numerical Methods for Scientists and Engineers"*, Third Ed.Prentice Hall of India, 2007.
3. C.F Gerald., and P.OWheatley, "*Applied Numerical Analysis"*, Sixth Edition, Pearson Education Asia, New Delhi.2006.
4. T.Veerarajan, "*Numerical Methods with programs in C",* Second Edition, Tata McGraw-Hill Publication,co.Ltd, New Delhi ,2008.

14U402-APPLIED THERMODYNAMICS AND HEAT TRANSFER

3 1 0 3.5

Objectives

- To analyze different cyclic processes involved in the power plant and IC Engines
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam Turbines, Compressors and Refrigeration and Air conditioning systems
- To build up necessary background for understanding the physical behavior of various modes of heat transfer, like, conduction, convection, and radiation, incompressible and compressible flow
- To understand the application of various experimental heat transfer correlations in engineering calculations

Programme Outcomes (POs)

b) Graduates will be able to identify, formulate and solve automobile engineering problems
i) Graduates will have solid foundation for succeeding in competitive examinations

Course Outcomes (COs)

- Able to apply fundamental concepts of thermodynamics to thermodynamic systems
- Able to demonstrate general knowledge of heat transfer (conduction, convection, radiation)
- Able to define and solve steady-state and transient problems.
- Able to design heat and mass transfer processes and equipment.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	20	20	20	20
2	Understand	20	20	20	20
3	Apply	20	20	20	20
4	Analyze / Evaluate	40	40	40	40
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is thermodynamic cycle?
2. List out the assumptions made for the analysis of thermodynamic air cycles.
3. What is meant by compression ratio?
4. Sketch the schematic arrangement of open cycle gas turbine plant and name the components.
5. What is meant by highest useful compression ratio?
6. What is Fourier's law and write the equation?
7. What is conduction?
8. State Newton's law of cooling or convection law
9. Write down the equation for heat transfer through a composite plane wall.
10. Define overall heat transfer co-efficient.
11. Define fins or extended surface.
12. State the application of fins.
13. Define Fin efficiency.
14. Define Fin effectiveness.
15. Define Radiation
16. Define Emmissive power.
17. Define monochromatic emissive power.
18. What is meant by absorptivity, reflectivity, and transmissivity?
19. State Plank's distribution law.
20. State Wien's displacement law.
21. State Stefan-Boltzmann law.
22. What is meant by gray body?
23. Define Reynolds number, Prandtl number, Nusselt number, Grashof number, Stanton number.
24. What is meant by laminar flow and turbulent flow?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

25. What is hydrodynamic boundary layer and thermal boundary layer?
26. What are the dimensionless parameters used in forced convection?
27. Define boundary layer thickness.

Understand

1. What are the effects of reheating process in Rankine cycle?
2. When will be the gas turbine cycle efficiency reaches maximum?
3. It is always useful to have a regenerator in gas turbine power cycle. Why?
4. Write down the effect of pressure ratio on the net output and efficiency of Brayton cycle
5. Compare two stroke and four stroke engines.
6. Why diesel engines are more efficient than petrol engines?
7. Which is efficient two stroke or four stroke engines? Why?
8. Why the actual cycle efficiency is much lower than the air-standard cycle efficiency?
9. What is the difference between the natural and forced convection?
10. How is the conduction resistance of solids affected by its thermal conductivity?
11. How is the convection resistance at a surface affected by the convection co-efficient? How is the radiation resistance affected by the surface emissivity?
12. What is the physical basis for existence of a critical insulation radius? How do the thermal conductivity and the convection coefficient affect its value?
13. Heat is transferred from hot water flowing through a tube to air flowing over the tube. To enhance the rate of heat transfer, should fins be installed on the tube interior or exterior surface?
14. What physical features distinguish a turbulent flow from a laminar flow?
15. How does the velocity boundary layer thickness vary with distance from the leading edge for laminar flow? For turbulent flow?
16. How does the local convection heat transfer coefficient vary with distance from the leading edge for laminar flow over a flat plate?

Apply/Evaluate

1. Air enters the compressor of an air-standard Brayton cycle at 100kPa, 300K with a volumetric flow ratio of 5m3/s. The compressor pressure ratio is 10. The turbine inlet temperature is 1400K. Determine (a) thermal efficiency of the cycle, (b) back work ratio, (c) net power developed in kW.
2. Find the percentage saving in work input by compressing air in two stages from 1 bar to 7 bar instead of one stage. Assume a compression index of 1.35 in both the cases and optimum pressure and complete intercooling in a two-stage compressor.
3. An aluminium alloy fin of 7mm thick and 50mm long protrudes from a wall which is maintained at 120ºC. The ambient air temperature is 22ºC. The heat transfer coefficient and conductivity of the fin material are 140 W/m2K and 55 W/mK respectively. Determine (a) Temperature at the end of the fin. (b) Temperature at the middle of the fin. (c) Total heat dissipated by the fin.
4. A long cylindrical heater 30mm in diameter is maintained at 700ºC. It has surface emissivity of 0.8. The heater is located in a large room whose wall are 35ºC. Find the radiant heat transfer. Find the percentage of reduction in heat transfer if the heater is completely covered by radiation shield (ε=0.05) and diameter 40mm.
5. CO_2 and air experience equimolar counter diffusion in a circular tube whose length and diameter are 1.2m and 60mm respectively. The system is at a total pressure of 1atm and a temperature of 273K. The ends of the tube are connected to large chambers. Partial pressure of CO_2 at one end is 200 mm of Hg while at the other end is 90 mm of Hg. Calculate the following (a) Mass transfer rate of CO_2 and (b) Mass transfer rate of air

Unit I

Gas Power Cycles

Air standard cycles – Otto – Diesel -Dual-Work output, Efficiency and MEP calculations - comparison of the cycles for same compression ratio and heat addition, same compression ratio and heat rejection, same peak pressure, peak temperature and heat rejection, same peak pressure and heat input, same peak pressure and work output , Brayton cycle with intercooling, reheating and regeneration.

9 Hours

Unit II

Reciprocating Air compressors & Refrigeration Cycles

Single acting and double acting air compressors, work required, effect of clearance volume, volumetric efficiency, isothermal efficiency, free air delivery, multistage compression, condition for minimum work. Fundamentals of

refrigeration, C.O.P., reversed carnot cycle, simple vapour compression refrigeration system, T-S, P-H diagrams, simple vapour absorption refrigeration system, desirable properties of an ideal refrigerant.

9 Hours

Unit III

Conduction

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Use of Heislers Chart.

9 Hours

Unit IV

Convection

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Combined Laminar and Turbulent – Flow over Bank of tubes – Free Convection – Dimensional Analysis – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

9 Hours

Unit IV

Radiation

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black Body Radiation –Grey body radiation Shape Factor Algebra – Electrical Analogy – Radiation Shields –Introduction to Gas Radiation.

9 Hours

Total: 45+15 Hours

Text book(s)

1. R.K.Rajput, “Applied Thermodynamics”, Laxmi Publishing Co.,New Delhi,2007
2. J.P. Holman “Heat Transfer”, Tata Mc Graw –Hill, 2003

References

1. P.K.Nag, “Basic and applied Thermodynamics” Tata McGraw –Hill Publishing Co. Ltd,New Delhi,2004
2. P.K.Nag, “ Heat Transfer”, Tata McGraw-Hill, New Delhi, 2002
3. C.P Kothandaraman, “Fundamentals of Heat and Mass Transfer” New Age International, New Delhi, 1998

14U403-MECHANICS OF MACHINES

3 1 0 3.5

Objectives

- To understand the principles in the formation of mechanisms and their kinematics.
- To understand the effect of friction in different machine elements.
- To analyze the forces and toques acting on simple mechanical systems
- To understand the importance of balancing and vibration

Programme Outcomes (POs)

b) Graduates will be able to identify, formulate and solve automobile engineering problems

Course Outcomes (COs)

- Able to determine the kinematic chain and mobility, and perform the kinematic analysis of a given mechanism,
- Able to understand and avoid/suppress certain common dynamical problems a machine may undergo.
- Able to understand static force relationships and inertia forces and their effect that exist in machines

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	25	20	10	10
2	Understand	30	30	20	20
3	Apply	30	30	30	30
4	Analyze / Evaluate	15	20	40	40
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define kinematic link, pair and chain.
2. Define Inversion of Mechanism.
3. What is lower and higher pair?
4. What are the types of Constrained Motion?
5. What is locked chain?
6. What are the types of Joints in a Chain?
7. Define Kutzbach Criterian to Plane Mechanism.
8. State Grashof's law for four bar mechanism.
9. Give an example of straight line generators.
10. Define Velocity and acceleration of a link
11. Define Radial component of an acceleration
12. Define Tangential component of an acceleration
13. What is the direction of radial and tangential component of acceleration of a link?
14. Define Rubbing Velocity at a pin joint.
15. Write the formula to calculate the angular velocity (ω) of a link when speed (N) is given in rpm.
16. What is Coriolis component of Acceleration?
17. Define Cam and Follower.
18. How to classify cams?
19. Give the applications of cam and follower mechanism.
20. Define Pressure angle of the cam
21. What is meant by lift and stroke of the follower?
22. Discuss the term of dwell period in the Cams and Follower?
23. What is meant by Undercutting in Cams?
24. State the advantages and disadvantages of gear drives.
25. Define module
26. What is spiral gearing?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

27. Define Law of gearing
28. Which materials are used to make gears?
29. Define gear train.
30. What are the types of gear trains?
31. Write the applications of flat, V belt and rope drive of belt.
32. Which are the materials used for belts?
33. Define Slip and Creep of the belt
34. What is the use of idler pulley in the belt drive?
35. Define Initial tension in the belt drive
36. Define static and dynamic friction
37. What is the use of friction clutches in automobiles?
38. List out the materials used for brake lining
39. What is the use of the collar bearing?
40. Define Journal bearing.
41. Define : Frequency in vibration
42. Define : Free vibration
43. Define : Natural vibration
44. Define : Free frequency
45. Define : Forced vibration
46. Define : Damped vibration
47. Define : Longitudinal vibrations
48. Define : Transverse vibration
49. What is critical speed of a shaft?
50. Define the term Vibration Isolation
51. What is the function of the governor?
52. State the different types of governor
53. State the difference types of centrifugal governor
54. What is the controlling force in centrifugal governor?
55. What is the function of a simple Watt governor?
56. Define sensitivity of governor
57. What is hunting of governor?
58. What are the different cases of balancing?
59. State the necessary conditions of dynamic balancing

Understand

1. What are the differences between a Machine and a Structure?
2. What is a Sliding Pair, and how it differs from turning and rolling pair?
3. Which is all the kinematic chain in the following arrangement?
   (a) Three links (b) Four links (c) Five links (d) Six links
4. How to find the Length of Stroke of the Crank and Slotted Lever Quick Return Motion Mechanism?
5. How to draw the velocity and acceleration diagram for a slider link?
6. How to draw the velocity and acceleration diagram for a fixed link?
7. How to calculate the radial and tangential component of acceleration of a link?
8. What is the condition to draw the tangential component for an input link?
9. What is the difference between Prime Circle and Pitch Circle of Cam?
10. Differentiate Pitch and Trace point of a cam.
11. How the follower is classified according to the surface in contact and path of motion?
12. Compare the different types of motion used in cam and follower motion?
13. Draw the displacement, Velocity and acceleration diagram for the follower moves with simple harmonic motion.
14. What is helical gearing, and how it differs from heringbone gearing?
15. How the power is transmitted in bevel and worm gear drive?
16. Which type of profile generally used in gear? Give reason
17. Discuss length of path of contact and length of arc of contact in gear systems.
18. How to find the velocity ratio of epicyclic gear train?
19. What are the factors affecting the amount of power transmission?
20. State the disadvantages of the V belt drive over flat belt drive.
21. What type of belt drive is selected for rotating the opposite direction of rotation of driver and driven pulley?

22. What are the factors considering the selection of the belt drive?
23. Compare Sliding friction and Rolling friction
24. List the various factors depends on the capacity of the brake.
25. What is the difference between piston effort, crank effort and crank-pin effort?
26. The inertia of the connecting rod can be replaced by two masses concentrated at two points and connected rigidly together. How to determine the two masses so that it is dynamically equivalent to the connecting rod? Show this
27. Given acceleration image of a link. Explain how dynamical equivalent system can be used to determine the direction of inertia force on it.
28. What is the function of flywheel?
29. Draw the turning moment diagram for a single cylinder, double acting steam engine.
30. Draw the turning moment diagram for a four stroke cycle internal combustion engine
31. State the functional difference between the governor and flywheel?

Apply

1. Sketch & describe working of bicycle free wheel sprocket mechanism
2. Design with suitable drive to transmit the power of 12 kW.
3. What happens to friction when we use wheels to roll an object instead of sliding it?
4. How are velocity and acceleration of the slider of a single slider crank chain determined analytically?
5. What is the velocity of the piston, When the crank is at the inner dead centre, in a horizontal reciprocating steam engine?
6. A local toy shop has asked you to design a model to encourage parents to buy their young children mechanical toys. The partially made model is seen below Figure 1. Add a suitable cam that controls two followers so that they rise and fall

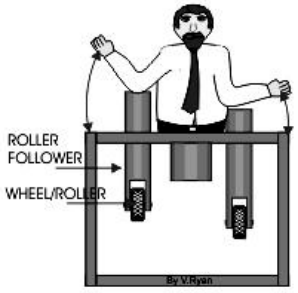


Fig. 1

7. Write the essential condition of placing the two masses, so that the system becomes dynamically equivalent
8. A horizontal steam engine running at 240 r.p.m. has a bore of 300 mm and stroke 600 mm. The connecting rod is 1.05 m long and the mass of reciprocating parts is 60 kg. When the crank is 60^0 past its inner dead centre, the steam pressure on the cover side of the piston is 1.125 N/mm^2 while that on the crank side is 0.125 N/mm^2. Neglecting the area of the piston rod, determine:
    i) The force in the piston rod ; and
    ii) The turning moment on the crankshaft.

Analyze/ Evaluate

1. A rotating shaft carries four masses A, B, C and D which are radially attached to it. The mass centres are 30 mm, 38 mm, 40 mm and 35 mm respectively from the axis of rotation. The masses A, C and D are 7.5 kg, 5 kg and 4 kg respectively. The axial distances between the planes of rotation of A and B is 400 mm and between B and C is 500 mm. The masses A and C are at right angles to each other. Find for a complete balance,
    1. The angles between the masses B and D from mass A
    2. The axial distance between the planes of rotation of C and D,
    3. The magnitude of mass B.
2. A shaft 1.5 m long is supported in flexible bearings at the ends and carries two wheels each of 50 kg mass. One wheel is situated at the centre of the shaft and the other at a distance of 0.4 m from the centre towards right. The shaft is hollow of external diameter 75 mm and inner diameter 37.5 mm. The density of the shaft material is 8000 kg/m^3. The Young's modulus for the shaft material is 200 GN/m^2. Find the frequency of transverse vibration.
3. A Porter governor has all four arms 200 mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to a sleeve at a distance of 25 mm from the axis. Each ball has a mass of 2 kg

and the mass of the load on the sleeve is 20 kg. If the radius of rotation of the balls at a speed of 250 r.p.m. is 100 mm, find the speed of the governor after the sleeve has lifted 50 mm. Also determine the effort and power of the governor.

Unit I

Mechanisms

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

9 Hours

Unit II

Friction

Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

9 Hours

Unit III

Gears and Cams

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicylic gear trains - Determination of speed and torque- Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions.

9 Hours

Unit IV

Balancing

Static and dynamic balancing – Single and several masses in different planes – Balancing of reciprocating masses-primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method

9 Hours

Unit IV

Vibration

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.

9 Hours

Total: 45+15 Hours

Textbook(s)

1. Rattan.S.S, “Theory of Machines”, Tata McGraw–Hill Publishing Co., New Delhi,2004
2. Ballaney.P.L, “Theory of Machines”, Khanna Publishers, New Delhi, 2002.

References

1. Rao,J.S and Dukkipati, R.V, “Mechanism and Machine Theory”, Second Edition, Wiley Eastern Ltd., 2002.
2. Malhotra, D.R and Gupta, H.C., “The Theory of Machines”, Satya Prakasam, Tech. India Publications, 2005.
3. Gosh, A. and Mallick, A.K., “Theory of Machines and Mechanisms”, Affiliated East West Press, 2006.

14U404-AUTOMOTIVE CHASSIS

3 0 0 3.0

Objectives

- To understand various types of layout of vehicles and features and applications.
- To study the Constructional details and Theory of important drive line, Structural, Steering, Braking and Suspension Systems of Automobiles.
- To solve problems in Steering Mechanism, Propeller Shaft, Braking and Suspension Systems are to be done.

Programme Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to understand the constructional, working principle of various sub system of an automobile.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	30	30	30	30
3	Apply	30	30	30	30
4	Analyze / Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Give the classifications of chassis.
2. Write a note about frame.
3. Define castor.
4. Describe the needs of Torsion bar.
5. Define Camber.
6. Give classification of spring.
7. Discuss the concept of ABS.
8. Define lattice and unit cells.
9. Mention the merits of hydraulic brake system.
10. Write a short note on drum bake.

Understand

1. How has wheel alignment checked in a vehicle?
2. What is slip angle?
3. What will happen during load acting on vehicle frame?
4. Explain the types of drive used in car.
5. Give the importance of wheel alignment.
6. What is full floating?
7. Discuss the significance of tyres.
8. Write the theory of drum brake.
9. What is the use of power assisted braking system in light duty vehicle?
10. Discuss the use of trailing shoes.

Apply

1. Explain the functions of a propeller shaft.
2. Why do the automotive vehicles need a suspension system?
3. What do you mean by 'brake fad'?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

4. Write two examples for constant velocity universal joints.
5. Mention the different loads acting on vehicle frame.
6. Discuss about the different tests available for the vehicle frame.
7. Describe the construction and working principles of three types of rear axle.
8. Write short notes on 'rubber suspension' and 'pneumatic suspension' systems.
9. Compare Disc and drum type of brakes.
10. Draw the layout of air braking system and explain the working principle of the air braking system.

Unit I

Introduction

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry, namely, Castor, Camber, King Pin Inclination and Toe–in, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Daut's Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power–Assisted Steering.

9 Hours

Unit II

Drive Line

Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Multi–axled vehicles, Differential principle and types, Differential housings, Non–Slip differential, Differential locks, Final drive of Crawler Tractors.

9 Hours

Unit III

Axles

Construction and Design of Drive Axles, Types of Loads acting on drive axles, Full – Floating, Three–Quarter Floating and Semi–Floating Axles, Axle Housings and Types, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

9 Hours

Unit IV

Suspension System

Need for Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf, Coil, Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details, Design of Leaf and Coil Springs.

9 Hours

Unit V

Braking System

Need for Brake systems, Stopping Distance, Time and Braking Efficiency, Effect of Weight Transfer during Braking, Classification of brakes , Braking Torque, Drum Brake and Disc Brake Theory, Types and Construction of Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders – Antilock Braking Systems(ABS)

9 Hours

Total: 45 Hours

Textbook(s)

1. Kripal Singh, "Automobile Engineering-Volume 1", Standard Publishes-Distributors, Delhi, 2012.
2. R.K. Rajput, "A Text–Book of Automobile Engineering", Laxmi Publications Private Limited, 2007
3. N.K. Giri, "Automotive Mechanics" Khanna Publishers, New Delhi, 2005.

References

1. Heldt P.M., "Automotive Chassis" Chilton Co., New York.
2. Newton Steeds and Garret, "Motor Vehicles" 13th Edition,Butterworth, London, 2005.
3. Heinz Hazler, "Modern Vehicle Technology", Butterworth, London, 2005.

14U405-STRENGTH OF MATERIALS
(Common to AU and ME- Regulation 2011)

3 1 0 3.5

Objectives

- To develop the theoretical basis about the stress, strain and elastic modulus concepts in various components with sound mathematical principles and to enable students to systematically solve engineering problems regardless of difficulty
- To familiarize about finding shear force, bending moment, deflection and slopes in various types of beams with different load conditions
- To develop confidence and competence in solving problems related to the machine components like shafts, columns, springs and purposes

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

d) Graduates will be able to design systems for automobiles

Course Outcomes (COs)

- To establish an understanding of the fundamental concepts of mechanics of deformable solids and including static equilibrium, geometry of deformation, and material constitutive behaviour.
- To provide students with exposure to the systematic methods for solving engineering problems in solid mechanics.
- To build the necessary theoretical background for further structural analysis and design courses and to analyse long columns subjected to axial loads.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	25	20	10	10
2	Understand	30	30	20	20
3	Apply	30	30	30	30
4	Analyze / Evaluate	15	20	40	40
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define Stress and strain.
2. What are the types of stress?
3. State Hook's law.
4. Define Poisson's ratio.
5. Write the equations which relate E and C and K.
6. Define factor of safety.
7. State the range of Poisson's ratio value for ductile material.
8. What do you mean by bulk modulus?
9. Define resilience.
10. Define proof resilience.
11. Define principle stress and principle strain.
12. Define hoop and longitudinal stress.
13. List out the types of beams.
14. What are the types of supports used in beams?
15. Name the types of loads applied onto a beam.
16. Define slenderness ratio.
17. State the assumptions made in simple bending.
18. Write the simple bending equation of beam.
19. Define stiffness of the spring.

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

20. Define crippling load.
21. List the assumptions made in simple torsion.
22. Write the torsional equation of the shaft.
23. Name the theories of failure.
24. Define section Modulus.
25. Define fluctural rigidity.
26. Define polar moment of inertia.
27. Name the methods available to find the slope and deflection of beams.
28. Define shear stress.
29. Define bending stress.

Understand

1. State the role of factor of safety in the design of product?
2. Differentiate true stress and engineering stress.
3. How do you find the value of E using stress – strain diagram.
4. Differentiate shear stress and shear strain.
5. Give some practical examples where bending stress stresses may occur.
6. What is the difference between limit of proportionality and elastic limit?
7. Write the significance of elastic constants in product design.
8. Distinguish pressure and stress.
9. Differentiate Ultimate and Yield strength of material with respect to applied load.
10. How do you reduce the induced stress value in cylindrical shells?
11. How do you differentiate thin and thick cylinders?
12. Why do cylindrical pressure vessels have hemispherical ends?
13. Differentiate simple and compound stress.
14. At what situation thin cylinders can be used?
15. State the use of Mohr's circle.
16. What is meant by composite beam?
17. Draw the schematic representation of hinged, continuous and over hanging beams.
18. What is meant by radius of curvature of the beam?
19. Compare the strength beams which have rectangular and I shape cross sections.
20. How do you reduce the stress induced in the cantilever beam where the load value remains same?
21. What is meant by point of contra flexure of the beam?
22. Differentiate open coil and closed coil helical springs.
23. Give some real time applications for open coil and closed coil helical springs.
24. What conditions must be met for neutral axis to pass through the centroid of a beam.
25. Differentiate Resilience and Proof resilience.

Apply/Evaluate

1. For axially loaded members, what is the maximum normal stress and in which plane does this stress act? What is the value of shear stress in this plane?
2. State how normal stress varies with the orientation of the section in a long slender member under axial load.
3. Which shaft will you recommend for design purposes when maximum shear stress due to torsion is same in both solid and hollow shaft?
4. What is the difference between plane stress and plane strain situations? Give practical examples.
5. If axial force F is fixed, then find a relation of geometrical parameters of a cylindrical pressure vessel for attainment of equal axial and hoop stress.
6. How to find the maximum shear force and bending moment from shear force and bending moment diagrams? Explain with an example.
7. What is understood by calculating the effort applied to a screw jack to lift up and lower down the given amount of load? Justify the phenomenon.

Unit I

Stress, Strain and Deformation of Solids

Mechanical properties of materials - Simple stress and strain – Stresses and strains due to axial force - Stress-strain curve for ductile and brittle materials– Hooke's law - Factor of safety – Poisson's ratio - Elastic constants and their relationship- Stresses in Stepped shafts and Uniformly varying sections – Stresses in Composite sections - Temperature stresses. Strain energy – Stresses due to different loadings – Strain energy in bending and torsion

Viscoelastic Materials, Fatigue, Strain Gages **10 Hours**

Unit II

Analysis of Stresses in Two Dimensions

State of stresses at a point – Normal and tangential stresses on inclined planes - Principal planes and stresses – Plane of maximum shear stress - Mohr's circle for biaxial stresses. Hoop and longitudinal stresses in thin cylindrical and spherical shells – Changes in dimensions and volume

Behavior of thick wall pressure vessels **8 Hours**

Unit III

Beams - Loads and Stresses

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever Simply supported and overhanging beams - Point of contra flexure. Theory of simple bending - Stresses in beams: bending and shear stress - Stress variation along the length and section of the beam – Section modulus

Shear flow and Shear centre **9 Hours**

Unit IV

Deflection of Beams

Slope and Deflection of beams: Double integration method, Macaulay's method and Moment-area method, for Cantilever, Simply supported and overhanging beams. Columns – Buckling of long columns due to axial load - Equivalent length of a column – Euler's and Rankine's formulae for columns of different end conditions – Slenderness ratio

Inelastic column buckling, Case studies related to column buckling **9 Hours**

Unit V

Torsion in Shafts and Springs

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Closed coil helical springs: Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Introduction to the design of helical coil springs – stresses in helical coil springs under torsion loads, Springs- Helical Springs, Leaf Spring-stiffness, deflections, Loads, Stresses of helical and leaf springs, problems - applications

Theories of Failures, Stress concentrations

9 Hours
Total: 45 +15 Hours

Textbook(s)

1. R. K. Bansal, "*A text book of Strength of Materials"*, Lakshmi Publications (P) Limited, New Delhi, 2007
2. S. S. Rattan, "Strength of Materials", Tata McGraw Hill Education Company Pvt Ltd.

References

1. Egor P. Popov, "*Engineering Mechanics of Solids"*, PHI Learning Pvt Ltd, New Delhi, 2010.
2. D. K. Singh, "*Mechanics of Solids"*, Pearson Education New Delhi **,**2006.
3. R.K. Rajput, "*Strength of Materials"*, S Chand & Co., New Delhi, 2006.
4. F. P. Beer and R. Johnston, "*Mechanics of Materials"*, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi**,** 2002.
5. B. K. Sarkar, "*Strength of Materials"*, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2006.
6. http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IIT ROORKEE/strength%20of%20materials/homepage.htm
7. http://nptel.iitm.ac.in/video.php?subjectId=112107147
8. http://nptel.iitm.ac.in/courses/IIT-MADRAS/Strength_of_Materials/
9. http://www.onlinevideolecture.com/civil-engineering/nptel-iit-kharagpur/strength-of-materials/?course_id=704
10. http://nptel.iitm.ac.in/video.php?subjectId=105105108

14U406-ENGINEERING DESIGN CONCEPTS

3 0 0 3.0

Objectives

- To understand the concept generation, concept selection, design process, planning for manufacture
- To know the various techniques used in designing a product

Programme Outcomes (POs)

d) Graduates will be able to design systems for automobiles
k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to select concepts for various product developments.
- Able to select materials, making experimental plan.
- Able to strengthen the decision making skills of the students.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I*	Test II*	Model Examination*	Semester End Examination
1	Remember	30	30	30	30
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is engineering design?
2. What are the principles of engineering design?
3. What are the six elements of design process?
4. List the content of a PDS
5. What is meant by Brainstorming?
6. List out the five creativity methods.
7. List out the five concept selection methods.
8. What are the five basic patterns of decision making?
9. List the principles of engineering design.
10. What are the steps follwed in industrial design?
11. What is Ergonomics in Engineering Design?
12. Define factor of safety?
13. What are the elements of cost?
14. What is meant by BOM?
15. What is meant by QFD?
16. List the content of a design report
17. Name the three types of patents

Understand

1. How are engineering design interfaces made within and outside the design department?
2. How will you identify a problem?
3. Why do we go for computer aided decision making?
4. How will you identify customer needs?
5. Differentiate criteria weighting and datum method of concept selection?
6. How will you make decision based on knowledge?
7. How will you estimate a manufacturing cost?
8. For which break even analysis is carried out in a company?
9. Differentiate final and intermediate design review.

* The marks secured in Test 1 and Test 2 will be converted to 20 and Model examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

10. Differentiate Patent and copyright
11. Differentiate concept sketches and scheme drawing
12. What are the steps followed in drafting a patent application?

Apply

1. Write PDS for a car
2. Write the concept generation for a under seat suspension system of an excavator.
3. Write the methods of selection of material for aircraft.
4. Write the material selection procedure for bought out components
5. Write a design report for a new product
6. Write a patent draft for any one product you know.

Unit I

Principles and Problem Identification

Engineering design introduction and definition, Considerations of a good design, Engineering design interfaces, Principles of engineering design, Problem identification, Design process, Product Design Specification (PDS) criteria, Content of a PDS, specification Principles, Exercises

Sample PDS

9 Hours

Unit II

Concept Generation and Selection

Identifying customer needs, bench marking, Societal considerations in engineering, Creativity and problem solving, creativity methods - Brainstorming, Morphological analysis, Exercises. Concept selection - Subjective decision-making, Criteria ranking, Criteria weighting, Datum method, Computer aided decision making, Exercises

Product and process cycle of a simple product

9 Hours

Unit III

Design Process

Detailed description of design process, five basic patterns of decision making , decision making based on state of knowledge, Design for manufacturing (DFM), Design for Assembly (DFA), Industrial design, Human factors design - ergonomics, Design for environment, engineering design principles

Design for X

9 Hours

Unit IV

Planning for Manufacture

Quality function deployment (QFD), Design review, Value analysis/engineering, Detail design, Factor of safety, Materials selection, break even analysis - problem, cost evaluation, Elements of cost, ISO concepts in brief

Impact of Computer Aided Engineering in design

9 Hours

Unit V

Report Preparation and Intellectual Property Rights

Presentation Techniques - Introduction, Concept sketches, Scheme drawing, Design Validation Design report. Intellectual Property Rights – Introduction, Patent, Trademark, copyright, Patentability, patenting process

Patenting for a simple product - a case study

9 Hours

Total: 45 Hours

Textbook (s)

1. Ken Hurst, "*Engineering Design Principles*", Elsevier Science and Technology Books, 2004
2. George E Dieter, "*Engineering Design*", Tata McGraw Hill publishing Company Pvt Ltd, New Delhi**,** 2008

References

1. Danlel E. Whitney, "*Mechanical Assembles: Design Manufacture and Role in Product Development*", Oxford University, Press, 2008

2. K. Otto, "*Product Design"*, Pearson Publications, 2005
3. Richard Birmingham, Graham Cleland, Robert Driver and David Maffin, "*Understanding Engineering Design"*, Prentice Hall of India, 1997
4. www.patentoffice.nic.in
5. ep.espacenet.com/advanced Search
6. http://nptel.iitm.ac.in/video.php?subjectId=106106093

14U407-THERMAL ENGINEERING LABORATORY
(Common to AU and ME- Regulation 2011)

0 0 3 1.5

Objectives

- To expertise in the various thermodynamic concepts and principles
- To conduct performance tests on petrol engine and diesel engine, heat balance test, energy balance test on 4 stroke diesel engine
- To find frictional power of a diesel engine, determination of oil viscosity, flash and fire point
- To develop comparative justification on conventional fuel with alternative fuel

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to analyze the fundamental theories and the industrial applications of thermal engineering equipments
- Able to understand some very important concepts and applications in the field of IC engines and refrigeration.
- Able to understand how the typical thermal devices work (refrigerators, air conditioning devices, car engines or steam engines).

ASSESSMENT PATTERN

	Internal Assessment	Semester end Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	25	25
Record	5	-
Mini-Project / Model Examination / Viva-voce	10	10
Total	**50**	**50**

Remember

1. What is valve timing and port timing?
2. Define cetane number and octane number
3. List some factors that affect performance of the engine
4. Is heat balancing necessary?
5. Give the firing order based on number of cylinder?
6. What is Frictional power?
7. Define Specific Fuel Consumption
8. What is Brake power?
9. What role does viscosity of oil plays in engine?

Understand

1. Real-time application of various cycles.
2. Thermodynamic Laws and application..
3. Concepts of various thermal applications.
4. Efficiency of different type of engines.
5. Energy balancing of thermal power.
6. Industrial engine performance testing set-up.

Apply/Evaluate

1. How to tune up the engine performance?
2. How to avoid heat loss in engine?
3. How to differentiate diesel and petrol engine?
4. How to best suit the right engine for the various application?
5. How to avoid engine breakdown?
6. How perfect energy utilization can be done?
7. How the revolution can be done on conventional fuels?
8. How to overcome the fossil fuel usage?

List of Experiments

1. Valve Timing and Port Timing Diagrams.
2. Performance Test on 4-stroke Diesel Engine.
3. Heat Balance Test on 4-stroke Diesel Engine.
4. Morse Test on Multicylinder Petrol Engine.
5. Retardation Test to find Frictional Power of a Diesel Engine.
6. Performance Test on 4-stroke Diesel engine hydraulic loading with data acquisition system.
7. Comparative study on conventional fuel with alternative fuel.
8. Determination of Viscosity – Red Wood Viscometer.
9. Determination of Flash Point and Fire Point.
10. Study of Steam Generators and Turbines.
11. Performance of Cooling Tower.
    - Design experiment
    - Application oriented experiment

Practical Schedule **Total: 45 Hours**

Sl. No.	Experiment	Hours
1	Valve Timing and Port Timing Diagrams.	3
2	Performance Test on 4-stroke Diesel Engine.	3
3	Heat Balance Test on 4-stroke Diesel Engine.	3
4	Morse Test on Multicylinder Petrol Engine.	3
5	Retardation Test to find Frictional Power of a Diesel Engine.	3
6	Performance Test on 4-stroke Diesel engine hydraulic loading with data acquisition system.	3
7	Comparative study on conventional fuel with alternative fuel.	3
8	Determination of Viscosity – Red Wood Viscometer.	3
9	Determination of Flash Point and Fire Point.	3
10	Study of Steam Generators and Turbines.	3
11	Performance of Cooling Tower.	3
12	Design experiment	6
13	Application oriented experiment	6

14U408-STRENGTH OF MATERIALS LABORATORY
(Common to AU and ME- Regulation 2011)

0 0 3 1.5

Objectives

- To understand the procedure of doing different tests like hardness, compression, tension, shear and impact etc in various materials and automobile components.
- To inject the knowledge about the testing of springs and composites materials subjected to compressive and tensile loads
- To explain the concept of testing the mechanical properties of materials under untreated and heat treated conditions.
- To gain knowledge for use in the designing of engineering components
- To acquire enough knowledge to understand:
  a) Basic elements of materials microstructures.
  b) Metals deformation and microstructures.
  c) Metal alloys and heat treatments

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
d) Graduates will be able to design systems for automobiles
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to understand specimen preparation, study of microstructure and heat treatment techniques of ferrous and non-Ferrous metals.
- Able to determine mechanical properties of materials by experiments
- Able to learn behavior of structural elements by experiments
- Able to analyze and synthesize test results, write individual and group reports incorporating experimental data, graphs, assessment of results, and conclusions

ASSESSMENT PATTERN

	Internal Assessment	Semester end Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	25	25
Record	5	-
Mini-project / Model Examination / Viva-voce	10	10
Total	**50**	**50**

Remember

1. Define stress.
2. Define strain.
3. What is Young's modulus?
4. What is shear modulus?
5. What is bulk modulus?
6. State Hooke's law.
7. What is meant by limit of proportionality of elastic constants?
8. What is meant by the term necking?
9. What is meant by strain hardening?
10. List the various types of support.

11. List the various types of loading conditions
12. What are the various assumptions made in the theory of simple bending?
13. What is meant by torsion?
14. List the various types of spring.
15. Define stiffness of a spring.
16. What is meant by flexural rigidity?
17. Define Maxwell's theorem.
18. Define alloy and steel
19. What are cooling curves?
20. Define the term heat treatment.
21. List the various stages of heat treatment processes.
22. List some quenching medium generally used in industries.
23. What is TTT and CCT diagram?
24. Write the governing equation for torsion of circular shaft.
25. Write the formula to find the modulus of rigidity of springs
26. Write the formula to calculate the stiffness of a spring
27. How is the Brinell's hardness number calculated?

Understand

1. When a material is said to be of perfectly elastic?
2. What is the type of stress induced in a structural member subjected to torsional loading?
3. Why the shear stress is maximum at the outer surface of the shaft than the inner core?
4. Why hollow circular shafts are preferred when compared to solid circular shafts?
5. What are the differences between closed coil & open coil helical springs?
6. What are the various stresses induced in the open coil helical spring?
7. What is surge in springs?
8. When do the materials attain their required properties?
9. How the deformation of materials take place?
10. How are the ceramics and composites manufactured?
11. How the hardness is achieved by various heat treatment processes?

Apply/Analyze/Evaluate

1. How will you calculate yield stress?
2. How will you calculate ultimate stress?
3. How is the ultimate shear stress estimated?
4. How will you calculate the value of shear stress at a particular distance from the neutral axis?
5. How is the pitch of helical springs calculated?
6. How will you evaluate the torsional stress of a shaft?
7. How will you choose the material for industrial application?
8. On what basis the cycle time is finalized in heat treatment process?
9. How will you estimate the hardness number in various testing methods?
10. How are the ceramics manufactured by various processes.
11. How you evaluate the fatigue strength of a shaft?

List of Experiments

Standards to be referred:

For cast iron:

Grey cast iron - IS-210
Spheroidal cast iron - IS-1865

For alloy steels:

Low carbon, Medium carbon & High carbon - IS -1570

Strength of Materials

1. Test involving axial compression and tension to obtain the stress – strain curve and the strength
2. Test involving torsion and flexure to obtain the torque vs. angle of twist and load deflection curve respectively and hence the stiffness
3. Tests on springs
4. Hardness tests and shear test on metal specimen
5. Test for impact resistance

6. Bending tests on metal beam
7. Verification of Maxwell's reciprocal theorem
8. Tests on thin cylinders
9. Study on the variation of shear force and bending moment in a beam
    - Design Experiments
    - Application oriented experiments
    - Mini Project

Metallurgy

1. Study of microstructure of low, medium, high carbon steels, tool steel and stainless steels.
2. Study of microstructure of various cast irons
3. Heat treatment – annealing, normalizing, hardening and tempering of plain carbon steels, Measurement of their hardness and study of their microstructure.
4. Performance study of specimen preparation with different polishing time.

- Design experiment
- Application oriented experiment

Practical Schedule **Total:45Hours**

Sl. No.	Experiment	Hours
1	Test involving axial compression and tension to obtain the stress – strain curve and the strength	3
2	Test involving torsion and flexure to obtain the torque vs. angle of twist and load deflection curve respectively and hence the stiffness	3
3	Tests on springs	3
4	Hardness tests and shear test on metal specimen	3
5	Test for impact resistance	3
6	Bending tests on metal beam	3
7	Verification of Maxwell's reciprocal theorem	3
8	Tests on thin cylinders	3
9	Study on the variation of shear force and bending moment in a beam	3
10	Study of microstructure of low carbon, medium carbon, high carbon steels, tool steel and stainless steels.	3
11	Study of microstructure of various cast irons	3
12	Heat treatment – annealing, normalizing, hardening and tempering of plain carbon steels, Measurement of their hardness and study of their microstructure	3
13	Performance study of specimen preparation with different polishing time.	3
14	Design experiment - Application oriented experiment	6

14U409-COMPUTER AIDED MACHINE DRAWING LABORATORY
(Common to AU and ME- Regulation 2011)

1 0 3 2.5

Objectives

- To know the specifications and symbols of standard machine components used in machine drawing
- To understand the concept of various tolerances and fits used for component design
- To understand and practice the drawings of machine components and simple assemblies using standard CAD packages
- To understand and create drawings manually or using any one CAD packages for standard machine components and assemblies with tolerance

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment
g) Graduates will demonstrate skills to use modern engineering and information technology tools necessary for engineering practice

Course Outcomes (COs)

- Model 2D / 3D drawings of any mechanical products using modeling software
- Knowledge of computer recording of design and methods for constructing solid and flat objects.
- Draw the different kind of mechanism of machining parts.

ASSESSMENT PATTERN

	Internal Assessment	Semester End Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	15	20
Record	10	-
Mini-Project/Model Examination/Viva-Voce	15	15
Total	**50**	**50**

Remember

1. State the role of CAD in product design.
2. Draw the symbols for first angle and third angle projections.
3. Name the input and output devices used in CAD.
4. What are the methods of dimensioning used in CAD?
5. Draw the symbols used for surface finish in machine drawing.
6. List the types of tolerances used in machine drawing.
7. Name the types of fits.
8. Define tolerance.
9. Draw the symbol used in machine drawing for welding.
10. What is meant by BIS specifications?
11. Name the different types of fasteners used in machine components.

Understand

1. Highlight the main advantages of CAD system in design and drafting.
2. What is meant by designing of a component?
3. Differentiate Orthographic and Isometric views.
4. Give two practical applications of reduced scale and enlarged scale drafting.

5. Differentiate first angle and third angle projection.
6. What is the use of Modeling in product life cycle?
7. State the use of windowing and clipping in drafting.
8. Differentiate CAD, CAM and CAE.
9. State the applications for different types of fits.
10. Differentiate limits and tolerances.
11. State the use of tolerances in product design.
12. Differentiate tolerance and allowance.
13. Name the methods used for tolerance analysis.

Apply / Evaluate

1. Solving exercises for tolerance analysis

List of Experiments

1 Orthographic views of brackets and V- blocks
2 Screw threads and threaded fasteners
3 BIS specifications – Welding symbols, riveted joints, keys
4 Referring to hand book for the selection of standard components like bolts, nuts, screws, keys etc
5 Introduction to Modeling software – simple exercises using any one CAD package
6 Preparation of Assembly drawings – Piston and cylinder
7 Assembly of plummer block bearing
8 Assembly of flange Couplings
9 Assembly of universal Joint
10 Assembly of eccentric cam

- Design Experiment
- Application oriented experiment

Practical Schedule **Total: 45 Hours**

Sl. No.	Name of the Experiment	Hours
1	Orthographic views of brackets and V- blocks	6
2	Screw threads and threaded fasteners	6
3	BIS specifications – Welding symbols, riveted joints, keys	6
4	Referring to hand book for the selection of standard components like bolts, nuts, screws, keys etc	6
5	Introduction to Modeling software – simple exercises using any one CAD package	6
6	Preparation of Assembly drawings – Piston and cylinder	3
7	Assembly of plummer block bearing	3
8	Assembly of flange Couplings	3
9	Assembly of universal Joint	3
10	Assembly of eccentric cam	3

14U501-AUTOMOTIVE TRANSMISSION

3 0 0 3.0

Objectives

- To understand various types of Clutches and Gear Box, its principle and applications.
- To know about the various transmission and drine line units of automobiles.
- To understand the construction, principle and the concept of Fluid Coupling & Torque Convertor

Program Outcomes (POs)

d) Graduates will be able to design systems for automobiles
k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to understand the constructional, working principle of various types of manual and automotive transmission of an automobile.
- Able to explain the advantages of automatic transmission over the conventional systems

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test 1*	Test 2*	Model Examination*	Semester End Examination
1	Remember	20	20	20	20
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze/Evaluate	10	10	10	10
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What are the requirements of a clutch in a vehicle?
2. How does a clutch function in a vehicle?
3. List the types of transmission system.
4. Discuss the objectives of gear box.
5. Explain the principle operation of fluid coupling.
6. Outline the performance characteristics of hydrodynamic torque converter.
7. Name the types of epicyclic gear train.
8. Describe the basic concept of automatic transmission system.
9. List the advantages of hydrostatic drive.
10. Draw the diagram of single plate clutch.

Understand

1. Classify types of clutch.
2. Distinguish Cone clutch and electro magnetic clutch.
3. Discuss the principle of friction clutch.
4. Explain about constant mesh gear box in details.
5. Summarize the function of multi stage torque converter.
6. Distinguish polyphase torque converter and converter coupling.
7. Distinguish hydraulic drive and pneumatic drive of a vehicle.
8. What is the use of automatic transmission system?
9. Write the performance characteristics of torque converter.
10. What is hydro drive?

* The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

Apply

1. Sketch the hydro static drive and explain it?
2. Classify various type of hydrostatic drive.
3. Explain principle of early Warner synchronizer.
4. Choose the best model of epicyclic gear box in detail.
5. Which type of gear box is used in light duty vehicle?
6. Why is constant mesh gear box replaced in a vehicle?
7. Discuss about Ford T model gear box.
8. Compare Ward Leonard and modified Ward Leonard control system.
9. Write about the torque capacity of a vehicle.
10. Write the construction details of fluid coupling.
11. Discuss the construction details of Sliding mesh gear box.
12. Discuss about Wilson gear box.

Analyze/ Evaluate

1. Determine the gear ratio for a passenger car.
2. Determine the gear ratio for tractor and heavy vehicle.

Unit I

Clutch

Requirement of transmission system. Types of transmission system. Types of clutches. Requirement of clutches. Principle of friction clutch. Construction and operation of single plate coil spring clutch. Single plate diaphragm spring clutch, multiplate clutch, cone clutch and electro magnetic clutch.

9 Hours

Unit II

Gear Box

Problems on performance of automobile such as resistance to motion, tractive effort, engine speed & power and acceleration. Determination of gear ratio for passenger car, heavy vehicle and tractors. Objectives and need of gear box in a vehicle. Construction and operation of Sliding mesh gear box, constant mesh gear box, Synchronizers –need, principle of operation and types such as Early Warner and Later Warner gear synchronizers.

9 Hours

Unit III

Hydromatic Drive

Fluid coupling: Principle of operation. Constructional details. Torque capacity. Performance characteristics. Reduction of drag torque. Hydrodynamic torque converter: Principle of operation, constructional details, performance characteristics, multistage torque converter, polyphase torque converter and converter coupling.

9 Hours

Unit IV

Epicyclic Gear Boxes

Introduction to epicyclic gear train – external mesh and internal mesh planetary gear trains. Ford – T – model gear box. Wilson gear box, Cotal Electro magnetic gear box , Automatic transmission. Hydraulic control system for automatic transmission.

9 Hours

Unit V

Hydrostatic and Electric Drive

Hydrostatic drive: Various types of hydrostatic drives, principle of hydrostatic drive system, advantages & limitations, comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive. Electric drives: Principle of early Ward Leonard and modified Ward Leonard control system, advantages & limitations.

9 Hours

Total: 45 + 15 Hours

Textbook(s)

1. Newton and Steeds, “Motor vehicles”, Illife Publishers, 2002.
2. Heldt .P.M, “Torque converters”, Chilton Book Co., 1992.

References

1. Judge.A.W. “Modern Transmission systems”, Chapman and Hall Ltd, 2000.
2. Heinz Heisler, “Advanced Vehicle Technology”, Butterworth Heinemann, 2002.
3. “Hydrostatic Transmission for vehicle applications”, I.Mech E.Conference, 1981-88

14U502-AUTOMOTIVE ELECTRICAL AND ELECTRONICS

3 0 0 3.0

Objectives

- To gain knowledge in vehicle electrical and electronics components for engine operation.
- To enhance the knowledge of sensors and microprocessor applications in vehicle control systems.
- To gain information on modern safety system in vehicle braking.

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

g) Graduates will demonstrate skills to use modern engineering and information technology tools necessary for engineering practice

k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to describe the working of lead acid battery. The operation of lighting system, Horn and Wiper system
- Able to know all the theoretical information and electrical components used in a vehicle.
- Able to describe the condition at starting and behavior of starter during starting and the working and maintenances of starter motor

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I*	Test II*	Model Examination*	Semester End Examination
1	Remember	20	20	20	20
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze/ Evaluate	10	10	10	10
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is meant by distributor less ignition system?
2. What is the function of detonation sensor?
3. What is the purpose of using wheel sensor in ABS?
4. List the sources of exhaust gas emissions from the automobiles that affect the environmental conditions.
5. State four advantages of a pre-engaged starter when compared with an inertia type.
6. What is dwell angle?
7. What is the function of electromagnetic sensors in electronically sensed ABS?
8. Define Total vehicle dynamics.
9. What is the purpose of Vehicle navigation system?
10. Write the components of embedded system.
11. What is meant by inductive charging?
12. What is meant by black box fault finding?
13. What are Euro Norms?
14. What is meant by telematics?
15. What is the concept of CAN with signal format?

Understand

1. Differentiate between a solenoid switch and relay switch
2. Whether the petrol fuel injection is different from diesel fuel injection? How does it differ?
3. Write any two advantage of Bosch compact alternator.

* The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

4. Write the two important methods in pre computerized ignition system to advance the ignition timing?
5. Difference between MAF and MAP sensors.
6. Why do we use Hall Effect sensors in automotive application?
7. How do you obtain the quantity of fuel to be injected in electronic engine management system?
8. Differentiate throttle body and MPFI injection systems.
9. Why acceleration enrichment of fuel is needed?
10. Why a D.C series motor is preferred for the starting system of automobiles?
11. Why an artificial intelligence system used in automobiles?
12. Why digital displays are multiplexed.
13. Where the cruise control system used in vehicles?
14. Why we are using multi cylinder engine rather than using a larger single cylinder of similar cubic capacity?

Apply/Evaluate

1. Calculate chemically correct air fuel ratio for complete combustion of octane (C8H18).
2. Design a Electric circuit for automatic seat adjuster, power window, auto lock and for parking assist sensor.

Unit I

Types of Batteries

Principle and construction of Lead Acid Battery, Nickel – Cadmium Battery, Nickel Metal, Hybrid Battery, Sodium Sulphur Battery and Aluminium Air Battery, Characteristics of Battery, Battery Rating, Capacity and Efficiency, Various Tests on Battery, Battery– Charging Techniques, .Maintenance of batteries.

9 Hours

Unit II

Electrical Components

Requirements of Starter Motor, Starter Motor types , construction and characteristics, Starter drive mechanisms, Starter Switches and Solenoids, Charging system components, Generators and Alternators ,types, construction and Characteristics . Voltage and Current Regulation, Cut –out relays and regulators, Charging circuits for D.C. Generator, A.C. Single Phase and Three – Phase Alternators.

9 Hours

Unit III

Ignition Systems

Battery Coil and Magneto–Ignition System, Circuit details and Components of Battery Coil and Magneto–Ignition System, Centrifugal and Vacuum Advance Mechanisms, Spark Plugs, Constructional details and Types.

9 Hours

Unit IV

Electrical and Electronic Ignition Sytems

Electronically–Assisted and Full Electronic Ignition System, Non–Contact–type Ignition Triggering devices, Capacitive Discharge Ignition Distributor–less Ignition System, Digital Ignition System, Control Strategy of Electronic Ignition System.

9 Hours

Unit V

Wiring, Lighting and Other Instruments and Sensors

Automotive Wiring, Insulated and Earth Return System, Positive and Negative Earth Systems, Head Lamp and Indicator Lamp Details, Anti–Dazzling and Dipper Details, Electrical and Electronic Fuel Lift Pumps, Theory and Constructional Details of Dash Board Instruments and their Sensors like Speedometer, Odometer, Fuel Level Indicator Oil Pressure and Coolant Temperature Indicators, Horns and Wiper Mechanisms, Automotive Wiring Circuits

9 Hours

Total: 45 Hours

Textbook(s)

1. Young, A.P. and Griffith, S.L., “Automobile Electrical Equipments”, ELBS and New Press.
2. Kholi .P.L, “Automotive Electrical Equipment”, Tata McGraw-Hill co ltd, New Delhi,2004

References

1. Crouse.W.H. “Automobile Electrical Equipment”, McGraw Hill Book Co Inc.NewYork,2005
2. Judge.A.W., “Modern Electrical Equipments of Automobiles”, Chapman & Hall, London 2004
3. Robert Bosch, “Automotive Handbook”, Bently Publishers,2004

14U503-VEHICLE DESIGN AND DATA CHARACTERISTICS

3 1 0 3.5

Objectives

- To collect important technical specifications of an automobile from Automobile journals and keeping this, as a guide, to calculate and tabulate various vehicle performance parameters and design parameters.
- To draw performance curves using these data.

Program Outcomes (POs)

d) Graduates will be able to design systems for automobiles
g) Graduates will demonstrate skills to use modern engineering and information technology tools necessary for engineering practice
k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to understand the basic design principle of vehicle
- Able to draw the performance curves pertain to engine and chassis.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I*	Test II*	Model Examination*	Semester End Examination
1	Remember	20	20	20	20
2	Understand	20	20	20	20
3	Apply	30	30	30	30
4	Analyze/ Evaluate	30	30	30	30
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Outline the important assumptions to be made in designing a vehicle.
2. Distinguish between rolling resistance and air resistance.
3. List the vehicles based on the values of engine displacement and acceleration.
4. Explain the significance of side thrust acting on the piston.
5. How to measure the frontal area of a vehicle?
6. How will you estimate mechanical efficiency?
7. Define gradiability of the vehicle.
8. What do you mean by gas force?
9. Define inertia force.
10. Differentiate between piston velocity and acceleration.
11. Plot the typical performance curves of a petrol engine.
12. Draw a performance curve for driving force against Vehicle speed.
13. Define mechanical efficiency?
14. What is minimum and maximum speed of a vehicle?
15. Define the term crank angle.

Understand

1. Illustrate the typical PV & TS diagram for a diesel engine.
2. Draw and indicate the salient parts of a flange coupling.
3. Discuss are the power requirement for different loads and acceleration.
4. Describe about interpolation pressure.

* The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

5. Define mean effective pressure.
6. Discuss about turning moment of a vehicle?
7. What is bore and stroke length?
8. Explain briefly the parameters considered in designing of a vehicle?
9. What is sliding thrust?
10. Explain Dry weight, Kerb weight and Normal Laden weight?

Apply

1. Assuming suitable vehicle data , plot the variation of excess driving force with respect to the vehicle speed?
2. Explain the need of gear box in a vehicle.
3. Explain the procedure of gear ratio of a small car.
4. Write a note on rolling resistance.
5. Draw the PV diagram of a SI engine.
6. Explain the indicative mean effective pressure with P-V diagram.
7. Describe in detail design variables and operating variables affecting performance and Emissions of a vehicle
8. Derive the expression for velocity and acceleration of the piston in terms of crank angle.
9. Write a note about gradient resistance.
10. Discuss about the procedure to draw Driving Force Curve.

Analyze/ Evaluate

1. An eight cylinder automobile engine of 85.7 mm bore and 82.5 mm stroke with a compression ratio of 7 is tested at 4000 rpm on a dynamometer which has a 0.5335 m arm, During a 10 minute test at a dynamometer scale beam reading of 400 N, 4.55 kg of gasoline for which the heating value is 46,000 kJ/kg are burnt, and air is supplied to the carburetor at the rate of 5.44 kg/mm. Find (i) the b.p delivered, (ii) the b.m.e.p, (iii) the b.s.f.c, (iv) the specific air consumption.
2. The bore and stroke of an engine are 75.5 ×90.5 mm. The ratio of the length of connecting rod to crank radius is 3.85. If the gas pressure corresponding to the crank angle of 45°is 35 kgf/cm^2, calculate the side thrust on piston skirt at this crank angle.
3. For a motor vehicle, the rolling resistance is given by 13.6 + 0.6965 V and the air resistance by the expression 0.0827 V^2 the resistance being in N and V the speed in km/hr. If the transmission efficiency in 88%, calculate the b.kW required for a top speed of 128 km/hr. Assuming that the engine torque at 48 km/hr in top gear is 25% more than that at 128 km/hr and that the vehicle inertia corresponds to a weight of 17805 N, calculate the acceleration in m/s^2 at 48 km/hr.

Unit I

Introduction

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, Basics of Automobile Design.

9 Hours

Unit II

Resistance to Vehicle Motion

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.

9 Hours

Unit III

Performance Curves

Calculation, Tabulation and Plotting of Torque and Mechanical Efficiency for different vehicle speeds, Interpolation of Pressure – Volume diagram, Calculation of frictional Mean Effective Pressure, Calculation of Engine Cubic Capacity, Bore and Stroke Length.

9 Hours

Unit IV

Connecting rod length to Crank Radius Ratio, Plotting of Piston Velocity and Acceleration against Crank Angle, Plotting Gas force, inertia force and Resultant force against Crank Angle, Turning Moment and Side Thrust against Crank Angle.

9 Hours

Unit V

Gear Ratios

Determination of Gear Ratios, Acceleration and Gradability, Typical Problems on Vehicle performance

9 Hours

Total: 45 + 15 Hours

Textbook(s)

1. N. K. Giri, “Automotive Mechanics”, Khanna Publishers, New Delhi, 2005.
2. Heldt, P.M., “High Speed Combustion Engines”, Oxford and I.B.H. Publishing Co., Kolkata, 2002.

References

1. Gupta. R.B., "Automobile Engineering", Sathya Prakashan, 2013.

14U504-DESIGN OF MACHINE ELEMENTS
(Common to AU and ME- Regulation 2011)

3 1 0 3.5

Objectives

- To understand the basic geometrical specifications of various machine component with their functional and strength requirements
- To understand the procedures and standards for designing various machine components with maximum economy and efficiency
- To inject the knowledge to evaluate the design parameters of machine components.

Program Outcome (POs)

b) Graduates will be able to identify, formulate and solve automobile engineering problems
d) Graduates will be able to design systems for automobiles

Course Outcome (COs)

- Able to select the proper dimensions for the machine component for specific applications.
- Able to check the failure modes in machine component and identify the solution.
- Able to design the machine component for particular applications.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test 1*	Test 2*	Model Examination*	Semester End Examination
1	Remember	25	20	10	10
2	Understand	30	30	20	20
3	Apply	30	30	30	30
4	Analyze/Evaluate	15	20	40	40
5	Create	--	--	--	--
	Total	**100**	**100**	**100**	**100**

Remember

1. Define standardization.
2. List the factors influencing machine design.
3. Define principal stress.
4. What is meant by curved beams?
5. Name some of the failure theories.
6. Define factor of safety.
7. Define torsional rigidity of the shaft.
8. Define critical speed of the shaft.
9. What do you meant by flexible shafts?
10. What is coupling? Where do you use it?
11. Define lead of screw threads.
12. Define pitch of the thread.
13. Name the types of threads used in fasteners.
14. List the types of joints used in welding.
15. Define stiffness of the spring.
16. Define spring index.
17. What is the solid length of the helical compression springs?
18. Name the types of bearings used in machine components.
19. What are the functions of bearings?
20. State some of the applications of ball and roller bearings.
21. What is coefficient of fluctuation of speed?
22. What is the difference between the function of flywheel and governor?

*The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

23. Define fatigue failure.
24. Define mechanical advantage.
25. What is leverage?
26. How will you classify bearings?

Understand

1. State the significance of factor of safety in machine design.
2. What are the causes for stress concentration?
3. What are the methods of reducing stress concentration?
4. Why hollow shaft is stronger than solid shaft?
5. How is resonance avoided in shafts?
6. Why maximum principal stress theory is not applicable for shafts?
7. What is the difference between coupling and clutch?
8. Give the difference between rigid and flexible coupling.
9. In What situation flexible coupling is used?
10. Why taper is provided in the key?
11. If a coupling is assembled to the shaft by key which should be stronger?
12. What are the advantages of threaded joints?
13. What are the advantages of V threads?
14. What is the function of plain washer in bolted joints?
15. State the difference between course and fine threads.
16. List the names of stresses induced in threaded joints.
17. What are the advantages of welded joints compared to riveted joints?
18. What are the causes of residual stress in welded joint? How are they relieved?
19. How do you differentiate open and closed coil helical spring?
20. Name the types of stresses induced in the springs.
21. What is the use of Wahl'?
22. Name the types of springs.
23. What is meant by nip of leaf spring?
24. What is meant by active coils of the spring?
25. Why ball and roller bearings are called antifriction bearings/
26. Why taper roller bearings are used in pairs?
27. What is the function of flywheel?
28. What do you understand by fluctuation of energy and maximum fluctuation of energy?
29. What types of stresses are induced in the spokes of a rimmed flywheel?
30. What is the effect of keyway on the torsional rigidity of the shaft?
31. Why steps are provided in the shaft? How does it affect the shaft strength?

Apply

1. What is approximate friction power loss in a single radial ball bearing having a bore diameter of 55mm and subjected to a radial load of 225KN? The shaft rotates at 600RPM.
2. Determine the approximate friction torque expected in single deep groove ball bearing under a radial load of 30KN. The bore of the bearing is 50mm.
3. A shaft is subjected to the varying load cycle as follows; 3KN for 1 Sec, 1 KN for 1s and 0.5KN for 3s. If the shaft rotates at the constant speed of 500RPM, What basic load rating for each fraction of cycle should be used in selecting the ball bearing with a life of 15000 hours?

Analyze / Evaluate

1. Taking stress concentration into account find the maximum stress induced when a tensile load of 20kN is applied to i) A rectangular plate 80mm wide and 12mm thick with a transverse hole of 16mm diameter ii) A stepped shaft of 60mm and 30mm diameter with 6 mm fillet radius.
2. A factory line shaft is 4m long and is to transmit 75KW at 200rpm. The allowable stress in shear is 40Mpa and maximum allowable twist is 10 in a length of 20mm diameter. Determine the required shaft diameter.
3. Design a journal bearing for a centrifugal pump with the following data.
   Diameter of the journal = 150mm
   Load on bearing = 40KN
   Speed of journal = 900Rpm

Unit I

Steady Stresses and Variable Stresses in Machine Members

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties – Direct, Bending and Torsional stress equations – Impact loading – Calculation of principle stresses for various load combinations– Design of curved beams – Crane hook and 'C' frame - Factor of safety - theories of failure – Introduction to fracture mechanics-Stress concentration – Design for variable loading – Soderberg, Goodman and Gerber relations

Stress intensity factor

9 Hours

Unit II

Design of Shafts and Couplings

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways - Design of rigid flange and flexible couplings – Muff, Clamp, Rigid Flange and Bushed-pin flexible couplings – Design of knuckle joints

Introduction to gear and shock absorbing couplings **9Hours**

Unit III

Design of Joints and Levers

Threaded fasteners - Design of bolted joints – Eccentrically loaded bolted joint in shear – Eccentric load perpendicular to axis of bolt – Eccentric load on Circular base – Design of welded joints for pressure vessels and structures – Butt, Fillet welded Joints – Strength of Parallel, Traverse fillet Welded Joints - Theory of bonded joints – Failures in pressure vessel joints - Design of Levers

Metal stir welding Process

9 Hours

Unit IV

Design of Springs and Flywheel

Design of helical, multi- leaf and torsional springs under constant loads and varying loads - End conditions and length of springs - Stresses in Helical springs of circular wire – Wahl stress factor – Concentric torsion springs – Belleville springs – Special springs - Design of flywheels involving stresses in rim and arm

Flywheel energy storage

9 Hours

Unit V

Design of Bearings

Design of bearings – Sliding contact and rolling contact types – Cubic mean load – Design of journal bearings – Mckees equation – Lubrication in journal bearings – Calculation of bearing dimensions – Fundamentals of engineering Tribology

Advance Bearings

9 Hours

Total: 45 + 15 Hours

Textbook(s)

1. V. B. Bhandari, "*Design of Machine Elements"*, Tata McGraw-Hill Publishing Company Pvt Ltd, New Delhi, 2010.

References

1. Faculty of Mechanical Engineering, PSG College of Technology, *Design Data Book*, M/s.Kalaikathir Achchagam, 2009.
2. J. E. Shigley and C. R. Mischke, "*Mechanical Engineering Design"*, Tata McGraw-Hill Publishing Company Pvt Ltd., New Delhi, 2003.
3. R. C. Juvinall and K. M. Marshek, "*Fundamentals of Machine Component Design"*, John Wiley & Sons, New Delhi, 2002.
4. R. L. Norton, "*Design of Machinery"*, Tata McGraw-Hill Publishing Company Pvt Ltd., New Delhi, 2004.
5. W. Orthwein, "*Machine Component Design"*, Jaico Publishing Co, 2003.
6. http://www.nptel.iitm.ac.in/courses/Webcourse contents/IIT%20Kharagpur/Machine%20design1/New_index1.html

14U505-AUTOMOTIVE FUELS AND LUBRICANTS

3 0 0 3.0

Objectives

- To understand the properties of fuels and lubricants for the design and operation of the I.C engines
- To study the combustion characteristics of fuels in I.C. Engines

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
b) Graduates will be able to identify, formulate and solve automobile engineering problems

Course Outcomes (COs)

- Able to understand the importance, manufacturing methods, testing methods, combustion methodology of automotive fuels and lubricants.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	30	30	30	30
3	Apply	20	20	20	20
4	Analyze / Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Mention characteristics of petroleum fuels.
2. Define petroleum refining process.
3. Brief distillation columns.
4. State the various products in the atmospheric distillation columns.
5. State the various products in the vacuum distillation columns.
6. Write short notes on Cracking.
7. Write short notes on Isomerization.
8. Define Hydrogenation.
9. Explain Alkylation.
10. Brief Reformation.
11. Classify lubricants.
12. Define octane rating.
13. Define cetane rating.
14. Define flammability.

Understand

1. Draw the flow chart for manufacture of lube oil base stocks.
2. How additives help to improve the desirable properties of lubricants?
3. What do you mean by knocking?
4. How does the molecular structure influence the knocking in SI engines?
5. How does the self ignition temperature influence the knocking in SI engines?
6. What are the important characteristics of diesel fuel used in CI engines?
7. Differentiate flash point and fire point.
8. Describe the thermo-chemistry of fuels.
9. What are the desirable characteristics of automotive lubricants?
10. Write a note on Elasto-hydrodynamic lubrication.

† The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

Apply

1. What are the tests performed in the grease?
2. Draw the neat sketch of the splash type lubrication system.
3. Mention the various types of friction occurred in the engines.
4. What is an aniline point?
5. What is API gravity?
6. Specify the important characteristics of diesel fuel used in CI engines.
7. Explain the chemical structure of petroleum hydrocarbons.
8. Draw a neat sketch of petroleum refining process.

Unit I

Manufacture of Fuels and Lubricants

Fuels, Structure of petroleum, refining process, thermal and catalytic cracking, products of refining process, manufacture of lubricating oil base stocks and finished automotive lubricants.

9 Hours

Unit II

Fuels for I.C. Engines

Types of Fuels, Liquid and gaseous fuels, heating value of fuels, higher and lower heating values, chemical structure of hydro-carbons SI Engine fuels, Volatility characteristics, desirable characteristics of SI Engine fuels, knock rating and additives, alternate fuels for SI engines. CI engine fuels, desirable characteristics, cetane rating, alternate fuels for CI engines, biodiesels.

9 Hours

Unit III

Combustion of Fuels

Stoichiometry - calculation of theoretically correct air required for combustion of liquid and gaseous fuels, volumetric and gravimetric analysis of the dry products of combustion, mass of dry gas per kg of fuel burnt, mass of carbon in the exhaust gas, mass of carbon burnt to carbon-monoxide per kg of fuel, heat loss due to incomplete combustion, exhaust gas analysis by Orsat apparatus.

9 Hours

Unit IV

Theory of Lubrication

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, Hydrostatic lubrication bearing lubrication, functions of the lubrication system.

9 Hours

Unit V

Lubricants

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, testing of grease.

9 Hours

Total: 45 Hours

Textbook(s)

1. Ganesan.V., “Internal Combustion Engineering”, Tata McGraw-Hill Publishing Co., New Delhi,2012.
2. Mathur. M.L., Sharma. R.P. “A course in internal combustion engines”, Dhanpatrai publication, 2010.

References

1. Francis, W, "Fuels and Fuel Technology", Vol. I & II, Pergamon, 1965
2. Hobson, G.D. & Pohl.W "Modern Petroleum Technology", 1974
3. Lansdown A.R., Lubrication, "A practical guide to lubricant selection", Pergamon press, 1982.

14U507-ENGINE PERFORMANCE AND EMISSION TESTING LABORATORY

0 0 3 1.5

Objectives

- To understand the working principle of hydraulic, electrical and eddy current dynamometers
- To understand the Valve timing and Port timing diagram
- To understand the importance of performance testing of IC Engines

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment
g) Graduates will demonstrate skills to use modern engineering and information technology tolls necessary for engineering practice

Course Outcomes (COs)

- Able to carry out the Experiment to determine the performance of various IC engines
- Able to define the Engine Parameters and their effects over the Performance
- Able to determine the P-θ and P-V Values

ASSESSMENT PATTERN

	Internal Assessment	Semester end Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	25	25
Record	5	-
Mini- Project / Model Examination / Viva-voce	10	10
Total	**50**	**50**

List of Experiments

1. Study of hydraulic, electrical and eddy current dynamometers
2. Valve timing and port timing diagram
3. Performance and emission test on two wheeler SI engine
4. Performance and emission test on automotive multi-cylinder SI engine
5. Performance and emission test on automotive multi-cylinder CI engine
6. Retardation test on I.C. Engines
7. Heat balance test on automotive multi-cylinder SI engine
8. Heat balance test on automotive multi-cylinder CI engine
9. Morse test on multi-cylinder SI engine
10. P-θ and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and PC

Practical Schedule **Total: 30 Hours**

Sl. No.	Name of the Experiment	Hours
1	Study of hydraulic, electrical and eddy current dynamometers	3
2	Valve timing and port timing diagram	3
3	Performance and emission test on two wheeler SI engine	3

4	Performance and emission test on automotive multi-cylinder SI engine	3
5	Performance and emission test on automotive multi-cylinder CI engine	3
6	Retardation test on I.C. Engines.	3
7	Heat balance test on automotive multi-cylinder SI engine	3
8	Heat balance test on automotive multi-cylinder CI engine	3
9	Morse test on multi-cylinder SI engine	3
10	P-θ and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and PC	3

14U508-AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY

0 0 3 1.5

Objectives

- To understand battery testing and maintenance
- To understand the testing of starting motors and generators
- To understand the testing of regulators and cut-outs relay
- To understand the diagnosis of ignition system faults.
- To study of automobile electrical wiring.
- To study the basic electronic components

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment
g) Graduates will demonstrate skills to use modern engineering and information technology tolls necessary for engineering practice

Course Outcomes (COs)

- Able to describe the testing procedure maintenance of the battery.
- Able to describe the working of regulators and cut-outs relay.
- Able to describe the working of ignition system and to know the diagnosis of ignition system
- Able to describe the various electrical circuits in a vehicle
- Able to construct the rectifier circuit using diodes and to know about the necessity in automobiles

ASSESSMENT PATTERN

	Internal Assessment	Semester end Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	25	25
Record	5	-
Mini- Project / Model Examination / Viva-voce	10	10
Total	**50**	**50**

List of Experiments

a. **Electrical Laboratory**

1. Testing of batteries and battery maintenance
2. Testing of starting motors and generators
3. Testing of regulators and cut – outs
4. Diagnosis of ignition system faults
5. Study of Automobile electrical wiring

b. **Electronics Laboratory**

1. Study of rectifiers and filters
2. Study of logic gates, adder and flip-flops

3. Study of SCR and IC timer
4. Interfacing Sensors like RTD, LVDT, Load Cell etc.
5. Interfacing ADC for Data Acquisition
6. Interfacing DAC for Control Application
7. Interfacing A/D converter and simple data acquisition
8. Micro controller programming and interfacing
9. Interfacing Actuators
10. EPROM Programming
11. Fault Diagnosis of various sensors

Practical Schedule **Total: 30 Hours**

Sl. No.	Name of the Experiment	Hours
1	Testing of batteries and battery maintenance	2
2	Testing of starting motors and generators	2
3	Testing of regulators and cut – outs	2
4	Diagnosis of ignition system faults	2
5	Study of Automobile electrical wiring	2
6	Study of rectifiers and filters	1
7	Study of logic gates, adder and flip-flops	1
8	Study of SCR and IC timer	2
9	Interfacing Sensors like RTD, LVDT, Load Cell etc.	2
10	Interfacing ADC for Data Acquisition	2
11	Interfacing DAC for Control Application	2
12	Interfacing A/D converter and simple data acquisition	2
13	Micro controller programming and interfacing	2
14	Interfacing Actuators	2
15	EPROM Programming	2
16	Fault Diagnosis of various sensors	2

14U509-AUTOMOTIVE FUELS AND LUBRICANTS LABORATORY

0 0 3 1.5

Objectives

- To do independent experiments to find out the properties of fuels and lubricants
- To grasp the importance of fuels and lubricants
- To be familiar with the properties of fuels and lubricants

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to produce high focused independent practical skill on fuels and lubricants.
- Able to identify how they can be involved in doing experiments
- Able to perform an in-depth analysis related with any fuel / lubricant.
- Able to describe how the temperature and friction can influence the properties of fuels and lubricants

ASSESSMENT PATTERN

	Internal Assessment	Semester end Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	25	25
Record	5	-
Mini- Project / Model Examination / Viva-voce	10	10
Total	**50**	**50**

List of Experiments

1. Study of International and National standards for fuels and lubricants.
2. Study of Octane and Cetane Number of fuels.
3. Testing of fuels - Ultimate analysis, proximate analysis
4. ASTM distillation test of liquid fuels
5. Aniline Point test of diesel
6. Calorific value of liquid fuel.
7. Calorific value of gaseous fuel.
8. Reid vapour pressure test.
9. Flash and Fire points of petrol and diesel.
10. Copper strip Corrosion Test
11. Cloud & Pour point Test.
12. Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer.
13. Viscosity Index of lubricants & Fuels by Saybolt Viscometer
14. Ash content and Carbon Residue Test
15. Drop point of grease and mechanical penetration in grease.

Practical Schedule **Total: 30 Hours**

Sl. No.	Name of the Experiment	Hours
1	Study of International and National standards for fuels and lubricants	2
2	Study of Octane and Cetane Number of fuels	2
3	Testing of fuels - Ultimate analysis, proximate analysis	2
4	ASTM distillation test of liquid fuels	2
5	Aniline Point test of diesel	2
6	Calorific value of liquid fuel	2
7	Calorific value of gaseous fuel	2
8	Reid vapour pressure test	2
9	Flash and Fire points of petrol and diesel	2
10	Copper strip Corrosion Test	2
11	Cloud & Pour point Test	2
12	Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer	2
13	Viscosity Index of lubricants & Fuels by Saybolt Viscometer	2
14	Ash content and Carbon Residue Test	2
15	Drop point of grease and mechanical penetration in grease	2

14U601-AUTOMOTIVE ENGINE COMPONENTS DESIGN

3 1 0 3.5

Objectives

- To understand the design concept and principles of various engine components.
- To understand the designing the parts of connecting rod and crankshaft, know about the materials of connecting rod and crankshaft, and also know about the balancing of crankshaft

Program Outcomes (POs)

b) Graduates will be able to identify, formulate and solve automobile engineering problems
d) Graduates will be able to design systems for automobiles
k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to impart knowledge in automotive engines.
- Able to understand the detailed concept, construction and principle of operation of engine and various engine components, combustion, cooling and lubrication systems
- Able to have good command over automotive engines and the recent development in the area of engines.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	20	20	20	20
2	Understand	20	20	20	20
3	Apply	30	30	30	30
4	Analyze /Evaluate	30	30	30	30
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Name the types of tolerances and fits.
2. Give any two application of interference fit.
3. Enumerate the design construction of crank pin.
4. Define co-efficient of fluctuation of speed.
5. State two types of stresses induced in a flywheel.
6. Why the inlet port area is made larger than the area of exhaust port?
7. Write the materials used for manufacturing of cam shaft.
8. Define Spring.
9. State the materials used for manufacturing springs.
10. What are the applications of helical springs?
11. Draw the stress-strain diagram for a ductile specimen and indicate its salient features.
12. Sketch and indicate the salient parts of a flange coupling.
13. Define 'coefficient of fluctuation of speed' in a flywheel.
14. In what way does a flywheel differ from that of a governor? Illustrate your answer with suitable examples?
15. Define Hysteresis of a spring.

Understand

† The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

1. Define Endurance stress of a spring.
2. Define free length.
3. Sketch a valve gear mechanism of an internal combustion engine and label its various parts.
4. Explain in detail about the design considerations for the interference fits.
5. Summarize the type of fit specified by 120 H7 p6 in a drawing
6. What is a 'bearing characteristic number'?
7. Discuss about Solid length.
8. Discuss the design consideration of piston.
9. How to attain perfection in finishing of surface?
10. Write Tetmajer's formula for push-rods.

Apply

1. Write the important Terms used in Limit System and explain in detail.
2. Prepare the design procedure for design of centre Crankshaft.
3. Prepare the Design Procedure for design of centre Crankshaft.
4. Determine the minimum length of connecting rod?
5. Design the connecting rod under bending and twisting?
6. Graph the turning movement diagram.
7. Write the significance of firing order.
8. Discuss about the designing procedure of shank.
9. Describe about cam profile generation.
10. Define surface roughness.

Analyze/ Evaluate

1. Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The Spring is to be enclosed in a closing of 25 mm dia. The approximate number of turns is 30. Also calculate the maximum shear stress induced. Take G = 85 GPa.
2. Design a suitable spring for the exhaust valve of a petrol engine. The spring should be capable of exerting a net force of 360N when the valve is open and 220N when it is closed. The maximum inside diameter of the spring is 25mm. The compression in spring is 8mm.
3. Design and draw suitable flywheel for a four stroke four cylinder 133 kW engine running at 375 rpm. Due to space restriction the flywheel diameter should not exceed 1.2m
4. Design a flywheel for a single cylinder, four stroke single cylinder vertical diesel engine developing 4 KW at 1500 rpm. Assume co efficient of speed fluctuation, Cs=0.01.
5. Design and draw a cast iron flywheel used for a four stroke I.C engine developing 180 kW at 240 rpm. The hoop or centrifugal stress developed in the flywheel is 5.2 MPa, the total fluctuation of speed is to be limited to 3% of the mean speed. The work done during the power stroke is 1/3 more than the average workdone during the whole cycle? The maximum torque on the shaft is twice the mean torque. The density of cast iron is 7220 kg/m^3.

Unit I

Introduction

Engineering materials - Introduction endurance limit, notch sensitivity. Tolerances, types of tolerances and fits, design considerations for interference fits, surface finish, surface roughness, Rankine's formula - Tetmajer's formula - Johnson formula- design of push-rods.

9 Hours

Unit II

Design of Cylinder, Piston and Connecting Rod

Choice of material for cylinder and piston, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly. Material for connecting rod, determining minimum length of connecting rod, small end design, shank design, design of big end cap bolts.

9 Hours

Unit III

Design of Crankshaft

Balancing of I.C. engines, significance of firing order. Material for crankshaft, design of crankshaft under bending

and twisting, balancing weight calculations, development of short and long crankarms. Front and rear-end details.

9 Hours

Unit IV

Design of Flywheels

Determination of the mass of a flywheel for a given co- efficient of speed fluctuation. Engine flywheel - stresses on the rim of the flywheels. Design of hubs and arms of the flywheel, turning moment diagram.

9 Hours

Unit V

Design of Valves and Valve Train

Design aspects of intake & exhaust manifolds, inlet & exhaust valves, valve springs, tappets and valve train. Design of cam & camshaft. Design of rocker arm. Cam profile generation.

9 Hours

Total: 45 + 15 Hours

Textbook(s)

1. Jain.R.K, “Machine Design”, Khanna Publishers, New Delhi, 2005.

References

1. Khurmi. R.S. & Gupta. J.K., “A textbook of Machine Design”, Eurasia Publishing House (Pvt) Ltd, 2001.
2. Giri.N.K, “Automobile Mechanics”, Khanna Publishers, New Delhi, 2007.

14U602-AUTOMOTIVE CHASSIS COMPONENTS DESIGN

3 1 0 3.5

Objectives

- To understand the fundamental principles involved in design of components of automotive chassis, the complete design exercise and arrive at important dimensions of chassis components.

Program Outcomes (POs)

b) Graduates will be able to identify, formulate and solve automobile engineering problems
d) Graduates will be able to design systems for automobiles
k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to design the automotive components like frame, suspension systems, axles, clutch, gear box, drive line components etc

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	20	20	20	20
2	Understand	20	20	20	20
3	Apply	30	30	30	30
4	Analyze /Evaluate	30	30	30	30
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What are the forces and stresses the automobile frame has to withstand?
2. Define spring rate and spring index of the coil spring.
3. Give the reason for the wide use of channel section with its web in vertical.
4. List out the different sections used in a rigid type front axle of a commercial vehicle.
5. Point the causes for stiff steering.
6. Why is front axle and designed as I – section in the middle and elliptical section at the ends?
7. List the various components of a clutch.
8. When is the torque capacity of the clutch greatest?
9. Describe about a cone clutch more effective than plate clutch.
10. Why is geometric progression preferred in gear ratios?
11. When is maximum vehicle speed attained?
12. Match the possible arrangements to achieve 12 speeds from a gear box.
13. Why is hollow shaft used as propeller shaft?
14. Name the different types of rear axles used in vehicles.
15. Discuss about the importance of the propeller shaft critical speed.

Understand

1. Why are shackles used along with leaf spring?
2. Classify the different types of sections used in the vehicle frame.
3. List the advantages of using coil spring over leaf spring.
4. What are the possible causes of hard steering?
5. In which section of front axle, torsional and bending moments are predominant?

† The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

6. Write the fundamental condition to be satisfied for true rolling motion.
7. Classify the types of clutch operating mechanisms used in automobile.
8. What is the major factor limiting the clutch capacity?
9. Why is a clutch needed in an automotive transmission system?
10. Compare the differences between a constant mesh and sliding mesh gear train.
11. Define the term “Tractive effort”.
12. What are the different types of resistances experienced by a vehicle?
13. Illustrate a neat sketch of three quarter floating axle.
14. How are the various reaction forces and torques taken care in a Hotch kiss drive?
15. Classify the different types of final drives used in a vehicle.

Apply

1. Discuss the various loads acting on chassis frame.
2. Define rate of spring.
3. What is an energy absorbing frame?
4. Mention the different configurations of laminated leaf spring suspensions.
5. Classify the various axle hubs employed in automobiles
6. Explain a note on Ackerman principle.
7. Give any two material properties for designing a friction clutch.
8. What is the requirement of gear box in an automobile?
9. How is length of propeller shaft varied automatically?
10. Define “Whirling of shafts”.

Analyze/ Evaluate

1. A steering box has a gear ratio of 16:1 and an efficiency of 85%. Assume the driver to exert a force of 60 N at the rim of a wheel 0.4 m in diameter, determine the torque at the drop arm shaft.
2. A motor car has a wheel-base of 2.743m and pivot centre of 1.065m. The front and rear wheels track is 1.217m. Calculate the correct angle of outside lock and turning circle radius of the outer front and inner rear wheels when the angle of inside lock is 40^0.
3. Write a short note on the following Ackermann steering geometry.
4. Discuss elaborately the design procedure to calculate the bearing loads on front and rear bearings of a 4 speed gear box, when the 2nd gear is in engaged position.
5. A hatch back vehicle engine develops 30 kw at 1450 rpm and its bottom gear ratio is 3:1. If a propeller shaft of 38 mm outside diameter is to be used, determine the inside diameter of mild steel tube to be used, assuming a safe shear stress of 56 x 103 kpa for MS.

Unit I

Vehicle Frame and Suspension

Study of loads-moments and stresses on frame members. Design Of frame for passenger and commercial vehicle - Design of leaf Springs-Coil springs and torsion bar springs.

9 Hours

Unit II

Front Axle and Steering Systems

Analysis of loads-moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings. Wheel spindle bearings. Choice of Bearings. Determination of optimum dimensions and proportions for steering linkages, ensuring minimum error in steering. Design of front axle beam.

9 Hours

Unit III

Clutch

Design of single plate clutch, multiplate clutch and cone clutch. Torque capacity of clutch. Design of clutch components, Design details of roller and sprag type of clutches.

9 Hours

Unit IV

Gear Box

Gear train calculations, layout of gearboxes. Calculation of bearing loads and selection of bearings. Design of three speed and four speed gearboxes.

9 Hours

Unit V

Drive Line and Rear Axle

Design of propeller shaft. Design details of final drive gearing. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings and design aspects of final drive.

9 Hours

Total: 45 + 15 Hours

Textbook(s)

1. Giri, N.K., "Automobile Mechanics", Khanna publishers, New Delhi, 2007.
2. Khurmi. R.S. & Gupta. J.K., "A textbook of Machine Design", Eurasia Publishing House (Pvt) Ltd, 2001.

References

1. Heldt, P.M., "Automotive Chassis", Chilton Book Co., 1992.
2. Dean Averns, "Automobile Chassis Design", Illife Book Co., 2001.

14U603-PRINCIPLES OF MANAGEMENT

3 0 0 3.0

Objectives

- To gain knowledge on the principles of management for all kinds of people in all kinds of organizations
- To have basic knowledge on international aspect of management
- To have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling

Program Outcomes (POs)

h) Graduates will have knowledge of professional and ethical responsibilities

Course Outcomes (COs)

- Expertise on responsibilities of a Manager.
- Expertise on Organizational Hierarchy and Staffing.
- Familiar with various Motivational Theories.
- Familiar with budgets and controlling techniques.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test 1*	Test 2*	Model Examination*	Semester End Examination
1	Remember	30	30	30	30
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze/Evaluate	--	--	--	--
5	Create	--	--	--	--
	Total	**100**	**100**	**100**	**100**

Remember

1. What is Management?
2. What are all the characteristics of Management?
3. What are all the role of management in Organisation?
4. Who is the father of Scientific Management?
5. What is scalar chain?
6. What are all the functions of management?
7. What is partnership?
8. What is private limited company?
9. Define planning.
10. What are all the objectives of planning?
11. What are all the different types of planning?
12. Mention the required reasons for the need of policies.
13. Classify budgets.
14. What is MBO?
15. What is planning premises?
16. Define organising.
17. List out the steps involved in organisation process.
18. State the kinds of organisational charts.
19. What are the types of departmentation?
20. What is matrix structure?
21. List out the sources of authority.
22. What is staff authority?

---

*The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

23. What is decentralization?
24. What are the steps involved in manpower planning?
25. What is stress interview?
26. What is performance appraisal?
27. What is Halo effect?
28. What is managerial grid?
29. List down the human factors in managing.
30. Define creativity.
31. What is SCAMPER tool?
32. What is meant by brain storming?
33. Define Motivation?
34. Name the steps involved in motivation process?
35. What are the types of motivation?
36. Mention the various types of communication in organisation.
37. What is control?
38. What are the characteristics of control?
39. What is feed forward control?
40. What is management by expectation?
41. Define budget.
42. What are the classification of Budget?
43. What is zero base budget?
44. What is PERT and CPM?
45. What are the factors affecting productivity?
46. Define OR.
47. What is Value analysis?
48. What is polycentric attitude?
49. What is geocentric attitude?

Understand

1. Write some important functions of top management.
2. Write the demerits of sole trading.
3. What are all the problems of partnership?
4. Give an example of public and private limited companies.
5. What are all the guidelines for objective setting?
6. What are all the benefits of Management by Objective?
7. When the strategy planning fails?
8. What are the practices made in making effective premising?
9. How to evaluate the importance of a decision?
10. What do you understand by effective organising?
11. How informal organisation characteristics differ from formal organisation?
12. State the advantages and disadvantages of departmentation by enterprise function.
13. Give a note on departmentation by customers.
14. Compare line and staff authority.
15. What are all the disadvantage of decentralization?
16. Differentiate recruitment and selection.
17. How to make an effective appraisal?
18. What are all the sources of an organisational conflict?
19. Differentiate innovation and invention.
20. How can be harmonizing objectives achieved?
21. What are the important assumptions made on Y theory?
22. Mention the importance of motivation.
23. Differentiate motivation and satisfaction.
24. Why is budget control important?
25. How PERT and CPM in used?
26. How to use MIS for middle management?
27. How to calculate ROI?

Apply

1. In addition to a paid job, where else might a person develop managerial experience?

2. In recent years, many employers seek out technically trained job candidates who also have studied management. What advantages do you think employers see in a technical person studying management?
3. Why do large companies encourage many of their employees to "think like entrepreneurs"?
4. What do you think might be advantages of making business executives adhere to a code of ethics as do physicians and lawyers?
5. During weather emergencies such as a severe ice storm, some companies send out an alert that only "essential" employees should report to work. Explain why managers should or should not stay home on such emergency days.
6. What is your reaction to the following statement made by many business graduates? "It may be nice to study ethics, but in the real world the only thing that counts is money."
7. Give examples of rights that you think every employee is entitled to.
8. Some business owners make a statement such as, "We're too busy to bother with strategy. We have to take care of the present." What might be wrong with their reasoning?
9. How might the use of Internet search engines help you make better decisions on the job?
10. Describe the general approach a firm of five real-estate developers might take to use the nominal group technique for deciding which property to purchase next.
11. Why would a heavy equipment company like Caterpillar hire a Ph.D. in economics as the CEO?
12. Gantt charts have been around for almost 100 years, and they are now implemented with software. Why do Gantt charts have such staying power?

Unit I

Overview of Management

Organization - Management - Role of managers - Evolution of Management thought - Organization and the environmental factors - Managing globally - Strategies for International Business.

9 Hours

Unit II

Planning

Nature and purpose of planning - Planning process - Types of plans – Objectives - - Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions.

9 Hours

Unit III

Organizing

Nature and purpose of organizing - Organization structure - Formal and informal groups *I* organization - Line and Staff authority - Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages – Training- Performance Appraisal.

9 Hours

Unit IV

Directing

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories Leadership - Leadership theories - Communication - Hurdles to effective communication - Organization Culture - Elements and types of culture - Managing cultural diversity.

9 Hours

Unit V

Controlling

Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control - Quality Control - Planning operations.

9 Hours

Total: 45 Hours

Textbook(s)

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

References

1. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management – A global & Entrepreneurial Perspective', Tata Mcgraw Hill, 12th edition, 2007.

3. Andrew J. Dubrin, 'Essentials of Management', Thomson Southwestern, 7th edition, 2007.

14U604-TWO AND THREE WHEELERS

3 0 0 3.0

Objectives

- To understand the construction and working of electronic ignition system, starting system; kick starter system.
- To know and understand the constructional details, operating characteristics and vehicle design aspects

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

i) Graduates will have solid foundation for succeeding in competitive examinations

Course Outcomes (COs)

- Able to understand the various subsystem of two and three wheeler and also know how it is different from light motors and heavy motor vehicles.
- Able to describe the maintenance procedures of various electrical systems like battery, starter motor, alternator, D.C motor etc
- Able to be familiar with maintenance procedures of engine, cooling system and lubrication system, checking and servicing of dash board instruments.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	30	30	30	30
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze / Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define Rake angle
2. Define Gyroscopic Effect.
3. Name the types of Scavening methods used in two stroke engines.
4. Name any two circuits or sub systems used in Carburetor.
5. Define pre unit construction of engine.
6. Differentiate between crossover type and non-crossover type gearbox
7. State the advantage of Cartridge type damper used in Front telescopic fork suspension.
8. Define Multi-Rated springs.
9. Name any two types auto rickshaws based on their application.
10. Name any two types of frames used in Auto rickshaws.
11. What do you mean by scavenging? Why it is necessary?
12. What are the types of scavenging pumps?
13. What is scavenging pump?
14. Draw symmetrical and unsymmetrical port timing diagram.
15. Mention the demerits of four stroke SI Engine.
16. Mention the merits of two stroke SI Engine?
17. Mention the demerits of two stroke SI Engine?
18. What is the use of reed valve in a two stroke petrol engine?

† The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

19. Give details of lubrication system used in two wheeler.
20. What is scavenging efficiency?
21. Write the disadvantages of carburetor?
22. Mention the advantages of Electronic ignition system?
23. Write about the kick starter mechanism.
24. Write about the properties of braking lining material.
25. Name any five motor cycle manufactures and three moped manufactures in India.
26. Name the major two wheeler manufacturers in India.

Understand

1. What do you mean by scavenging? Why it is necessary?
2. What are the types of scavenging pumps?
3. What is scavenging pump?
4. Draw symmetrical and unsymmetrical port timing diagram.
5. Mention the merits of two stroke SI Engine.
6. Mention the demerits of two stroke SI Engine.
7. What is scavenging efficiency?
8. Give details of lubrication system used in two wheeler.
9. Write the disadvantages of carburetor.
10. Mention the demerits of four stroke SI Engine.
11. What is the use of reed valve in a two stroke petrol engine?
12. Differentiate scooters and scooties.
13. Compare the constructional differences of scooters and mopeds.
14. Compare the transmission system of motorbike and scooter.
15. List the difference between scooter and moped.
16. What do you understand by DTS-i?

Apply

1. Why centrifugal clutch is used in mopeds?
2. What is the purpose of having gear box in a vehicle?
3. Sketch and List out various panel meters used in the handle bar.
4. List out various controls used in the handle bar.
5. List out the differences in front and rear suspension systems used in two wheeler.

Unit I

Power Unit

Two stroke SI engine, four stroke SI engine; merits and demerits. Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes; merits and demerits, scavenging pumps. Rotary valve engine. Fuel system. Lubrication system. Magneto coil and battery coil spark ignition system, electronic ignition system. Starting system; Kick starter system.

9 Hours

Unit II

Chassis and Sub-Systems

Mainframe and its types. Chassis and shaft drive, Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.

9 Hours

Unit III

Brakes, Wheels and Tyres

Drum brakes, disc brakes, front and rear brake links, layouts. Spoked wheel, cast wheel, disc wheel, disc types. Tyres and tubes.

9 Hours

Unit IV

Two Wheelers

Case study of major Indian models of motorcycles, scooters and mopeds. TVS mopeds and motorcycles, HeroHonda motorcycles, Bajaji scooters and motorcycles, Yamaha, Enfield motorcycles. Servicing and maintenance.

9 Hours

Unit V

Three Wheelers

Case study of Indian models. Auto rickshaws, pickup van, delivery van and trailer. Maintenance & Fault tracing.

9 Hours

Total: 45 Hours

Textbook(s)

1. Irving. P. E., "Motor Cycle Engineering", Temple Press Book, London – 1992.
2. "The Cycle Motor Manual",- Temple Press Limited, London - 1990

References

1. "Encyclopedia of Motorcycling", 20 volume Marshall, Cavensih, UK - 1989
2. Brayant R.V, Vespa, "Maintenance and Repair Series", S.Chand & Co., New Delhi - 1986.
3. Raymond Broad Lambretta, "A Practical Guide to maintenance and repair", S.Chand & Co., New Delhi - 1987.

14U605-FINITE ELEMENT ANALYSIS

3 1 0 3.5

Objectives

- To impart basic knowledge in the area of finite element method focusing on design of mechanical components
- To introduce the concepts of Mathematical Modeling of Engineering Problems
- To make one to ensure the design by FEM is correct and can go for real time testing
- To appreciate the use of FEM to a range of Engineering Problems.

Program Outcomes (POs)

d) Graduates will be able to design systems for automobiles
g) Graduates will demonstrate skills to use modern engineering and information technology tolls necessary for engineering practice
k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to learn the mathematical formulation of the finite element method and how to apply it to basic (linear) ordinary and partial differential equations.
- Able to learn how to implement the finite element method efficiently in order to solve a particular equation.
- Able to understand the mathematical and physical principles underlying the FEM as applied to solid mechanics and thermal analysis.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	30	30	30	30
2	Understand	30	30	30	30
3	Apply	30	30	30	30
4	Analyze / Evaluate	10	10	10	10
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is the basic concept of finite element method?
2. List the applications of FEM.
3. What are the types of analysis that can be performed in fem?
4. What is weighted residual method?
5. What are the different types of boundary conditions?
6. What is an Eigen value problem?
7. What are the methods for solving equilibrium problem?
8. What are the types of analysis that can be performed in FEM?
9. State the principle of minimum potential energy.
10. What is meant by Discretisation of the domain?
11. What are the properties of stiffness matrix?
12. What are the methods for solving propagation problem?
13. What are the three major categories of problem in FEM?
14. What is natural coordinate system?
15. What is global Coordinate system?
16. What is local Coordinate system?

† The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

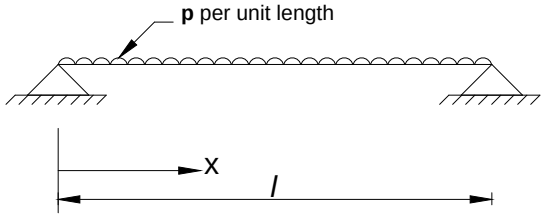
17. What are the advantages of natural Coordinate system?
18. What is aspect ratio?
19. Draw one 2 –D element and one 3-D element and name it.
20. What is stiffness matrix?
21. Define CST element with diagram.
22. Define LST element with diagram.
23. What is a truss element?
24. Define beam element,
25. What is meant by plane stress?
26. What is meant by plane strain?
27. What is field variable?
28. Define simplex element.
29. What is meant by Multiplex elements?
30. What are the advantages of polynomial type of interpolation function?
31. Write down the finite element equation for one dimensional heat conduction.
32. What are the three convergence requirement that is to be satisfied for attaining an exact solution?
33. What are higher order elements?
34. Define "serendipity element".
35. Write down the finite element equation for two dimensional heat transfer problem.
36. Write down the finite element equation for one dimensional heat conduction.
37. Define shape function.
38. What are the types of error in FEA?
39. What are the types of mesh refinement?
40. What are the types of non linearity?

Understand

1. Name any 4 commercial FEA packages
2. What is meant by CAD and CAE?
3. What is the difference between Propagation and Steady state problem?
4. Compare FEM with other methods
5. Differentiate between static and dynamic analysis
6. How do you make a node numbering scheme for a fem model?
7. What do you understand by element connectivity?
8. How do you built a finite element model?
9. Differentiate Beam element and Truss element
10. Differentiate between plane stress and plane strain?
11. Differentiate between Multiplex and Complex element.
12. For what the Numerical integration is used in FEM?
13. Is beam element an isoparametric element? Give reason for your answer.
14. Differentiate between Sub and Super parametric element with diagram.
15. How will you select the order of the polynomial
16. How will you draw a Pascal's triangle and tetrahedron for arranging 2-D and 3-D polynomial Function.
17. Differentiate h-method and p-method of mesh refinement?
18. In Steady state and Propagation there exist _____solution but in Eigen value problem there is no _____ solution.
19. If the interpolation polynomial is of the order two or more the element is known as a_____element

Apply/Evaluate

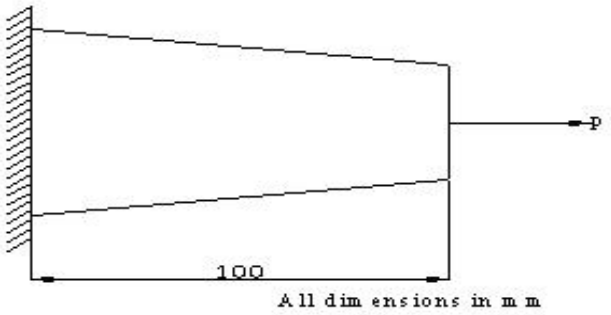
1. Elucidate the step by step procedure for solving a static structural problem in FEM for the axially loaded stepped bar.



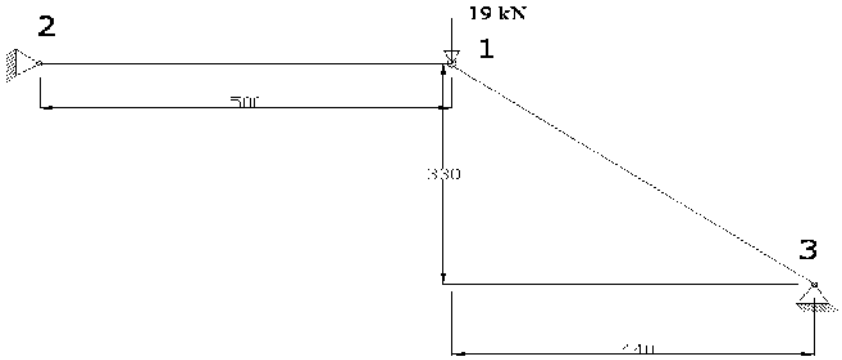
2. Find the approximate deflection of a simply supported beam under a uniformly distributed load **p** as shown using Rayleigh-Ritz method.
3. When you will apply the Pascal's triangle and tetrahedron and for what?
4. In a CST element the nodal coordinates are given by (1,1) (4,1) and (1,4), the temperature distribution has been computed as T_1 is 100°C, T_2 is 60°C and T_3 is 50°C respectively. Calculate the temperature at a point P. Whose coordinates are given by (2,3).
5. Calculate the displacement at a point P. whose co-ordinates are given by (2,3), if the nodal displacement of a triangular element are given by
   Ui = 3mm Uj = 4mm Uk = 2mm
   Vi = 2mm Vj = 3mm Vk = 4mm and the nodal co-ordinates are given by (1,1) (4,1) and (1,5)
6. Calculate the element stresses and strain for the element shown below
   The nodal displacements are
   U_1 = 2.0mm, V_1 = 1.0mm,
   U_2 =0.5mm, V_2 = 0.0mm,
   U_3 = 3.0mm, V_3 = 1.0mm.
   Take E = 2.1 x10^5 N/mm^2 and γ = 0.25. Assume plane stress condition
7. Find the shape function at a point P (6,9) located inside a triangular element and its coordinates are
   x_1 = 4mm, y_1 = 8mm,
   x_2 =10mm, y_2 = 5mm,
   x_3 = 8mm, y_3 = 12mm.

Analyze/Evaluate

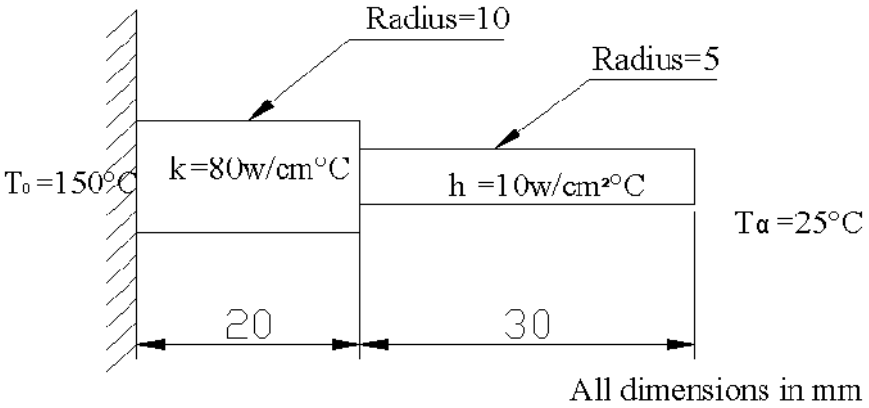
1. Find the stresses distribution in the tapered bar shown in fig. below using two finite element under an axial load of P=10N.Cross section areas at root = 200mm^2, at the end = 100mm^2 and Young's modulus E = 2x10^5 N/mm^2.



2. For the two bar truss shown in fig. below determine the displacement at node 1 and stress in element 2. Take A= 200mm^2E = 70x 10^3 N/mm^2



3. Find the temperature distribution in the stepped fin shown in fig. below using two finite element.



4. Evaluate the integral $I = \int_{-1} (2+x+x^2)\, dx$ and compare with exact solution.

Introduction (Not for examination)

Solution to Engineering problems – Mathematical modeling – discrete and continuum modeling – need for numerical methods of solution – relevance and scope of finite element methods – engineering applications of FEA

2 Hours

Unit I

Finite Element Formulation of Boundary Value Problems

Weighted residual methods –general weighted residual statement – weak formulation of the weighted residual statement –comparisons – piecewise continuous trial functions-example of a bar finite element –functional and differential forms – principle of stationary total potential – Rayleigh Ritz method – piecewise continuous trial functions – finite element method – application to bar element

7 Hours

Unit II

One Dimensional Finite Element Analysis

General form of total potential for 1-D applications – generic form of finite element equations – linear bar element – quadratic element –nodal approximation – development of shape functions – element matrices and vectors – example problems – extension to plane truss– development of element equations – assembly – element connectivity – global equations – solution methods –beam element – nodal approximation – shape functions – element matrices and vectors – assembly – solution – example problems

9 Hours

Unit III

Two Dimensional Finite Element Analysis

Introduction – approximation of geometry and field variable – 3 noded triangular elements – four noded rectangular elements – higher order elements – generalized coordinates approach to nodal approximations – difficulties – natural coordinates and coordinate transformations – triangular and quadrilateral elements – iso-parametric elements – structural mechanics applications in 2-dimensions – elasticity equations – stress strain relations – plane problems of elasticity – element equations – assembly – need for quadrature formule – transformations to natural coordinates – Gaussian quadrature – example problems in plane stress, plane strain and axisymmetric applications

9 Hours

Unit IV

Dynamic Analysis Using Finite Element Method

Introduction – vibrational problems – equations of motion based on weak form – longitudinal vibration of bars – transverse vibration of beams – consistent mass matrices – element equations –solution of eigen value problems – vector iteration methods – normal modes – transient vibrations – modeling of damping – mode superposition technique – direct integration methods

9 Hours

Unit V

Applications in Heat Transfer & Fluid Mechanics

One dimensional heat transfer element – application to one-dimensional heat transfer problems- scalar variable problems in 2-Dimensions – Applications to heat transfer in 2-Dimension – Application to problems in fluid

mechanics in 2-D

9 Hours
Total: 45 + 15 Hours

Textbook(s)

1. P Seshu, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.
2. J.N.Reddy, “An Introduction to the Finite Element Method”, McGraw-Hill International Editions(Engineering Mechanics Series), 1993.

References

1. Chandrupatla & Belagundu, “Introduction to Finite Elements in Engineering”, 3rd Edition, Prentice-Hall of India, Eastern Economy Editions.
2. David V.Hutton,”Fundamentals of Finite Element Analysis”, Tata McGraw-Hill Edition 2005.
3. Cook,Robert.D., Plesha,Michael.E & Witt,Robert.J. “Concepts and Applications of Finite Element Analysis”,Wiley Student Edition, 2004.

14U607-COMPUTER AIDED ENGINE AND CHASSIS DESIGN LABORATORY

1 0 3 2.5

Objectives

- To understand the gear box assembly calculations by using drafting software like Catia or PRO-E
- To draw and calculate the clutch components assembly by using drafting software like Catia or PRO-E
- To know about the design of engine components piston, piston pin and piston ring.
- To know about the design of engine component connecting rod and its components

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
d) Graduates will be able to design systems for automobiles
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to prepare the complete design of clutch components and assembly drawing of clutch using drafting software
- Able to design and draw the piston, piston pin and piston rings as per the engine specification
- Able to do calculation of bearing loads, Selection of bearings and Assembly drawing of gear box using drafting software.
- Able to design and draw the crankshaft and the balancing weight as per the engine specification

ASSESSMENT PATTERN

	Internal Assessment	Semester End Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	15	20
Record	10	-
Mini-Project/Model Examination/Viva-Voce	15	15
Total	**50**	**50**

List of Experiments

a. Engine Design

1. Design and drawing of piston, Piston pin and piston rings and drawing of these components.
2. Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly
3. Design of crankshaft, balancing weight calculations
4. Development of short and long crank arms, front end and rear end details, drawing of the crankshaft assembly.
5. Design and drawing of flywheel
6. Design and drawing of the inlet and exhaust valves.
7. Design of cam and camshaft, cam profile generation, drawing of cam and camshaft.
8. Design of combustion chamber.

b. Chassis Design

1. Complete design of clutch components.
2. Assembly drawing of clutch using drafting software.
3. Design of propeller shaft
4. Assembly drawing of gear box using drafting software

5. Layout of gear box
6. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings
7. Design aspects of final drive

Practical Schedule **Total: 45 Hours**

Sl. No.	Name of the Experiment	Hours
1	Design and drawing of piston, Piston pin and piston rings and drawing of these components	3
2	Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly	3
3	Design of crankshaft, balancing weight calculations	3
4	Development of short and long crank arms, front end and rear end details, drawing of the crankshaft assembly	3
5	Design and drawing of flywheel	3
6	Design and drawing of the inlet and exhaust valves	3
7	Design of cam and camshaft, cam profile generation, drawing of cam and camshaft	3
8	Design of combustion chamber	3
9	Complete design of clutch components	3
10	Assembly drawing of clutch using drafting software	3
11	Design of propeller shaft	3
12	Assembly drawing of gear box using drafting software	3
13	Layout of gear box	3
14	Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings	3
15	Design aspects of final drive	3

14U608-TWO AND THREE WHEELERS LABORATORY

0 0 3 1.5

Objectives

- To conduct performance test of a two wheeler using chassis dynamometer
- To conduct performance test of a shock absorber and coil spring
- To dismantle and assemble the 2& 3 wheeler gear box and to find gear ratio
- To study about the three wheeler chassis frame and power transmission system

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data

e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to analyze the various testing procedure of two wheelers using chassis dynamometer and measuring the output from dyno.
- Able to find the performance of Shock Absorber by using shock absorber test rig
- Able to know the procedure of using suitable tools to dismantle & assemble of gearbox of 2&3 wheelers and drawing of power flow diagram from Input shaft to output shaft.
- Able to know the procedure of using suitable tools to dismantle & assemble three wheeler steering system and rectifying it.

ASSESSMENT PATTERN

	Internal Assessment	Semester End Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	25	25
Record	5	-
Mini-Project/Model Examination/Viva-Voce	10	10
Total	**50**	**50**

List of Experiments

1. Performance test of a two wheeler using chassis dynamometer.
2. Performance test on shock absorber
3. Performance test on coil spring.
4. Two wheeler chain test
5. Brake and Clutch adjustment as per specification.
6. Dismantling and assembling of two wheeler gear box and finding gear ratios
7. Dismantling and assembling of three wheeler gear box and finding gear ratios
8. Three wheeler brake and clutch play adjustment
9. Dismantling and assembling of three wheeler steering system.
10. Study of three wheeler chassis frame and power transmission system.

Practical Schedule **Total: 45 Hours**

Sl. No.	Name of the Experiment	Hours
1	Performance test of a two wheeler using chassis dynamometer	3
2	Performance test on shock absorber	3
3	Performance test on coil spring	3
4	Two wheeler chain test	3
5	Brake and Clutch adjustment as per specification	3
6	Dismantling and assembling of two wheeler gear box and finding gear ratios	3
7	Dismantling and assembling of three wheeler gear box and finding gear ratios	3
8	Three wheeler brake and clutch play adjustment	3
9	Dismantling and assembling of three wheeler steering system	3
10	Study of three wheeler chassis frame and power transmission system	3

11O701 - ENGINEERING ECONOMICS
(Common to all branches)

3 0 0 3.0

Objectives

- To understand the basics of Micro and Macro Economics
- To understand the methods by which Demand Forecasting, Cost Analysis, Pricing and Financial Accounting are done in the Industry

Program Outcomes (POs)

h) Graduates will have knowledge of professional and ethical responsibilities
i) Graduates will have solid foundation for succeeding in competitive examinations

Course Outcomes (COs)

- Able to understand the terminology used in engineering economic analysis.
- Able to understand time-value-of-money concepts such as net present worth analysis, equivalent uniform annual worth analysis, benefit/cost analysis, internal rate of return analysis, loans, leveraging, and fixed-income investment analysis.
- Able to understand the criteria for making economic-based decisions.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	20	20	20	20
2	Understand	30	30	30	30
3	Apply	30	30	30	30
4	Analyze /Evaluate	20	20	20	20
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define Economics
2. Define Managerial Economics
3. What are the branches of Economics?
4. What are the two methodologies used for Investigation in Economics?
5. Name the other disciplines which are linked to Managerial Economics.
6. List the theories that explain the basic objectives of a firm.
7. What are the basic concepts in Decision making?
8. What are the types of decisions a manager is expected to make?
9. What are the techniques used in the process of decision making?
10. What is opportunity cost?
11. What is Demand?
12. What are the types of Demand?
13. What are the variations in the nature of Demand?
14. State the law of Demand.
15. What are the factors determining Demand?
16. Define Elasticity of Demand.
17. State the different degrees of elasticity of Demand?

† The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

18. What are the factors determining Elasticity of Demand?
19. State the Law Of Diminishing Marginal Utility.
20. What is Consumer Equilibrium?
21. List the factors effecting Demand Forecasting.
22. What methods will you use for forecasting demand for a new product?
23. Define Cost.
24. What is a semi variable cost.
25. What are fixed costs?
26. Define Short Run and Long Run costs.
27. Define Optimum Size of a Firm.
28. Define Replacement Cost and Historic Cost.
29. What is a Monopoly?
30. What is an Oligopoly?
31. What is Price Discrimination?
32. What are the reasons for Price Discrimination?
33. What are the advantages of Price Discrimination?
34. Define Oligopoly in terms of market share.
35. Name the two types of Oligopoly.
36. What are the objectives of Pricing?
37. What are the two basic methods of Pricing?
38. What is Market Skimming?
39. What is sealed bid pricing?
40. Define Accounting.
41. What are the uses of accounting?
42. What is a Balance Sheet?
43. Definitions of key words used in Financial Statements.
44. What is inflation?

Understand

1. Explain the nature and scope of Economics.
2. Differentiate between Macro and Micro economics
3. List and explain the focus areas of Managerial economics.
4. Give reasons why Mangers aim to Maximize Sales even at the cost of a lower profit.
5. Explain the steps in the decision making process.
6. Differentiate between Mechanistic and Analytical Decision making with examples.
7. Explain Giffens Paradox.
8. Explain with examples, exceptions to the Law of Demand.
9. Explain the nature of Demand.
10. Differentiate between Extension and Increase in Demand.
11. What is the significance of Elasticity of Demand?
12. Differentiate between Point and Arc Elasticity of Demand.
13. What are the assumptions made when talking about the Law of Diminishing Marginal Utility?
14. Explain the characteristics of the Indifference Curve with examples.
15. Explain the concepts of consumer's equilibrium and consumers' surplus with examples.
16. Can Demand Forecasting principles be applied to Services? Substantiate your answer with an example.
17. What is the difference between Accounting Cost and Economic Cost? Explain with an example.
18. Match the following type of question between Cost Concepts and their Basis of Distinction
19. Why is a study of Cost-Output Relationship necessary for a good Manager?
20. How is Incremental cost different from Sunk Cost?
21. Differentiate between Monopoly and Monopolistic Competition.
22. Explain the concept of a Perfect Market and its features.
23. Explain Total Revenue, Average Revenue and Marginal Revenue.
24. Distinguish between Cost and Price.
25. Explain with an appropriate diagram, the mechanism of pricing in a Perfectly Competitive Market.
26. Explain the role of Time in price determination.
27. Under what conditions can a firm charge different prices for the same products?
28. What are the characteristic features of an oligopoly industry ?
29. What causes Oligopoly?
30. Why does a firm need to have a Pricing Policy?
31. Explain the types and features of Cost Based Pricing.

32. Explain the types and features of Demand Based Pricing.
33. Explain the types and features of Strategy Based Pricing.
34. Under what conditions does a company go in for Cross Subsidization pricing?
35. Explain the Business Entity concept.
36. What are the advantages of Double-entry Book-keeping?
37. What is the role of the Central bank in controlling inflation?

Apply

1. Compare the merits and demerits of the Deductive Method and the Inductive Method of Investigation.
2. Explain decisions based on the degree of certainty of the outcome with examples.
3. Problems involving Marginal and Incremental Costs.
4. Problems concerning Elasticity of Demand.
5. Problems using statistical methods for Demand Forecasting.
6. Problem – Calculate and plot Average Variable Cost, Average Total Cost, and Marginal Cost and find the optimal production volume.
7. Give examples of products falling under the various kinds of Competition, and the reasons they are able to survive in the market.
8. Give six examples of products that fall under Monopolistic Competitive pricing.
9. Give six examples of products that fall under Oligopolistic pricing.

Analyze/Evaluate

1. "The per-capita income of farmers in the country has to be raised by 20% this year to prevent their migration to cities". Analyze this statement from the point of view of Positive and Normative Economics.
2. Decision making improves with age and experience. Discuss.
3. Do a survey of the automotive (only cars) industry and analyze the reasons and timing for discounts offered from the point of view of elasticity of demand.
4. What are the methods you would adopt to forecast demand for an industrial product? Assuming that the actual demand versus forecast is very high, what would the most likely reason be for failure of the forecast?
5. "Most of the cost concepts are overlapping and repetitive". Yes or No? Substantiate your answer with reasons.
6. How would you modify a sealed bid pricing system to take care of different technical approaches by different bidders for a project for which bids are called for, given that the cost varies depending on the technical approach?
7. What are the steps you would take to control inflation?

Unit I

Introduction

Introduction to Economics, Kinds of Economic Systems, Production Possibility Frontier, Opportunity Cost, Objective of Organizations, Kinds of Organizations, Business Decision Making,

Legal rights and responsibilities of types of Organizations.

9 Hours

Unit II

Demand and Supply

Functions of Demand & Supply, Law of Demand and Supply, Elasticity of Demand, Demand Forecasting Methods, Price Equilibrium.

Role of logistics in managing supply and demand.

9 Hours

Unit III

Production and Cost

Production Function, Returns to Scale, Economies & Diseconomies of scale, Fixed Cost, Variable Cost, Average Costs, Cost Curves, Break Even point, Law of diminishing Marginal Utility.

Costing of a product during the stages of its life cycle

9 Hours

Unit IV

Pricing & Market Structure

Components of Pricing, Methods of Pricing, Return on Investment, Payback Period, Market Structure and Pricing, Perfect Competition, Monopoly, Oligopoly, Monopolistic, Non price competition, E-commerce.

The secure payment process in e-commerce.

9 Hours

Unit V

Introduction to Macro Economics & Financial Accounting,

National Income – GDP, Per Capita Income, Inflation, Stagflation, Deflation, Business Cycle, Stabilization Policies, Direct Taxes, Indirect Taxes, Balance of Payment. Accounting - Terminology, Book Keeping, P&L, Balance Sheet.

Role of Central Excise and Customs

9 Hours
Total: 45 Hours

Textbook(s)

1. A. Ramachandra Aryasri and V V Ramana Murthy, *"Engineering Economics and Financial Accounting"*, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006.

References

1. V. L. Samuel Paul and G S Gupta, *"Managerial Economics – Concepts and Cases"*, Tata McGraw Hill Publishing Company Limited , New Delhi, 1981.
2. S N Maheswari, *"Financial and Management Accounting"*, Sultan Chand, 2004.
3. R Kesavan, C Elanchezhian and T Sunder Selwyn, *"Engineering Economics and Financial Accounting"*, Laxmi Publication (P) Ltd , New Delhi, 2005.

14U702- ENGINE AND VEHICLE MANAGEMENT SYSTEM

3 0 0 3.0

Objectives

- To explain the principle of engines and vehicle electronic management system and different sensors used in the systems.

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
g) Graduates will demonstrate skills to use modern engineering and information technology tolls necessary for engineering practice
k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to understand the role of various sensor, its construction and working principle and it influence in controlling pollution, enhancing safety of the vehicle.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	20	20	20	20
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze /Evaluate	10	10	10	10
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is meant by engine management system?
2. What is the function of temperature sensor?
3. What is the purpose of using wheel sensor in ABS?
4. List the sources of exhaust gas emissions from the automobiles that affect the environmental conditions.
5. State four advantages of a pre-engaged starter when compared with an inertia type.
6. What is dwell angle?
7. What is the function of electromagnetic sensors in electronically sensed ABS?
8. Define Total vehicle dynamics.
9. What is the purpose of Vehicle navigation system?
10. Write the components of embedded system.
11. What is meant by inductive charging?
12. What is meant by black box fault finding?
13. What are Euro Norms?
14. What is meant by telematics?
15. What is the concept of CAN with signal format?

Understand

1. Differentiate between a solenoid switch and relay switch
2. Whether the petrol fuel injection is different from diesel fuel injection? How does it differ?
3. Write any two advantage of Bosch compact alternator.

† The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

4. Write the two important methods in pre computerized ignition system to advance the ignition timing?
5. Difference between MAF and MAP sensors.
6. Why do we use Hall Effect sensors in automotive application?
7. How do you obtain the quantity of fuel to be injected in electronic engine management system?
8. Differentiate throttle body and MPFI injection systems.
9. Why acceleration enrichment of fuel is needed?
10. Why a D.C series motor is preferred for the starting system of automobiles?
11. Why an artificial intelligence system used in automobiles?
12. Why digital displays are multiplexed.
13. Where the cruise control system used in vehicles?
14. Why we are using multi cylinder engine rather than using a larger single cylinder of similar cubic capacity?

Apply

1. Calculate chemically correct air fuel ratio for complete combustion of octane (C8H18).
2. Design a Electric circuit for automatic seat adjuster, power window, auto lock and for parking assist sensor.

Unit I

Fundamentals of Automotive Electronics

Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI enignes and in the other parts of the automobile.

9 Hours

Unit II

Sensors

Inductive, Hall effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, air mass flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.

9 Hours

Unit III

SI Engine Management

Three way catalytic converter, conversion effciency versus lambda. Layout and working of SI engine management systems like Bosch L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control. Electronic ignition systems and spark timing control. Closed loop control of knock.

9 Hours

Unit IV

CI Engine Management

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valves.

9 Hours

Unit V

Vehicle Management Systems

ABS system, its need, layout and working. Electronic control of suspension – Damping control, Electric power steering, Supplementary Restraint System of air bag system – crash sensor, seat belt tightening. Cruise control. Vehicle security systems- alarms, vehicle tracking system. On board diagnostics. Collision avoidance Radar warning system.

9 Hours

Total: 45 Hours

Textbook(s)

1. William B Ribbens "Understanding Automotive Electronics", SAE Publications, 2003.
2. Eric Chowanietz "Automobile Electronics" SAE Publications, 1995.

References

1. Diesel Engine Management by Robert Bosch, SAE Publications, 2006.
2. Gasoline Engine Management by Robert Bosch, SAE Publications, 2006.

14U703-VEHICLE DYNAMICS

3 1 0 3.5

Objectives

- To know about the application of basic mechanics principles for dynamic analysis of vehicles.
- To Enhance the knowledge in vibration of vehicles due to dynamic conditions.
- To understand the vehicle performance parameters and various testing methodologies
- To understand the effects ride characteristics over the stability of vehicles

Program Outcomes (POs)

d) Graduates will be able to design systems for automobiles
g) Graduates will demonstrate skills to use modern engineering and information technology tolls necessary for engineering practice
k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to understand, how passenger comfort is achieved along with vehicle stability.
- Able to perceive the significance of Vibration analysis
- Able to acquire knowledge over the influence of performance parameters on ride characteristics
- Able to apply Dunkerley's and Rayleigh's methods for determining fundamental frequency

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	20	20	20	20
2	Understand	30	30	30	30
3	Apply	30	30	30	30
4	Analyze / Evaluate	20	20	20	20
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is meant by vibrations?
2. What is meant by natural vibration?
3. What is meant by logarithmic decrement?
4. Define transmissibility.
5. What is dry friction damper?
6. Mention the uses of vibration.
7. What is Rayleigh's method, write its applications.
8. What is the critical speed of shaft?
9. Define continuous beam.
10. Name three forces acting on the wheel and tyre.
11. Name three couples acting on the wheel and tyre.
12. What are the two important angle associated with a rolling wheel?
13. Define Resonance.
14. Mention important types of free vibrations.
15. What is meant by viscous damping?
16. Define vibration isolation.

† The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

17. What is an accelerometer and what is its use?
18. Define influence coefficients.
19. What is continuous system?
20. What are three elementary part of a vibrating system?
21. How does vehicle speed affect the tyre grip?
22. Whether the slip functions of tractive effort or brake effort?
23. Explain the deformation slip.
24. Explain the effect of wheel speed on braking effort.
25. Define cornering stiffness.
26. Define the term magnification factor.
27. How can we make a system to vibrate in one of its natural made?
28. What is basic assumption is deriving Dunkerlay's formula?
29. How does a continuous system differ from a discrete system in the nature of its equation of motion?
30. What ate various methods available for vibration control?
31. How does vertical load affect cornering coefficient?
32. Define camber stiffness.
33. What is camber thrust?
34. How camber thrust is is related to lateral force?
35. How does camber effect force effect cornering force?
36. Explain vehicle drag.
37. Define coefficient of rolling resistance.

Understand

1. How does coefficient of adhesive does is different from the coefficient of friction?
2. Explain the condition when the maximum coefficient of adhesive friction occurs.
3. What are the factors that the ability of tyre to grip the road when being braked?
4. When is the relation between tractive effort and braking effort?
5. On what factor that maximum braking effort depends?
6. What are the factors that affect rolling resistance?
7. Why is pneumatic tyre particularly suitable for road vehicle?
8. What is the critical speed of shaft?
9. Explain the effect of wheel speed on braking effort.

Apply

1. A rack & pinion steering has a pinion of 10 mm pitch circle diameter .What effort must be applied on the 320mm diameter steering wheel to overcome resistance of 500 mm experienced frequently on the rack?
2. How can we make a system to vibrate in one of its natural made?

Unit I

Introduction

Fundamentals of vibration, single degree of freedom, two degree of freedom, multidegree freedom, free, forced and damped vibrations, modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber.

9 Hours

Unit II

Stability of Vehicles

Load distribution, calculation of acceleration, tractive effort and reactions for different drives, stability of a vehicle on a curved track, slope and a banked road,.

9 Hours

Unit III

Multi Degree Freedom Systems

Closed and far coupled system, eigen value problems, orthogonality of mode shapes, modal analysis, forced vibration by matrix inversion.

9 Hours

Unit IV

Suspension, Tyres and Vehicle Handling

Requirements, sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft, roll axis and vehicle under the action of side forces, tyre, dynamics, ride characteristics power consumed by a tyre. Oversteer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

9 Hours

Unit V

Numerical Methods

Approximate methods for determining fundamental frequency, Dunkerleys lower bound, Rayleighs upper bound, Holzer method for closed coupled system and branched systems.

9 Hours

Total: 45 + 15 Hours

Textbook(s)

1. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., 2002.
2. Giri N.K – "Automotive Mechanics", Khanna Publishers, 2007.

References

1. Ham B, Pacejka, "Tyre and Vehicle Dynamics", SAE Publication - 2002.
2. Ellis.J.R - "Vehicle Dynamics"- Business Books Ltd., London- 1991
3. Gillespie T.D, "Fundamentals of Vehicle Dynamics", SAE USA 1992.
4. Giles.J.G.Steering - "Suspension and Tyres", Illiffe Books Ltd., London- 1998

14U704-AUTOMOTIVE POLLUTION AND CONTROL

3 0 0 3.0

Objectives

- To understand effect of vehicle population and emitted pollutants on human health and environment and various types of emissions
- To understand the formation mechanism of various types of pollutants from SI and CI engines
- To understand the construction and working of emission measuring instruments

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to analyse the impact of vehicle population on pollution and the effects HC, CO, CO2, NOX, smoke, particulates, lead and aldehydes on health and environment.
- Able to get awareness of US, Euro, Japan and Indian emission norms, standards CVS sampling and test procedures.
- Able to know the various techniques to avoid the pollution formation from automobiles

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	40	40	40	40
3	Apply	20	20	20	20
4	Analyze /Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Write basic ways to reduce NOx emission.
2. What is the function of the fuel tank?
3. What are the functions of EGR valves?
4. State the functions of catalytic converters.
5. List the materials used for the outer shell of oxidation catalyst.
6. What is the function of a catalyst?
7. Define reduction reaction.
8. Sate the effects of HC emissions from an engine.
9. List the different emission control systems used in SI engine.
10. What is SCR?
11. List the various sources of vehicle noise.
12. What are the different emission control systems used in SI engine?
13. Brief the three way catalytic converter.
14. List out the Indian Emission Standards for two wheelers.
15. List out the Bharat stage norms for two wheelers.
16. Define drive train vibration.
17. Define drive train vibration.
18. What are the methods of controlling the oxides of nitrogen present in an IC engine exhaust?

† The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

Understand

1. When NOx emissions formed in an engine cylinder?
2. What is Photochemical smog?
3. What is the function of flame ionization detector?
4. Distinguish the air borne noise and structure borne noise.
5. Write short notes on Positive crank case ventilation system.
6. Explain the working of chemilluminescent analyzer.
7. State the advantages of EURO IV norms over EURO III norms for automotive vehicles.
8. Enumerate the various engine noise control techniques.
9. What are the factors to be considered for tyre noise?
10. What is meant by rubber mountings?
11. What is meant by extensive layer damping?
12. What is meant by constrained layer damping?
13. Explain the methods and causes to the damage of catalysts in the exhaust gases.

Apply

1. How the evaporative emission control is achieved in S.I engines?
2. How SCR controls the NOx emission?
3. How a Bosch smoke meter works?
4. Tabulate the EURO IV and EURO III norms for two wheelers.
5. Discuss various vibration damping materials.

Unit I

Introduction

Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, types of emission, transient operational effects on pollution, noise vibration and harshness (NVH).

9 Hours

Unit II

Pollutant Formation in Engines

Pollutant formation in Engines, mechanism of HC and CO formation in four stroke and two stroke engines, NOx formation in engines, smoke and particulate emissions in CI engines, effects of design and operating variables on emission formation, control of evaporative emission. Two stroke engine pollution.

9 Hours

Unit III

Control of Emissions from Engines

Design strategies to control emission from engines, optimum selection of operating variables for control of emissions, EGR, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control.

9 Hours

Unit IV

Noise Pollution from Automobiles

Noise, Vibration And Harshness, Sources of Noise, Measurement of Noise -Engine combustion noise**,** Inlet And Exhaust Noise, Traffic Noise, Vehicle Body Noise - control of noise, control devices and noise proof materials

9 Hours

Unit V

Measurement Techniques Emission Standards and Test Procedure

NDIR,FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles – USA, Japan, Euro and India. Test procedures – ECE, FTP Tests. SHED Test – chassis dynamometers, dilution tunnels.

9 Hours

Total: 45 Hours

Textbook(s)

1. Paul Degobert, “Automobiles and Pollution”, SAE International, 1995.
2. Ganesan.V., “Internal Combustion Engineering”, Tata McGraw-Hill Publishing Co., New Delhi,2012.
3. Beranek.L.L. “Noise Reduction”, McGraw Hill Book co., Inc, New York, 1993.

References

1. SAE Transactions- “Vehicle Emission”- 1982 (3 volumes).
2. Obert.E.F.- “Internal Combustion Engines”- 1988
3. Marco Nute- “ Emissions from two stroke engines”, SAE Publication, 1998.

14U707-VEHICLE MAINTENANCE AND RECONDITIONING LABORATORY

0 0 3 1.5

Objectives

- To understand the complete knowledge of the vehicle maintenance procedures and acquire skills in handling situations where the vehicle is likely to fail
- To understand various types of maintenance of vehicles and features and applications

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment
i) Graduates will have solid foundation for succeeding in competitive examinations

Course Outcomes (COs)

- Able to describe the minor and major tuning of diesel and petrol engines
- Able to dismantle, study, perform corrections and assemble the braking system, steering system and suspension system
- Able to do the wheel alignment procedure and tyre removal procedure etc
- Able to define the procedures of valve grinding, lapping, reboring calibration of fuel injection pump etc

ASSESSMENT PATTERN

	Internal Assessment	Semester End Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	25	25
Record	5	-
Mini-Project/Model Examination/Viva-Voce	10	10
Total	**50**	**50**

List of Experiments

1. Study and layout of an automobile repair, service and maintenance shop.
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Cylinder reboring – checking the cylinder bore, Setting the tool and reboring.
4. Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage
5. Calibration of fuel injection pump
6. Minor and major tune up of gasoline and diesel engines.
7. Study and checking of wheel alignment - testing of camber, caster.
8. Testing kingpin inclination, toe-in and toe-out
9. Brake adjustment and Brake bleeding.
10. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.
11. Battery testing and maintenance

Practical Schedule **Total: 45 Hours**

Sl. No.	Name of the Experiment	Hours
1	Study and layout of an automobile repair, service and maintenance shop	2
2	Study and preparation of different statements/records required for the repair and maintenance works	2
3	Cylinder reboring – checking the cylinder bore, Setting the tool and reboring	3
4	Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage	3
5	Calibration of fuel injection pump	3
6	Minor and major tune up of gasoline and diesel engines	3
7	Study and checking of wheel alignment - testing of camber, caster	2
8	Testing kingpin inclination, toe-in and toe-out	3
9	Brake adjustment and Brake bleeding	3
10	Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms	3
11	Battery testing and maintenance	3

14U708-COMPUTER AIDED ENGINEERING LABORATORY

0 0 3 1.5

Objectives

- To understand the types of element used, type of analysis done, interpretation of results, method of solving and analyzing a given problem
- To have better knowledge in finite element analysis software , applied to structural and heat transfer components at various loading conditions

Program Outcomes (POs)

c) Graduates will be able to conduct experiments as well as analyze and interpret data
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment
i) Graduates will have solid foundation for succeeding in competitive examinations

Course Outcomes (COs)

- Able to model, mesh and analyze mechanical components using ANSYS
- Able to use ANSYS to perform structural and thermal analyses
- Able to define and solve an engineering problem individually as well as in a team setting

ASSESSMENT PATTERN

	Internal Assessment	Semester End Examination
Preparation Remember Understand Apply	10	15
Observation and Results Analyze Evaluate	15	20
Record	10	-
Mini-Project/Model Examination/Viva-Voce	15	15
Total	**50**	**50**

Remember

1. What are the types of co-ordinate systems in 2 dimension drawing?
2. What are the types of co-ordinate systems in 3 D / GUI / goemetric modeling?
3. What are the types of goemetric modeling?
4. Name any five 2D packages.
5. Name any ten 3D packages.
6. Name any ten CAM packages.
7. Name any ten finite element analysis packages.
8. What is 2 ½ D?
9. What are the types of non linearity?
10. What are three general modules of FEA software?
11. What are the methods of analysis?
12. What is an exact solution?
13. What is an approximate solution?
14. What is meant by discretisation?
15. What is plane stress?
16. What is plane strain?
17. What is meant by CAD and CAE?
18. What is aspect ratio?
19. What is stiffness matrix?
20. What is an axisymmetric problem?
21. What is bottom up modeling?
22. What is top down modeling?

23. What is structural analysis?
24. What is thermal analysis?
25. What is node?
26. What is an element?
27. What is general post processor?
28. What is nodal solution?
29. What is pre processor?
30. What is pro processor?
31. What type of options we use in preferences?
32. What is h-method and p-method of mesh refinement?
33. What is DOF?
34. What is steady state analysis?
35. What is unsteady state analysis?
36. What are the types of Thermal analysis?
37. What are the types of structural analysis?
38. What are the types of elements used in ANSYS?
39. What are the types of loads?
40. What is truss?
41. What are the theories of failure?
42. What is von mises stress?
43. What is material non linearity?
44. What is geometric non linearity?
45. What is boundary non linearity?
46. What are the types of coupled field analysis?
47. What are the types of meshing involved in ANSYS?
48. Name any three thermal elements in ANSYS?
49. What is transient thermal analysis?
50. Define modal analysis.
51. APDL is an acronym for _____
52. What is a quadratic element?
53. What is a real constant?
54. Expand CFD.
55. Name few applications of FEA.
56. What is an element solution?
57. What are higher order elements?
58. Define beam element?
59. Define Truss element?
60. What is r- refinement method?
61. What are the numerical errors? Name them?
62. Define band width?
63. What is load step in ANSYS?
64. What are the steps involved in pre processor?
65. What are the steps involved in pro processor or solution?
66. What are the steps involved in post processor?
67. What all are the ways that a result can be plotted?
68. What are basic primitives? Name any ten.
69. What is meant by screen coordinate system?
70. Nonlinear structural behavior arises from a number of causes, name them.
71. In What way Boolean operations are useful.

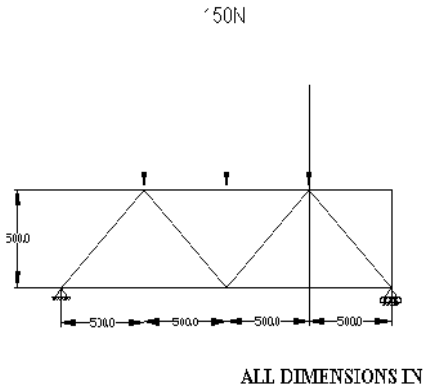
Understand

1. What is the difference between FDM and FEM?
2. How do you identify data loss in ANSYS?
3. Differentiate between material and geometric non-linearity.
4. Why the grid sensitivity test is made in FEA?
5. When you will go for coupled field analysis?
6. What is the difference between animation and modeling?
7. What is the difference between structural analysis & thermal analysis?
8. What is the difference between node & element?
9. Differentiate h-method and p-method of mesh refinement?

10. What is the difference between static and dynamic analysis?
11. What is the difference between global/ world/ model coordinate system and working/user coordinate system?
12. How to apply loads in thermal analysis?
13. How to apply loads in structural analysis?
14. How to create a node?
15. How to create an element?
16. Is it possible to apply load on key point and solve?
17. How will you print the ansys display?
18. How will you decide on which element to be meshed in ANSYS?
19. How do you animate a result and capture it?
20. How will you decide on the solution you obtain is right?

Apply / Analyze / Evaluate

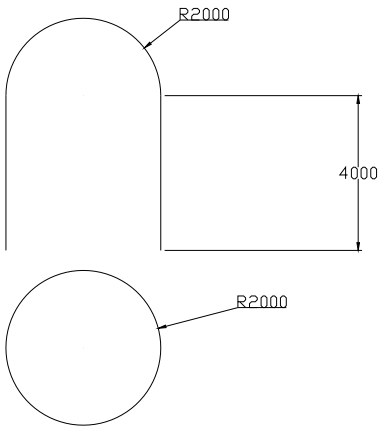
1. Determine the maximum deformation that occur when a truss is loaded as shown below. The truss is fully constrained at the one end; while the other end is constrained in y-direction. Load of 150 N act at each point as shown in sketch. The truss is made of A36 steel with a Young's modulus of 2e5 and Poisson's ratio of 0.33. Take section of the link as 10 x 30 mm.



ALL DIMENSIONS IN MM

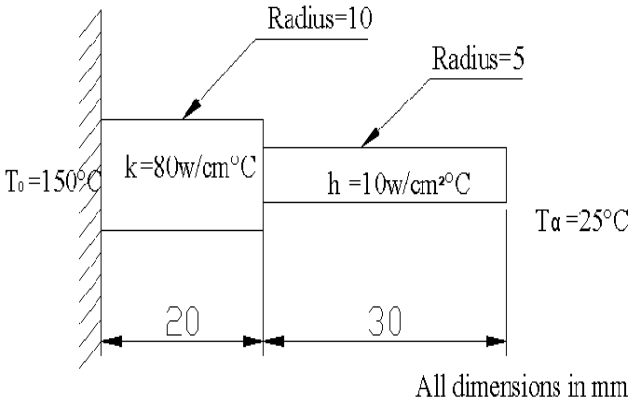
2. Determine the maximum deformation, shear force and bending moment that occur when a simply supported beam of 100 x 5 x 5 mm is used. The beam with a point load of 100N is acting downward at mid point of the span. Take Young's modulus as 2E5 N/ mm^2 and Poisson's ratio as 0.3.
3. Determine the mode shapes and frequencies of a steel fixed beam of circular section having 100 x 8 mm. Take Young's modulus as 183 GPa Poisson's ratio as 0.25 and density of 7750 kg/m3
4. Using ANSYS find out the temperature distribution of a rectangular fin when the heat transfer is steady and convective. The fin size is 10 x 2 x 1 m. A temperature of 500^0 C is admitted on the left side of the fin, while the remaining three sides are subject to convection with film coefficient of 10 $W/m^2\ ^0C$ at 80^0C and the conductivity of the fin material is 80 $W/m\ ^0C$

5. Find out the maximum deformation that occurs in a pressure vessel with a thickness of 25mm as shown below. The vessel is subjected to a pressure of 20 bar at the inner side of the walls. Take Young's modulus as 20e4 and Poisson's ratio of 0.3.



All dimesions in mm

6. Using ANSYS find out the temperature distribution of a 3 D circular fin when the heat transfer is steady and convective.. A temperature of 150 ^{0} C is admitted on the left surface of the fin, while the remaining surfaces are subject to convection.



Unit I

Introduction to FEA Software

Basics of FEA, software available for FEA, Geometric modeling co-ordinate systems, types of elements, preferences available, types of problem, pre processor, pro processor, post processor.

1hour

Unit II

Geometric Modeling

Creation of keypoints,lines,areas and volumes. Modeling using basic primitives, Types of modeling – top down and bottom up, Modeling of 2D components & Modeling of 3D components. Operations – Boolean addition, subtraction, division, extrude. Creation, edition and deletion of entities.

5 hours

Unit III

Meshing

Choosing the element type, assigning - real constants, material properties, size of element or division of element, Free meshing of 2D & 3D components, Mapped meshing of 2D & 3D components. Optimizing element size.

5 hours

Unit IV

Pro Processor and Post Processor

Choosing the type of analysis, constraining the object, loading on node, line, area, volume and distribution of loading and Solving of the problem. Reading of results, Listing the results, Plotting of results – stress, deformation,

temperature, vectors etc., animation of results. Saving results and printing. Importing and exporting of files.

1 hour

List of Experiments

1. Analysis of Trusses
2. Stress analysis of a plate with a circular hole.
3. Stress analysis of Rectangular L bracket
4. Static analysis of simple Mechanical elements.
5. Stress analysis of beams (Cantilever, Simply supported, fixed end
6. Analysis of a composite system
7. Conduction and Convection heat transfer analysis of a 2D component
8. Convective heat transfer analysis of a 3D component
9. Modal analysis of beams (Cantilever, Simply supported, Fixed ends)
10. Dynamic analysis of a structure
11. Coupled field analysis
    - Design experiment
    - Application Oriented experiment

Total: 45 Hours

Practical Schedule

S. No.	Experiment	Hours
1	Analysis of Trusses	3
2	Stress analysis of a plate with a circular hole.	3
3	Stress analysis of Rectangular L bracket	3
4	Static analysis of simple Mechanical elements.	3
5	Stress analysis of beams (Cantilever, Simply supported, fixed ends)	3
6	Analysis of a composite system	3
7	Conduction and Convection heat transfer analysis of a 2D component	3
8	Convective heat transfer analysis of a 3D component	3
9	Modal analysis of beams (Cantilever, Simply supported, Fixed ends)	3
10	Dynamic analysis of a structure	3
14	Coupled field analysis	3
12	Design experiment	3
13	Application oriented experiment	3

11O801- PROFESSIONAL ETHICS
(Common to all branches)

2 0 0 2.0

Objectives

- To study the basic issues in Professional Ethics
- To appreciate the rights of others and to instill moral, social values and loyalty
- To enable the student in their engineering profession to explore the ethical issues in technological society

Program Outcomes (POs)

e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment
f) Graduates will be able to communicate effectively in both verbal and written form
h) Graduates will have knowledge of professional and ethical responsibilities

Course Outcomes (COs)

- Able to gain an understanding of the importance of ethics and its importance to the Human Service Profession.
- Able to demonstrate a beginning knowledge of the Human Service Code of Ethics and the ethical decision-making model.
- Able to understand the impact of personal values and ethics on their professional roles and responsibilities.
- Able to demonstrate a beginning understanding of the relationship between personal values and professional values.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	30	30	30	30
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define Human Values.
2. What are Morals and Values?
3. What do you mean by Civic virtue and Respect for others?
4. Write the various meanings of "Spirituality"?
5. List four different types of Virtues.
6. Mention different Human values.
7. What is meant by moral autonomy?
8. Classify the types of inquiry.
9. What are the steps needed in confronting moral dilemmas?
10. List the levels of moral development suggested by Kohlberg.
11. What do you understand by self-interest and ethical egoism?
12. What are the steps needed in confronting moral dilemmas?
13. What are the three virtues of religion?.
14. What are the professional responsibilities?
15. What is meant by "Informed consent" when bringing an engineering product to market?
16. What is engineering experimentation?

---

*The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

17. What are the different roles and functions of “Code of Ethics”?
18. What are the Limitations of “Code of Ethics”?

Understand

1. Which are the practical skills that will help to produce effective independent thought about moral issues?
2. Why does engineering have to be viewed as an experimental process?
3. Why isn’t engineering possible to follow a random selection in product design?
4. Why is the “code of ethics” important for engineers in their profession?
5. What does the Balanced Outlook on Law stress in directing engineering practice?
6. Are the engineers responsible to educate the public for safe operation of the equipment? How?
7. What kind of responsibility should the engineer have to avoid mistakes that may lead to accident due to the design of their product?
8. What is the use of knowledge of risk acceptance to engineers?
9. Why is Environmental Ethics so important to create environmental awareness to the general public?
10. Why do the engineers refuse to do war works sometimes?

Apply

1. How does the consideration of engineering as a social experimentation help to keep a sense of autonomous participation is a person’s work?
2. How does the “code of ethics” provide discipline among the engineers?
3. How would you classify the space shuttle Challenger case accident?
4. How does the manufacturer understand the risk in a product catalog or manual?
5. How does the knowledge of uncertainties in design help the engineers to access the risk of a product?
6. How can the quantifiable losses in social welfare resulting from a fatality be estimated? Give some examples.
7. How does the engineer act to safeguard the public from risk?

Unit I

Human Values

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – Caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence

Character – Spirituality in business.

6 Hours

Unit II

Engineering Ethics

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and controversy – Models of Professional Roles – Theories about right action

Self-interest – Uses of ethical theories.

6 Hours

Unit III

Engineering as Social Experimentation

Engineering as experimentation – Engineers as responsible experimenters – Codes of ethics – A balanced outlook on law – The Challenger case study – Bhopal Gas Tragedy – The Three Mile Island and Chernobyl case studies

Safety aspects in Nuclear Power plants

6 Hours

Unit IV

Responsibilities and Rights

Fundamental Rights, Responsibilities and Duties of Indian Citizens – Collegiality and loyalty – Respect for authority – Collective bargaining – Confidentiality – Conflicts of interest – Occupational crime – Professional rights – Employee rights – Discrimination.

Right to Information Act.

6 Hours

Unit V

Global Issues

Multinational corporations – Environmental ethics and Environmental Protection Act – Computer ethics – Engineers as managers – Consulting engineers – Engineers as expert witnesses and advisors – Moral leadership – Sample code of ethics like IETE, ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management *Weapons development.*

6 Hours

Total: 30 Hours

Textbook(s)

1. M. Govindarajan, S. Natarajan and V. S. Senthil Kumar, *"Engineering Ethics"*, PHI Learning Private Ltd, New Delhi, 2012.

References

1. Charles D. Fleddermann, *"Engineering Ethics"*, Pearson Education/ Prentice Hall of India , New Jersey, 2004.
2. Mike W. Martin and Roland Schinzinger, *"Ethics in Engineering"*, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2003.
3. Charles E. Harris, Michael S. Protchard and Michael J. Rabins, *"Engineering Ethics – Concepts and Cases"*, Wadsworth Thompson Learning, United States, 2005.
4. http://www.slideworld.org/slidestag.aspx/human-values-and- Professional-ethics
5. *www.mne.psu.edu/lamancusa/ProdDiss/Misc/ethics.ppt*

11O10B BASIC ENGLISH I *

3 0 0 3.0

Objectives

- To offer students the basics of the English Language in a graded manner.
- To promote efficiency in English Language by offering extensive opportunities for the development of four language skills (LSRW) within the classroom.
- To give an intense focus on improving and increasing vocabulary.
- To improve Spelling and Pronunciation by offering students rigorous practice and exercises.

Program Outcomes (POs)

f) Graduates will be able to communicate effectively in both verbal and written form

Course Outcomes (Cos)

- Able to get Listening skills
- Able to get fluency in Speaking
- Able to get interest in Reading and Writing

Unit I

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
1	Basic words- 12 most used words in English, usage and pronunciation	Starting a conversation and talking about what one does	Sentence construction bolstered by mother tongue
2	Basic words- 20 oft used words, usage and pronunciation	Analysing an action plan	Creating and presenting one's own action plan
3	Basic words with a focus on spelling	Discriminative listening	Informal conversation
4	Basic words- 10 oft used words, usage and pronunciation	Content listening and Intonation	Reading comprehension
5	Tutorial		

Unit II

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
6	Basic words + greetings to be used at different times of the day	Formal conversation	Intonation to be used in formal address
7	Last 28 of the 100 most used words	Informal conversation between equals	Reading practice and peer learning
8	Using the 14 target words to form bigger words	Informal dialogues using contracted forms	Guided speaking- talking to peers using contracted forms
9	Palindromes, greetings- good luck, festivals	Placing a word within its context- culling out meaning	Offering congratulations
10	Tutorial		

Unit III

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
14	Homophones	Formal and informal methods of self-introduction	Let's Talk is a group activity that gives them some important pointers of speech
12	Homophone partners, matching words with their meanings	Contracted forms of the –be verbs, 've and 's	Translating English sentences to Tamil
13	Briefcase words- finding smaller words from a big word	Formal and informal ways of introducing others	Team work- speaking activity involving group

			work, soft skills
14	Compound words and pronunciation pointers	Giving personal details about oneself	Using the lexicon
15	Tutorial		

Unit IV

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
16	Proper and common nouns	Asking for personal information and details	Pronunciation pointers- an informal introduction to the IPA
17	Pronouns	Telephone skills and etiquette	Reading aloud and comprehension
18	Abstract and common nouns	Dealing with a wrong number	Reading practice and comprehension
19	Group names of animals, adjectives	Taking and leaving messages on the telephone	Pronunciation pointers
20	Tutorial		

Unit V

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
21	Determiners	Interrupting a conversation politely- formal and informal	Pair work reading comprehension
22	Conjugation of the verb 'to be'- positive and negative forms	Thanking and responding to thanks	Comprehension questions that test scanning, skimming and deep reading
23	Am/is/are questions	Giving instructions and seeking clarifications	Small group activity that develops dialogue writing
24	Present continuous tense-form and usage	Making inquiries on the telephone	Finishing sentences with appropriate verbs
25	Tutorial		

Unit VI

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
26	Words with silent 'b' Present continuous questions	Calling for help in an emergency	Dialogue writing
27	Words with silent 'c' Simple present tense- form and usage	Making requests and responding to them politely	Identifying elements of grammar in text extract
28	Simple present tense- rules	Describing people	Guided writing
29	Words with silent 'g' Questions in the simple present tense	Describing places	Filling in the blanks with correct markers of tense
30	Tutorial		

Total: 45 Hours

Resources

1. Basic English Module, L&L Education Resources, Chennai, 2014.

14O10C COMMUNICATIVE ENGLISH *

3 0 0 3.0

Objectives

- To equip students with effective speaking and listening skills in English
- To help the students develop speaking skills in Business English

Program Outcomes (POs)

f) Graduates will be able to communicate effectively in both verbal and written form

Course Outcomes (COs):

- The Students will be able to clear the BEC Vantage Level Examination conducted by the Cambridge ESOL

Unit I
Grammar and Vocabulary

Vocabulary for describing different company structures and company hierarchy – Practice using *wh* – questions; *there is / there are*, Definitions of Quality, Vocabulary of quality management – Using nouns and adjectives to form group nouns – Phrases for offering and accepting help and invitations – Telephone terms – Verb tenses – Questions and responses – Conditionals – Gap Filling Exercises.

9 Hours

Unit II
Listening

Business Presentation – Conversation between old friends; introducing a stranger – A Quality Manager talks about his work – Conversation between acquaintances – Sales talk at a sports equipment stand – Small talk among colleagues – A tour of a factory in Italy – Lunch in the factory canteen – A meeting to improve the efficiency of internal communication – A phone conversation arranging to meet – A credit card salesman talks to the bank – A conversation between business acquaintances - A management meeting about a recent merger – A conversation about a town, a country and its people.

9 Hours

Unit III
Speaking

Pronunciation Practice – Describing organizations - A company presentation — Practicing of conversation starters and closers with friends and strangers – Practice of simple language and step – by – step procedures to describe complex ideas – Explaining visual information – The language of increase and decrease applied to graphs and bar charts - Presenting a work – related graph – Making a telephone call – A sports equipment buyer and a manufacturer's sales representative talk business – Entertaining a visitor in your country – A short marketing meeting – Negotiating to meet around a busy schedule – Pairs or small groups discuss the implications of problems at an electronics factory – Finding out all you can about a partner – Chairing and holding meetings – Pairwork on questions and answers about places and people.

9 Hours

Unit IV
Reading

Signalling the structure of a presentation – introducing, sequencing and concluding a talk - Explaining concepts and ideas – The pattern of phone call conversations – Giving, getting and checking information – Common Business phrases – Giving encouragement: phrases for positive feedback; more emphatic adjectives and adverbs – Giving facts and explaining functions and processes – Asking for and clarifying information – How to state your point, agree and disagree – Practice of frequency, quantity and number - A short marketing meeting – Suggesting and agreeing times and places – Phrases for the Chairperson – People at work: their emotions, skills and attitudes.

9 Hours

Unit V
Writing

Making conditions using the present and future conditional Phrases for stalling for time - Common telephone phrases and responses - Business Communication – Calling for Quotation – Letter asking for Clarification – Transcoding – Rearranging the sentences – Cloze – Explaining visual information – Explaining concepts and ideas – Giving, getting and checking information – Business description – Informal negotiations.

9 Hours
Total: 45 Hours

***** Subject to continuous assessment

Textbook(s)

1. Jeremy Comfort, Pamela Rogerson, Trish Stott, and Derek Utley, *"Speaking Effectively – Developing Speaking Skills for Business English"*, Cambridge University Press, Cambridge, 2002.

References

1. Brook-Hart Guy, *BEC VANTAGE: BUSINESS BENCHMARK Upper-Intermediate – Student's Book*, Cambridge University Press, New Delhi, 2006.
2. Aruna Koneru, *"Professional Communication"*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.
3. P. Kiranmai Dutt, Geetha Rajeevan and CLN Prakash, *"A Course in Communication Skills"*, Cambridge University Press, New Delhi, 2008.
4. Krishna Mohan Balaji, *"Advanced Communicative English"*, Tata McGraw-hill Education Private Limited, New Delhi, 2009.

14O20B-BASIC ENGLISH II *

3 1 0 3.5

Objectives

- To promote fluency even downplaying accuracy
- To give room for a tacit acquisition of Basic English Grammar through ample listening, reading and writing inputs with direct theory wherever relevant
- To specifically focus on speaking and conversation skills with an aim to increase speaking confidence
- To nurture in students the capacity to express themselves lucidly and articulate their thoughts and impressions on a wide gamut of topics both through speech and writing
- To improve Spelling and Pronunciation by offering rigorous practice and exercises
- To correct common mistakes and to teach self-assessment techniques

Program Outcomes (POs)

f) Graduates will be able to communicate effectively in both verbal and written form

Course Outcome (COs)

- Able to communicate better with improved fluency, vocabulary and pronunciation.

Unit I

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
31	Difference between present continuous and simple present tense.	Calling for help in an emergency	Reporting an event- journalistic style
32	Verbs 'have' and 'have got'	Describing animals	Asking for and giving directions
33	Simple past tense	Inviting people, accepting and declining invitations	Self- enquiry and offering one's opinion on a given topic.
34	Spelling rules & table of irregular verbs	Refusing an invitation	Reading and practicing pre-written dialogues
35	Tutorial		

Unit II

36	Questions and the negative form of the simple past tense	Apologizing and responding to an apology	(Reading) conversation practice
37	Asking questions in the simple past tense	Reading comprehension	Seeking, granting and refusing permission
38	Past continuous tense	Paying compliments and responding to them	Pair work: writing dialogues and presenting them
39	Difference between simple past and past continuous- when and where to use each	Describing daily routines	Reading and comprehension skills
40	Tutorial		

Unit III

41	Simple future tense	Talking about the weather	Making plans- applying grammar theory to written work
42	Simple future tense- more aspects, possessive pronouns	Talking about possessions	Opening up and expressing one's emotions
43	Future continuous	Talking about current activities	Listening comprehension
44	Revision of future tense- simple and continuous forms,	Asking for the time and date	Discussion- analyzing and debating a given topic

	prepositions used with time and date		
45	Tutorial		

Unit IV

46	Articles a/an	Writing, speaking and presentation skills	Transcribing dictation
47	Singular- Plural (usage of a/an)	Reading practice- independent and shared reading	Comprehension –logical analysis, process analysis and subjective expression
48	Countable and uncountable nouns- a/an and some	Listening comprehension	Vocabulary: using context tools to decipher meaning
49	Articles- the	Sequencing sentences in a paragraph	Listening to a poem being recited, answer questions on it and practice reciting the same
50	Tutorial		

Unit V

51	Articles- the: usage and avoidance	Speaking: sharing stories about family, village/town, childhood, etc. 10 students	Listening: comprehend and follow multiple step instructions read out by the teacher
52	Articles- the: usage and avoidance with like and hate	Speaking: sharing stories about family, village/town, childhood, etc.- 10 students	Reading: make inferences from the story about the plot, setting and characters
53	Articles- the: usage and avoidance with names of places	Speaking: sharing stories about family, village/town, childhood, etc.- 10 students	Comprehension passage
54	This/ that/ these and those	Writing a notice- announcement	Speaking: Debate
55	Tutorial		

Unit VI

56	One and ones	Collaborative learning- problem solving	Writing short answers to questions based on reading
57	Capitalization and punctuation	Controlled writing	Listen to a story and respond to its main elements
58	Syntax and sentence construction- rearrange jumbled sentences	Guided writing	Listen to a poem and discuss its elements
59	Cloze	Free writing	Frame simple yet purposeful questions about a given passage
60	Tutorial		

Total: 45+15 Hours

Resources

1. Basic English Module, L&L Education Resources, Chennai, 2014.

***** Subject to continuous assessment

14O20C-ADVANCED COMMUNICATIVE ENGLISH *

3 1 0 3.5

Objectives

- To take part in a discussion in an effective manner
- To listen to an explanation and respond
- To write a formal communication
- To read company literature or any document

Program Outcomes (POs)

f) Graduates will be able to communicate effectively in both verbal and written form

Course Outcomes (COs)

- Able to read graphs and charts
- Able to skim and scan texts like job adverts
- Able to read business articles for specific information
- Able to understand the structure of a text

Unit I

Grammar and Vocabulary

Comparison of adjectives and adverbs – tenses – simple and complex questions – countable/ uncountable nouns, *-ing* forms and infinitives – conditionals – comparing and contrasting ideas – modal verbs – *while and whereas* for contrasting ideas – passives – used to, articles, reported speech, relative pronouns and expressing cause and result – workplace-related vocabulary.

9 Hours

Unit II

Listening

Prediction - the ability to identify information – ability to spell and write numbers correctly – ability to infer, understand gist, topic, context, and function, and recognize communicative functions (complaining, greeting, apologizing, etc.) – ability to follow a longer listening task and interpret what the speakers say.

9 Hours

Unit III

Speaking

The ability to talk about oneself and perform functions such as agreeing and disagreeing – ability to express opinions, agree, disagree, compare and contrast ideas and reach a decision in a discussion – appropriate use of stress, rhythm, intonation and clear individual speech sounds - take an active part in the development of the discourse - turn-taking and sustain the interaction by initiating and responding appropriately.

9 Hours

Unit IV

Reading

The ability to skim and scan business articles for specific details and information – To understand the meaning and the structure of the text at word, phrase, sentence, and paragraph level – ability to read in detail and interpret opinions and ideas – to develop one's understanding and knowledge of collocations – ability to identify and correct errors in texts.

9 Hours

Unit V

Writing

The ability to write concisely, communicate the correct content and write using the correct register – ability to write requests, instructions, explanations, and ask for information by using the correct format in business correspondences like charts, memo, note, email, letter, fax, report, proposal – understanding formal and informal styles – responding to written or graphic input.

9 Hours

Total: 45+15 Hours

Textbook(s)

1. Brook-Hart, Guy, "*Business Benchmark: Upper Intermediate* – Student's Book", Cambridge University Press, New Delhi, 2006.

* Subject to continuous assessment

References

1. Whitby, Norman, *Bulats Edition: Business Benchmark,* Pre-Intermediate to Intermediate – Student's Book, Cambridge University Press, New Delhi, 2006.
2. Cambridge Examinations Publishing, *Cambridge BEC Vantage* – Self-study Edition, Cambridge University Press, UK, 2005.

14O20H- HINDI *

3 1 0 3.5

Objectives

- To help students acquire the basics of Hindi
- To teach them how to converse in Hindi in various occasions
- To help learners acquire the ability to understand a simple technical text in Hindi

Program Outcomes (POs)

f) Graduates will be able to communicate effectively in both verbal and written form

Course Outcomes (COs)

- The students will become familiar with the basics of Hindi language and start conversing in Hindi.

Unit I

Hindi Alphabet

Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu & Visarg - Table of Alphabet -Vocabulary.

9 Hours

Unit II

Nouns

Genders (Masculine & Feminine Nouns ending in – ā,i,ī, u,ū) - Masculine & Feminine – Reading Exercises.

9 Hours

Unit III

Pronouns and Tenses

Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - Interrogative Sentences.

9 Hours

Unit IV

Classified Vocabulary

Parts of body – Relatives – Spices – Eatables – Fruit & Vegetables - Clothes - Directions – Seasons - Professions.

9 Hours

Unit V

Speaking

Model Sentences – Speaking practice for various occasions.

9 Hours

Total: 45+15 Hours

Textbook(s)

1. B. R. Kishore, *Self Hindi Teacher for Non-Hindi Speaking People*, Vee Kumar Publications (P) Ltd., New Delhi, 2009.

References

1. Syed, *Prayojan Mulak Hindi*, Rahamathullah Vani Prakasan, New Delhi, 2002.
2. Ramdev, *Vyakaran Pradeep*, Saraswathi Prakasan, Varanasi, 2004.

***** Subject to continuous assessment

14O20G - GERMAN *

3 1 0 3.5

Objectives

- To help students acquire the basics of German language
- To teach them how to converse in German in various occasions

Programme Outcomes (POs)

f) Graduates will be able to communicate effectively in both verbal and written form

Course Outcome (COs)

- Able to be familiar with the basics of German language and start conversing in German.

Unit I

Grammar & Vocabulary

Introduction to German language: Alphabet, Numbers – Nouns - Pronouns Verbs and Conjugations - definite and indefinite article - Negation - Working with Dictionary – Nominative - Accusative and dative case – preopositions - adjectives - modal auxiliaries - Imperative case - Possessive articles.

9 Hours

Unit II

Listening

Listening to CD supplied with the books, paying special attention to pronunciation: Includes all lessons in the book – Greetings - talking about name – country – studies – nationalities - ordering in restaurants - travel office - Interaction with correction of pronunciation.

9 Hours

Unit III

Speaking

Speaking about oneself - about family – studies - questions and answers - dialogue and group conversation on topics in textbooks - talks on chosen topics.

9 Hours

Unit IV

Reading

Reading lessons and exercises in the class - pronunciation exercises: Alphabet – name – country – people – profession – family – shopping – travel – numbers – friends – restaurant – studies - festivals

9 Hours

Unit V

Writing

Alphabet – numbers - words and sentences - Exercises in the books - control exercises - writing on chosen topics such as one self – family – studies - country.

9 Hours

Total: 45+15 Hours

Textbook(s)

1. Grundkurs *DEUTSCH, A Short Modern German Grammar Workbook and Glossary"*, *VERLAG FUR DEUTSCH*, Munichen, 2007.
2. Grundkurs, *DEUTSCH* Lehrbuch Hueber Munichen, 2007.

References

1. *Cassel Language Guides – German*: Christine Eckhard – Black & Ruth Whittle, Continuum, London / New York, 1992.
2. Kursbuch and Arbeitsbuch, *TANGRAM AKTUELL 1 DEUTSCH ALS FREMDSPRACHE, NIVEAUSTUFE AI/1*, Deutschland, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2005.
3. *Langenscheidt Eurodictionary* – German – English / English – German, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2009.

***** Subject to continuous assessment

14O20J - JAPANESE *

3 1 0 3.5

Objectives

- To help students acquire the basics of Japanese language
- To teach them how to converse in Japanese on various occasions
- To teach the students the Japanese cultural facets and social etiquettes

Programme Outcomes (POs)

f) Graduates will be able to communicate effectively in both verbal and written form

Course Outcomes (COs)

- Able to be familiar with the basics of Japanese language and start conversing in Japanese.

Unit I

Introduction to Japanese - Japanese script - Pronunciation of Japanese(Hiragana) - Long vowels - Pronunciation of in,tsu,ga - Letters combined with ya,yu,yo - Daily Greetings and Expressions - Numerals. N1 wa N2 des - N1 wa N2 ja arimasen - S ka - N1mo - N1 no N2 - …….san - Kanji - Technical Japanese Vocabulary (25 Numbers)

9 Hours

Unit II

Introduction - Kore - Sore - are - Kono N1 - Sono N1 - ano N1 - so des - so ja arimasen - S1 ka - S2 ka - N1 no N1 - so des ka – koko - soko - asoko - kochira - sochira - achira - N1 wa N2 (Place) des – dhoko-N1 no N2 - Kanji-10 - ima….ji…fun des - Introduction of verb - V mas - V masen - V mashitha - V masen deshitha - N1(Time) ne V - N1 kara N2 des - N1 tho N2 / S ne Kanji-10 - Technical Japanese Vocabulary (25 Numbers) – Dictionary Usage.

9 Hours

Unit III

- N1(Place) ye ikimas - ki mas - kayerimasu - Dhoko ye mo ikimasen - ikimasendheshitha - N1(vehicle) de ikimasu - kimasu - kayerimasu - N1(Personal or Animal) tho V ithsu - S yo. - N1 wo V (Transitive) - N1 wo shimus - Nani wo shimasu ka - Nan & Nani - N1(Place) de V - V masen ka - V masho - Oo……. Kanji-10 , N1(tool - means) de V - " Word / Sentence " wa …go nan des ka - N1(Person) ne agemus - N1(Person) ne moraimus - mo V shimashitha - , Kanji-10 – Japanese Typewriting using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

9 Hours

Unit IV

Introduction to Adjectives - N1 wa na adj des. N1 wa ii adj des - na adj na N1 - ii adj ii N1 - Thothemo - amari - N1 wa dho des ka - N1 wa dhonna N2 des ka - S1 ka S2 – dhore - N1 ga arimasu - wakarimasu - N1 ga suki masu - N1 ga kiraimasu - jozu des - hetha des - dhonna N1 - Usages of yoku - dhaithai - thakusan - sukoshi - amari - zenzen - S1 kara S2 - dhoshithe, N1 ga arimasu - imasu - N1(Place) ne N2 ga arimasu - iimasu - N1 wa N2(Place) ne arimasu - iimasu - N1(Person,Place,or Thing) no N2 (Position) - N1 ya N2, Kanji-10 - Japanese Dictionary usage using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

9 Hours

Unit V

Saying Numbers , Counter Suffixes , Usages of Quantifiers -Interrogatives - Dhono kurai - gurai – Quantifier-(Period) ne ….kai V - Quantifier dhake / N1 dhake Kanji - Past tense of Noun sentences and na Adjective sentences - Past tense of ii-adj sentences - N1 wa N2 yori adj des - N1 tho N2 tho Dhochira ga adj des ka and its answering method - N1 [no naka] de {nani/dhoko/dhare/ithsu} ga ichiban adj des ka - answering -N1 ga hoshi des - V1 mas form dhake mas - N1 (Place) ye V masu form ne iki masu/ki masu/kayeri masu - N1 ne V/N1 wo V - Dhoko ka - Nani ka – gojumo - Technical Japanese Vocabulary (25 Numbers)

9Hours

Total: 45+15 Hours

Textbook(s)

1. *Japanese for Everyone: Elementary Main Textbook 1-1*, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.
2. *Japanese for Everyone: Elementary Main Textbook 1-2*, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.

* Subject to continuous assessment

References

Software

1. Nihongo Shogo-1
2. Nihongo Shogo-2
3. JWPCE Software

Websites

1. www.japaneselifestyle.com
2. www.learn-japanese.info/
3. www.kanjisite.com/
4. www.learn-hiragana-katakana.com/typing-hiragana-characters/

14O20F - FRENCH *

3 1 0 3.5

Objective

- To help students acquire the basics of French language
- To teach them how to converse in French in on various occasions

Programme Outcomes (POs)

f) Graduates will be able to communicate effectively in both verbal and written form

Course Outcome (COs)

- The students will become familiar with the basics of French language and start conversing in French.

Unit I

Alphabet Français (alphabet) - Les accents français (the accents in French) – aigu – grave – circonflexe – tréma - cédille - écrire son nom dans le français (spelling one's name in French)

9 Hours

Unit II

Les noms de jours de la semaine (Days of the week) - Les noms de mois de l'année (Months) - numéro 1 à 100 (numbers 1 to 100)

9 Hours

Unit III

Moyens de transport (transport) - noms de professions (professions) - noms d'endroits communs (places) - nationalités (nationalities)

9 Hours

Unit IV

Pronoms (pronouns) - Noms communs masculins et de femme (common masculine and feminine nouns) - Verbes communs (common verbs)

9 Hours

Unit V

Présentation - même (Introducing Oneself) - narration de son nom - l'endroit où on vit - son âge - date de naissance - sa profession - numéro de téléphone - adresse (name - where one lives – age - date of birth – profession - telephone number and address) - Narration du temps (tellling the time)

9 Hours

Total: 45+15 Hours

Textbook(s)

1. Angela Wilkes, *French for Beginners*, Usborne Language Guides, Usborne Publishing Ltd., Ohio, 1987.

References

1. Ann Topping, *Beginners French Reader*, Natl Textbook Co, 1975.
2. Stanley Applebaum, *First French Reader*, Dover Publications, 1998.
3. Max Bellancourt, *Cours de Français*, London: Linguaphone, 2000.

Software

1. Français Linguaphone, Linguaphone Institute Ltd., London, 2000.
2. Français I. Harrisonburg: The Rosetta Stone: Fairfield Language Technologies, 2001.

* Subject to continuous assessment

14U001-AUTOMOTIVE AIR-CONDITIONING

3 0 0 3.0

Objectives

- To understand the fundamentals of air conditioning system
- To understand the basic of vehicle air-conditioning system, its components, working principle, control mechanism, service etc.
- To Understand the properties of the different refrigerants

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
b) Graduates will be able to identify, formulate and solve automobile engineering problems

Course Outcomes (COs)

- Able to understand the components of the automotive air-conditioning and their functions and the latest developments in this field.
- Able to describe the working principles of the components of the automotive air conditioning system
- Able to identify and describe the current developments relating to the automotive air conditioning

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	40	40	40	40
3	Apply	20	20	20	20
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. State two environmental and safety aspects each in A.C. system.
2. Enlist various types of vacuum operated devices with their functions.
3. State procedure for charging and discharging of refrigerant.
4. State any four functions of comfort heating system.
5. Define heating and humidification of air.
6. State the types of refrigerant.
7. Define DBT, WBT and DPT.
8. Define one tone of refrigeration.
9. Write down the formula for bypass factor.
10. List the types of vacuum operated devices.
11. Classify air conditioning systems.
12. What is split duct system?
13. What is comfort heating system?
14. What is sun load sensor?

Understand

1. Distinguish between H-valve and block type thermostatic expansion valve on any four aspects.
2. Explain psychrometric chart.
3. What is bypass factor?
4. What is meant by wet bulb depression?
5. What is the function of a thermostatic expansion valve?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

6. What are the three laws of air-conditioning?
7. Differentiate general climate control system and electronic climate control system.
8. What are the functions of vacuum operated devices?

Apply

1. Test the air control system of a vehicle using suitable instruments.
2. Brief cooling load of a car.
3. State the requirements of air-conditioning of car?
4. How fluorescent leak detector works?
5. Why liquid charge is dangerous?
6. What is meant by retrofitting?
7. Sketch the layout of A/C system.

Unit I

Air Conditioning Fundamentals

Basic air conditioning system - location of air conditioning components in a car, schematic layout of a refrigeration system, compressor components, condenser and high pressure service ports, thermostatic expansion valve, expansion valve calibration, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

9 Hours

Unit II

Air Conditioner – Heating System

Automotive heaters, manually controlled air conditioner, heater system, automatically controlled air conditioner and heater systems, automatic temperature control, air conditioning protection, engine protection.

9 Hours

Unit III

Refrigerant

Containers handling refrigerants, tapping into the refrigerant container, refrigeration system diagnosis, diagnostic procedure, ambient conditions affecting system pressures.

9 Hours

Unit IV

Air Routing and Temperature Control

Objectives, evaporator airflow through the recirculating unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control and handling systems.

9 Hours

Unit V

Air Conditioning Service

Air conditioner maintenance and service, servicing heater system removing and replacing components, trouble shooting of air controlling system, compressor service

9 Hours

Total: 45 Hours

Textbook(s)

1. William H. Crouse and Donald I. Anglin, “Automotive Air conditioning”, Mc Graw Hill Inc., 1990.
2. Boyce H. D Wiggins, “Automotive Air Conditioning”, Delmar, 2002

References

1. Mitchell information Services, Inc., “Mitchell Automatic Heating and Air Conditioning Systems”, Prentice Hall Ind., 1989.
2. Paul Weiser,“Automotive Air Conditioning” , Reston Publishing Co., Inc., 1990.
3. MacDonald, K.I., “Automotive Air Conditioning”, Theodore Audel series, 1978
4. Goings.L.F., “Automotive Air Conditioning”, American Technical services, 1974

14U002-ALTERNATE FUELS AND ENERGY SYSTEMS

3 0 0 3.0

Objectives

- To know about the types of alternative fuels and energy sources for IC engines.
- To understand the properties, performance and emission characteristics of Alcohols
- To know about Natural gas, LPG, hydrogen and biogas.

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
b) Graduates will be able to identify, formulate and solve automobile engineering problems

Course Outcomes (COs)

- Able to understand the various alternative fuels available, its properties, performance characteristics, combustion characteristics, emission characteristics, engine modifications required etc.
- Able to apply various alternate fuels appropriately to the needs
- Able to be acquainted with the knowledge of natural gas, LPG, hydrogen and biogas

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	30	30	30	30
3	Apply	20	20	20	20
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define alternate fuels and give examples for that.
2. What is the function of Solar Cell?
3. Discuss the properties of LPG and CNG
4. Differentiate between DME and DEE
5. What are the safety aspects following in storage of hydrogen?
6. Define hybrid electric vehicle
7. Discuss the different types of batteries
8. Define Electronic control system
9. Draw a neat sketch of hybrid electric vehicle

Understand

1. Differentiate Biofuel and Dual fuel mode
2. Compare LPG and petrol as fuel for SI engine
3. Discuss the properties of alcohol as engine fuel
4. Explain Hybrid electric vehicle
5. Discuss the refining process of petroleum
6. Discuss the characteristics of the vegetable oil
7. Draw a CNG kit conversion with an engine
8. Draw a LPG kit conversion with an engine
9. What are the important features of alcohol fuels?
10. Why isn't ammonia used ina vehicle?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

Apply

10. What are the modifications required for using CNG in a vehicle
11. Explain some hydrogen storage methods
12. Discuss the combustion characteristics of alcohol using in CI engines
13. Explain the esterification process in vegetable oil
14. Discuss the specifications of any one fuel cell vehicle

Unit I

Introduction

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars.

9 Hours

Unit II

Alcohols

Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

9 Hours

Unit III

Natural Gas, LPG, Hydrogen and Biogas

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG using LPG in SI & CI engines, performance and emission of LPG. Hydrogen; storage and handling, performance and safety aspects.

9 Hours

Unit IV

Vegetable Oils

Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, bio diesel and its characteristics

9 Hours

Unit V

Electric, Hybrid, Fuel Cell and Solar Cars

Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles

9 Hours

Total: 45 Hours

Textbook(s)

1. Richard.L.Bechfold, "Alternative Fuels Guide Book", SAE International Warrendale- 1997.
2. Maheswar Dayal - "Energy today & tomorrow" - I & B Horishr India - 1982.

References

1. Nagpal, "Power Plant Engineering", Khanna Publishers - 1991.
2. "Alcohols as motor fuels progress in technology" - Series No.19 - SAE Publication USE - 1980.
3. SAE paper nos. 840367, 841333, 841334, 841456, Transactions, SAE, USA.

14U003-VIBRATION, NOISE AND HARSHNESS CONTROL

3 0 0 3.0

Objectives

- To gain knowledge in basic of vibration and noise
- To understanding the effect of noise an human comfort and environment
- To knowing the methods of vibration and noise measurement

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

d) Graduates will be able to design systems for automobiles

Course Outcomes (COs)

- Able to understand the sources, effects, prediction, control techniques, measurement techniques of noise, vibration pertain to an automobile.
- Able to know vibration isolation by tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, Crank shaft damping, Modal analysis of the mass elastic model shock absorbers

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	30	30	30	30
3	Apply	30	30	30	30
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is vibration?
2. Explain the types of vibration?
3. Define degree of freedom
4. What is meant by damping?
5. List out the damping treatments
6. What is combustion noise?
7. What are the characteristics of noise?
8. List out the vibration control techniques
9. Define Harshness
10. What are the effects of harshness?

Understand

1. Differentiate free vibration and forced vibration
2. How to determine natural frequency?
3. How to provide damping for crankshaft?
4. How to calculate combustion noise?
5. How brake noise is generated?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

6. How to assessment the mechanical noise?
7. List out the sources for harshness
8. How to measure the harshness?
9. What are the causes for harshness?
10. How to control the harshness

Apply

1. Identify the vibrations in the automobile and compare linear vibration and non linear vibration
2. How to eliminate vibration in the automobile?
3. Briefly explain the measurement of noise in engine?
4. Identify the causes for following noise
   i. engine radiated noise
   ii. intake and exhaust noise
   iii. transmission noise
   iv. tyre noise
   v. brake noise
5. Identify the methods to control the following noise
   i. engine noise
   ii. combustion noise
   iii. mechanical noise

Unit I

Basics of Vibration

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

9 Hours

Unit II

Vibration Control Techniques

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers

9 Hours

Unit III

Basics of Noise and Sources

Introduction, , noise dose level, legislation, measurement and analysis of noise in engines, Noise characteristics, overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

9 Hours

Unit IV

Noise Control

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

9 Hours

Unit V

Harshness and its Control

Harshness - sources, its effects, measurement and control

9 Hours

Total: 45 Hours

Textbook(s)

1. Singiresu S.Rao - “Mechanical Vibrations” - Pearson Education, ISBM –81-297-0179-0 - 2004.
2. Rao V. Dukkipati and J.Srinivas ,”Text book of Mechanical Vibrations”, Prentice-Hall of India P Ltd,New Delhi.2004
3. Kewal Pujara “Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

References

1. Bernard Challen and Rodica Baranescu - “Diesel Engine Refrence Book” - Second edition - SAE International - ISBN 0-7680-0403-9 – 1999.
2. Julian Happian-Smith - “An Introduction to Modern Vehicle Design”- Butterworth-Heinemann, ISBN 0750-5044-3 - 2004
3. John Fenton - “Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing, ISBN 1-86058-073- 1998.

14U004-ADVANCED THEORY OF I.C ENGINES

3 0 0 3.0

Objectives

- To impart basic knowledge in the field of Automobile Engineering focusing internal combustion engines and their recent developments.
- To understand the combustion process in engines.
- To acquire ability to simulate the various types combustion processes of IC engines.
- To gain Knowledge in performance simulation of IC engines

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
b) Graduates will be able to design systems for automobiles

Course Outcomes (COs)

- Able to model and simulate the engine cycle, perform combustion analysis, instruments used in measurement, recent developments in the IC engines
- Able to be familiar with combustion reactions and stiochiometry
- Able to evaluate performance and emission characteristics of engines

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	30	30	30	30
3	Apply	30	30	30	30
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is an engine? Differentiate IC engines and EC engines?
2. Define knocking
3. What are the stages of combustion in SI and CI engines?
4. Sketch and mention the parts of fuel spray pattern
5. Define the term turbocharging
6. What is meant by Scavenging?
7. What are the variables affecting heat transfer in engines?
8. Define alternate fuels and give examples for that
9. Define HCCI
10. Define Hybrid electric vehicle

Understand

1. Distinguish between SI and CI engines
2. Draw a P-V and T- S diagram of SI and CI engines
3. What are factors affecting to design a combustion chamber?

† The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

4. Define volumetric efficiency
5. Differentiate between turbocharger and supercharger
6. What are the different types of scavenging process?
7. Draw a pressure – crank angle diagram for two stroke and four stroke engines
8. Draw a CNG kit conversion with an engine
9. Draw a LPG kit conversion with an engine
10. What are the important features of alcohol fuels?
11. Discuss the hydrogen storage in vehicles
12. Differentiate between HCCI and direct injection method
13. Differentiate between Bifuel and Dual fuel mode
14. Define lean burn engine
15. Draw a neat sketch of hybrid electric vehicle
16. Compare LPG and petrol as fuel for SI engine
17. State the factors affecting the delay period.
18. Differentiate 2-stroke and 4-stroke engines based on construction.
19. Compare direct and indirect injection systems.
20. Discuss the properties of alcohol as engine fuel.

Apply

1. Evaluate the relationship between homogeneous and heterogeneous mixture.
2. How will you differentiate dual cycle with diesel cycle in IC engines?
3. How the ignition takes place in C.I. Engine?
4. Mention the advantages of turbo charging
5. Indicate the features of mono point and multi point injection systems

Unit I

Combustion in SI Engines

Stages of combustion - ignition, flame propagation, factors affecting flame structure and speed, cycle by cycle variations, misfire, knock and pre-ignition. Factors controlling combustion chamber design. Combustion in diesel engines, comparison of different combustion systems, fuel spray structure and factors affecting it. Models for combustion in SI and CI engines.

9 Hours

Unit II

Gas Exchange Processes

Gas Exchange Processes in two and four stroke engines, factors affecting volumetric efficiency, flow through valves and ports, multi valve concept. Charge motion within the cylinder. Turbocharging and Turbocharger control. Different methods of charging and scavenging Two stroke engines.

9 Hours

Unit III

Combustion Analysis

Introduction to HWA, LDA and PIV systems to analyse engine flows. Engine heat transfer and energy balance, correlations for heat transfer coefficient, variables affecting heat transfer in Engines. Cylinder pressure data acquisition and thermodynamic analysis of engine pressure data to yield heat release rates.

9 Hours

Unit IV

Alternative Fuels

Alternative gaseous and liquid fuels for SI and CI engines, Alcohols, Biogas, LPG, CNG, Hydrogen, Biodiesel and Straight Vegetable oils, their properties and characteristics when used as engine fuels. Production, storage and distribution of different alternative fuels.

9 Hours

Unit V

Recent Developments

Homogeneous charge compression ignition, Stratified charge and gasoline direct injection, Dual fuel, lean burn and Hot surface Ignition Engine concepts. Hybrid Electric Drives

9 Hours

Total: 45 Hours

Textbook(s)

1. Ganesan.V., “Internal Combustion Engineering”, Tata McGraw-Hill Publishing Co., New Delhi,2012.
2. John B Heywood, “Internal Combustion Engine Fundamentals”, McGraw Hill, 1988.
3. Heisler, “Advanced Engine Technology”, SAE Publication, 1995.

References

1. Ramalingam. K.K., "Internal combustion engine", scitech publications, Chennai, 2003.
2. Ganesan,V., "Compute Simulation of Compression Ignition engine process", Universities Press (India) Ltd., Hyderabad, 1996.
3. John,B., Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill Publishing Co., New York, 1990.
4. Benson,R.S., Whitehouse,N.D., "Internal Combustion Engines", Pergamon Press, Oxford1979.

14U005-QUALITY CONTROL AND RELIABILITY ENGINEERING

3 0 0 3.0

Objectives

- To study the application of statistical approach for quality control
- To study the quality concepts in product design, manufacturing etc in order to maximize customer satisfaction
- To study the application of various control charts
- To study the various sampling procedures such as single sampling plan, double sampling plan etc
- To study the various reliability parameters and failure test – data analysis

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

g) Graduates will demonstrate skills to use modern engineering and information technology tolls necessary for engineering practice

Course Outcomes (COs)

- Able to know how to construct the process control charts for variables and attributes
- Able to know how to construct OC curve for various sampling plans
- Able to know how to calculate the reliability for various systems

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	20	20	25	20
2	Understand	20	30	20	20
3	Apply	30	30	30	30
4	Analyze/Evaluate	30	20	30	30
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define the term Quality.
2. How the quality can be quantified?
3. What is a non conforming unit?
4. What is meant by nonconformity?
5. State the meaning of attributes related to quality.
6. How the subgroup is sized?
7. What is a scatter diagram?
8. What is an np chart?
9. How the central tendency is calculated?
10. What is the objective of measuring central tendency?
11. Write an equation for sample standard deviation.
12. What is meant by population?
13. What is a sample?
14. What is a control chart?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

15. What is the meaning of upper and lower control limits?
16. Mention the control charts used for variables.
17. What is meant by reliability?
18. Why is it important to study reliability engineering?
19. List the three tasks of reliability engineering.
20. Define failure.
21. How is redundancy related to reliability?
22. Define availability.
23. List the configuration of systems.
24. What is mixed configuration system?
25. What is meant by MTTR?
26. How does maintainability affect reliability?
27. What is 80/20 principle?

Understand

1. Compare X Bar & R charts.
2. Why poission distribution curve is used for preparing c-chart?
3. How control charts helps in finding poor quality?
4. Why do we invest more on prevention cost than appraisal cost?
5. How the dispersion of the data is measured?
6. How customer requirements are converted into product specifications?
7. Differentiate defect and defective.
8. When are c-charts used?
9. Is customer complaint necessary for an organization? If yes, list the various tools used for collecting customer complaints.
10. Differentiate control limit and specification limit
11. Why np chart is not recommended when the sub group size is variable?
12. Under what situation, one can use cause and effect diagram.
13. Differentiate between the chance causes and assignable causes of variations giving suitable examples
14. When a process is 'in control' or 'stable'? What type of variations is present in the process?
15. How does maintainability affect reliability?
16. Differentiate supply down time with that of administrative down time.
17. Distinguish element redundancy in comparison with unit redundancy.
18. How to achieve a trade-off between reliability and cost?
19. Differentiate MTTF and MTBF.
20. How should the reliability of a component constituting a system to be improved?
21. What do you understand by the terms inherent availability, achieved availability and operational availability?
22. When do you prefer single sampling plan?
23. Differentiate single sampling plan and double sampling plan.
24. What do you infer from the term AQL and LTPD?

Apply

1. A certain product has been statistically controlled al a process average of 36.0 and a S:D. of 1.00. The product IS presently being sold to two users who have different specification requirements. User A has established a specification of 38.0 ± 4.0 for the product, and user R has specification of 36.0 ± 4.0.
   (i) Based on the present process set up, what percent of the product produced will not meet the specifications set up by user A?
   (ii) What percent of the product will not match the specifications of user B?
   (iii) Assuming that the two users' needs are equal, a suggestion is made to shift the process target to 37.0. At this suggested value, what percent of the product will not meet the specifications of user A?
   (iv) At the suggested process target, what percent or the product will not meet the specifications of user B?
   (v) Do you think .that this shift to a process target of 37.0 would be desirable? Explain your answer.
2. Three lamps are connected in parallel to produce light in a hall. The reliabilities are 0.92, 0.95 and 0.96. Find the reliability of the total lamp system. If the systems are connected in series, determine the reliability of the system.
3. An electronic system has a MTBF of 1000 hours and a MTTR of 40 hours. Determine its availability.
4. Construct the OC curve for the single sampling plan: N = 830, n = 62, c = 1 and r = 2. Use at least seven points

Analyze/ Evaluate:

1. A manufacturing process operates with an in control fraction of nonconforming production of at most 0.1%, which management is willing to accept 95% of the time; however, it the fraction nonconforming increases to 2% or more, management wishes to detect this shift with probability 0.90. Design an appropriate acceptance control chart for this process.
2. In designing a fraction nonconforming chart with center line at p=0.20 and three sigma control limits, what is the sample size required to yield a positive lower control limit? What is the value of n necessary to give a probability of 0.50 of detecting a shift in the process to 0.26?
3. Consider rectifying inspection for single sampling. Develop an AOQ equation assuming that all defective items are removed but not replaced with good ones
4. Draw the primary and supplementary OC curves for a double sampling plan with n1=50, c1=2, n2=100, c2=6. If the incoming lots have fraction nonconforming p=0.05, what is the probability of acceptance on the first sample? What is the probability of final acceptance? Calculate the probability of rejection on the first sample.
5. If two identical elements each having a reliability of 0.95 are in parallel redundancy in a system, determine the system reliability. If they are connected in standby redundancy, what would be the change in system reliability?
6. Determine the reliability and MTBF of the system for 10 hours operating period. The system has five components in series with constant failure rates of 1.3, 1.65, 2.0, 1.4 and 1.7 failures per 1000 hours respectively.

Unit I

Introduction and Process Control for Variables

Introduction, Definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process-causes of variation –Theory of control chart-uses of control chart – Control chart for variables – X chart, R chart and chart -process capability – process capability studies and simple problems. Six sigma concepts.

9 Hours

Unit II

Process Control for Attributes

Control chart for attributes –control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

9 Hours

Unit III

Acceptance Sampling

Economics of sampling, Lot formation, OC-Curve-Producer's and Consumer's risk, Single and double sampling plans, AOQ, AOQL, ATI, ASN, Sequential sampling plan, MIL – STD – 1050 tables, MIL – STD – 414 tables, IS 2500 Standard.

9 Hours

Unit IV

Life Testing - Reliability

Life Testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

9 Hours

Unit V

Quality and Reliablity

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

9 Hours

Total: 45 Hours

Textbook(s)

1. Douglas.C.Montgomery, " Introduction to Statistical Quality Control" John wiley 4th edition2001.
2. L.S.Srinath, "Reliability Engineering", Affiliated East west press, 1991.

References

1. John.S. Oakland. Statistical Process Control", Elsevier, 5th edition, 2005
2. Connor, P.D.T.O., " Practical Reliability Engineering", John Wiley, 1993
3. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996

4. Monohar Mahajan, “Statistical Quality Control”, Dhanpat Rai & Sons, 2001.
5. R.C.Gupta, “Statistical Quality Control”, Khanna Publishers, 1997.
6. Besterfield D.H., “Quality Control”, Prentice Hall, 1993.
7. Sharma S.C., “Inspection Quality Control and Reliability”, Khanna Publishers, 1998.
8. Danny Samson, “Manufacturing & Operations Strategy”, Prentice Hall, 1991

14U006-METRTOLOGY AND INSTRUMENTATION

3 0 0 3.0

Objectives

- To aquire knowledge in usage of software to measure parameters like speed, position, velocity, pressure, force, torque, temperature etc

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
d) Graduates will be able to design systems for automobiles
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to have awareness on various instruments that are available to measure parameters like speed, position, velocity, pressure, force, torque, temperature etc.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	30	30	30	30
3	Apply	30	30	30	30
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define mechanical sensor
2. What is hysteresis?
3. What are the types of errors?
4. Define precision.
5. Define sensitivity.
6. Define electrical sensor.
7. What is the difference between span and range?
8. Define accuracy.
9. Name the components of a measurement system.
10. What is the effect of hysteresis on an instrument?
11. Define brony brake.
12. Give the principle of hot wire anemometer.
13. List out low pressure measuring instruments.
14. What is thermocouple?
15. What is diaphragm gauges?
16. What is the principle involved in fluid expansion thermometer?
17. What is the difference between RTD and thermistor?
18. What are the important elements of measurements?
19. Define ultra sonic flow meter
20. What is comparator?
21. What are the types of comparator?
22. How do you classify slip gauges?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

23. What are the uses of slip gauges?
24. What are the applications of autocollimator?
25. What are limit gauges?
26. What is Taylor's principle of gauge design?
27. What is a sine bar?
28. What is wringing in gauge blocks?
29. Name the various methods for measuring effective diameter.
30. Name the various methods for measuring pitch diameter.
31. What is best size of wire?
32. What is best size of wire?
33. Define drunken thread.
34. What are the types of gears?
35. Define: module.
36. Define measurement of surface finish.
37. What are the various methods used for measuring the gear tooth thickness?
38. Write short notes on flatness and its measurement.
39. What is CMM?
40. Define machine vision.
41. What are the types of CMM?
42. State any two applications of machine vision system.
43. Define position accuracy.
44. Define gray scale analysis.
45. What are the advantages of machine vision system?

Understand

1. How can you measure effective diameter of internal threads?
2. What is the difference between linear and angular measurement?
3. Mention the principle involved in bimetallic strip.
4. Describe the features of flexible inspection system.
5. Describe the generalized measurement system.
6. Write short notes on classification of instruments.
7. Define sensor. Explain mechanical sensors with examples?
8. Define error. Explain the types of errors.
9. Define sensor. Explain electrical sensors with examples.
10. Explain calibration parameters in an instrument.
11. What are the features of CMM software?
12. State the possible sources of errors in CMM?

Apply

1. Briefly explain various methods of measuring torque.
2. Briefly explain various methods of measuring temperature.
3. Briefly explain various methods of measuring flow.
4. Briefly explain various methods of measuring power.
5. Briefly explain various methods of measuring force.
6. Explain working of Pressure thermometer and resistance thermometer.
7. Explain the construction and working of bimetallic strip and thermocouple.
8. Describe briefly the construction and operation of a Co-ordinate Measuring Machine.

Unit I

Introduction to Measurements and Sensors

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards- Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error- Propagation of error- Odds and uncertainty- principle of transduction- Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers- Dynamic characteristics of first and second order transducers for standard test inputs.

9 Hours

Unit II

Variable Resistance and Inductance Sensors

Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT

9 Hours

Unit III

Variable and Other Special Sensors

Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor

9 Hours

Unit IV

Automotive Pressure and Force/Torque Sensor

Pressure Sensor:

Typical automotive applications- Thick film pressure sensor- Semiconductor pressure sensor-Integrated silicon intake-manifold pressure sensor-Integrated silicon combustion-pressure sensor- Piezo electric sensor-High pressure sensor with metal diaphragm.

Force/Torque Sensor:

Typical automotive applications- Magneto elastic bearing-pin sensor- Magneto elastic tension/compressive-force sensor according to the cross-ductor principle – Basic principle of torque measurement – Stress and Angle measuring torque sensor

9 Hours

Unit V

Automotive Position and RPM/Velocity Sensors

Position Sensors:- Typical automotive applications- Wiper potentiometers- Short-circuiting ring sensor- Half-differential sensor- Eddy-current pedal-travel sensor- Integrated Hall IC's – Hall acceleration sensor- Knock sensors-RPM and Velocity Sensors: - Inductive rotational speed sensor-Hall effect sensor

Temperature Sensors:- Typical automotive applications -Sintered-Ceramic resistors-Thin film resistors-Thick film resistors- Monocrystalline silicon semiconductor resistor- Thermopile sensors

Flow Sensors:- Ultrasonic flow sensors-Pitot tube air-flow sensor- Hot wire air-mass flow meter- Micro mechanical hot-film air-mass flow meter- Lambda sensor -Imaging sensor-Rain Sensor Introduction to MEMs

9 Hours

Total: 45 Hours

Textbook(s)

1. Doeblin E.O, "Measurement Systems : Applications and Design", 5th Edition, Tata McGraw-Hill Publishing Co,2007
2. Robert Brandy, " Automotive Electronics and Computer System", Prentice Hall, 2001
3. William Kimberley," Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH, 2004

References

1. Bentley J.P ," Principles of Measurement Systems", 4th Edition, Addision Wesley Longman Ltd., U.K, 2004
2. Patranabis. D, " Sensors and Transducers", 2nd Edition, Prentice Hall India Ltd, 2003
3. Murthy D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2007
4. Neubert H.K.P.," Instrument Transducers- An Introduction to their Performance and Design", Oxford University Press, Cambridge, 2003

14U007-SUPERCHARGING AND SCAVENGING

3 0 0 3.0

Objectives

- To impart basic knowledge in the field supercharging and scavenging processes
- To understand the need for supercharging and the various types of superchargers used and their performance characteristics and the scavenging methods for two stroke engines.

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
b) Graduates will be able to identify, formulate and solve automobile engineering problems

Course Outcomes (COs)

- Able to understand the fundamental philosophy of internal combustion engines.
- Able to know about the working principle of super charging
- Able to differentiate supercharging and scavenging
- Able to understand the design of ports and mufflers.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	40	40	40	40
3	Apply	20	20	20	20
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define Supercharging
2. Define turbocharging
3. Name the different types of scavenging
4. What is meant by ring breakage?
5. Define cross flow scavenging
6. Define Curtis type loop scavenging
7. What are the objectives of supercharging?
8. Discuss the reed valve mechanism with a neat sketch.
9. What is a kadenacy system? Explain
10. What is meant by Orbital engine combustion system?
11. What are unsymmetrically scavenged engines?
12. Give the types of backflows in a two stroke cycle engines.

Understand

1. Draw a neat sketch of shankey diagram.
2. Discuss the perfect mixing and perfect scavenging models
3. Discuss the limitations of supercharging S.I and C.I engines
4. Discuss the various methods of turbocharging
5. What is meant by surging and choking in a centrifugal compressor?
6. Discuss the benefits of supercharging automotive in S.I and C.I engine

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

7. Discuss the limitations of supercharging automotive in S.I and C.I engine
8. Illustrate with neat sketches the arrangement of manifolds for turbocharging
9. Explain the Curtis type apparatus for determining scavenging efficiency

Apply

1. Explain the thermodynamic cycle of supercharging with necessary illustrations.
2. What is the effect of supercharging on air utilization and fuel utilization during combustion?
3. Obtain the relationship between pure air ratio and delivery ratio in the case of perfect scavenging
4. List down the modification required for an engine for supercharging
5. Explain the effect of waste gate on the boost pressure with a neat sketch
6. Give the porting diagram of different scavenging arrangements and explain
7. Design the complete porting of Curtis type scavenging two stroke engine system using the following data : Bore * stroke = 520 * 700 mm connecting rod length = 1575 mm Speed = 240 rpm compression ratio = 16 : 1 Also give the port timing diagram.
8. Discuss the tracer gas method for the calculation of scavenging efficiency

Unit I

Supercharging

Effects on engine performance – engine modification required Thermodynamics of Mechanical Supercharging and Turbocharging – Turbocharging methods – Engine exhaust manifolds arrangements.

9 Hours

Unit II

Superchargers

Types of compressors – Positive displacement blowers – Centrifugal compressors – Performance characteristic curves – Suitability for engine application – Surging – Matching of supercharger compressor and Engine – Matching of compressor, Turbine, Engine.

9 Hours

Unit III

Scavenging of Two Stroke Engines

Peculiarities of two stroke cycle engines – Classification of scavenging systems – Mixture control through Reed valve induction – Charging Processes in two stroke cycle engine – Terminologies – Shankey diagram – Relation between scavenging terms – scavenging modeling – Perfect displacement, Perfect mixing – Complex scavenging models.

9 Hours

Unit IV

Ports and Muffler Design

Porting – Design considerations – Design of Intake and Exhaust Systems – Tuning.

9 Hours

Unit V

Experimental Methods

Experimental techniques for evaluating scavenging – Firing engine tests – Non firing engine tests – Port flow characteristics – Kadenacy system – Orbital engine combustion system.

9 Hours

Total: 45 Hours

Textbook(s)

1. Watson, N. and Janota, M.S., “Turbocharging the I.C.Engine”, MacMillan Co., 1982.
2. John B.Heywood, “Two Stroke Cycle Engine”, SAE Publications, 1997

References

1. Obert, E.F., “Internal Combustion Engines and Air Pollution”, Intext Educational Publishers, 1980.
2. Richard Stone,”Internal Combustion Engines”, SAE, 1992.
3. Vincent,E.T., “Supercharging the I.C.Engines”, McGraw-Hill. 1943
4. Schweitzer, P.H., “Scavenging of Two Stroke Cycle Diesel Engine”, MacMillan Co., 1956

14U008-AUTOMOTIVE AERODYNAMICS

3 0 0 3.0

Objectives

- To understand the fundamentals of aerodyanmics, vehicle body optimisation, measuring aerodynamics forces etc
- To understand the design concept of automobile bodies and to determine their drag coefficients and optimize their shapes.
- To understand the principle of wind tunnel technology

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

d) Graduates will be able to design systems for automobiles

Course Outcomes (COs)

- Able to apply basic principles of aerodynamics for the design of vehicle body
- Able to be familiar with types of drag force and be able to analyse aerodynamic drag
- Able to optimize various shape configurations in automobiles
- Able to involve the principle of wind tunnel technology and also various measurement techniques involved in it

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	20	20	20	20
2	Understand	25	25	25	25
3	Apply	25	25	25	25
4	Analyze/Evaluate	30	30	30	30
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What do you mean by vehicle aerodynamics?
2. What are the various tasks of vehicle aerodynamics?
3. Define lift and pitching moment. What is its effect on the vehicle and how it can be prevented?
4. What is the effect of crosswind on a vehicle?
5. Mention the three tasks to be performed by air flow through the passenger compartment.
6. Mention the four periods in the history of vehicle aerodynamics.
7. What are the different modes by which analysis of fuel consumption has to be made?
8. Define fuel consumption.
9. Define Euromix.
10. What is the strategy adopted for lowest fuel consumption?
11. Define co-efficient of tangential force.
12. What do you mean by "acceleration capability" and "elasticity" of a vehicle?
13. Write short notes on the following properties of incompressible fluids i) Density, ii) Viscosity, iii) Thermal conductivity.
14. What are the various types of drag? Explain.
15. Define aerodynamic stability (or) when a vehicle is said to be aerodynamically stable?
16. What are the parameters influencing drag on the front end shape?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

17. Define optimum nose.
18. What are the disadvantages arose by increasing the wind shield inclination?
19. Name the three types of rear end for cars.
20. What do you mean by "boat-tailing" and "bob-tailing"?
21. Draw the flow field for a backward-facing step notch.
22. What is the effect of side-window recess on drag?
23. What are the characteristics of the function involving shape elements?
24. What do you mean by facelift?

Understand

1. Give the expression for drag force.
2. How the flow fields around a vehicle and an airplane differ?
3. How the time taken in the development of a new car can be reduced (aerodynamics only)?
4. Give the expression for tractive force, tire rolling resistance, effective vehicle mass.
5. What is the effect of drag on i) Front edge radii, ii) Hood inclination, iii) Windshield angle and iv) Front end inclination.
6. Explain how drag can be classified according to the locations of generation.
7. With neat sketches briefly explain how the front end shape of a car can be optimized.
8. Explain in detail about the aerodynamics of commercial vehicles and motorcycles.
9. Compare the 3 different rear-end shapes of Lay, Kamm and Klemperer's model.
10. Explain how drag is subdivided according to their regions of generation.
11. Describe with a neat sketch the external flow and internal flow of vehicles
12. Write short notes on the fuel consumption of cars and light trucks.
13. Explain and why passenger cars are considered against bluff bodies.
14. Explain the flow field around a car.
15. Explain in brief about the following. i) Rumpler's tear drop model, ii) Jaray's combination shape, iii) Mauboissin's "Mistral" car, iv) Lange car, v) Schlor's one volume body, and vi) "Bath tub" (3 volume) body.
16. Write short notes on the drag co-efficient of production cars.
17. At what location the flow separation takes place around the wind shield?

Apply/Evaluate

1. Explain any three measures to reduce the drag on a Fastback rear end.
2. Explain in brief about the era of the streamline.
3. Explain in detail about the concept of "borrowed" shapes of vehicle aerodynamics.
4. Write short notes on i) Detail optimization, ii) Shape optimization, iii) Aerodynamics Vs Design
5. What are the measures available to reduce the drag on a Notchback rear end? Explain.
6. Describe the physical mechanism generating drag
7. How to analyse the performance of a vehicle based on i) Traction diagram, ii) Maximum speed, iii) Acceleration?
8. Where the air stream gets disturbed along the side panels?
9. Explain how drag can be reduced with the modifications on windshield(A-pillar) and roof.
10. Explain any two strategies involved in the body shape development.
11. Explain the evaluation of drag by forecasting (rating) and expert systems.
12. Describe with neat sketches how boat-tailing measures are performed to reduce the drag on a Square back rear end.
13. How the plan view of a car can be improved?

Unit I

Introduction

Scope – historical development trends – Fundamentals of fluid mechanics – Flow phenomenon related to vehicles – External & Internal flow problems – Resistance to vehicle motion – Performance – Fuel consumption and performance – Potential of vehicle aerodynamics.

9 Hours

Unit II

Aerodynamic Drag of Cabs

Car 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.

9 Hours

Unit III

Shape Optimization of Cabs

Front and modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back – Dust flow patterns at the rear – Effect of gap configuration – Effect of fasteners.

9 Hours

Unit IV

Vehicle Handling

The origin of force and moments on a vehicle – Side wind problems – Methods to calculate forces and moments – Vehicle dynamics Under side winds – Effects of forces and moments – Characteristics of forces and moments – Dirt accumulation on the vehicle – wind noise – drag reduction in commercial vehicles.

9 Hours

Unit V

Wind Tunnels for Automotive Aerodynamics

Introduction – Principles 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.

9 Hours

Total: 45 Hours

Textbook(s)

1. Hucho,W.H., “Aerodynamics of Road vehicles”, Butterworths Co. Ltd., 1987.
2. Pope, A., “Wind Tunnel Testing”, John Wiley & Sons, 2nd Edt, New York, 1974.

References

1. Automotive Aerodynamics: Update SP-706, SAE, 1987.
2. Vehicle Aerodynamics, SP-1445, SAE, 1996

14U009-COMPOSITE MATERIALS

3 0 0 3.0

Objectives

- To understand the need of composite in structural and non-structural applications
- To know the manufacturing, properties and application of different types of reinforcement and matrix
- To understand the fabrication techniques involved in the polymer, metal, and ceramic matrix composites

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

d) Graduates will be able to design systems for automobiles

Course Outcomes (COs)

- Able to describe the properties of various available composite materials.
- Able to design the composite product suitable for specific applications.
- Able to select suitable composite or smart materials for industrial oriented applications

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	35	30	30
2	Understand	40	40	40	40
3	Apply	20	25	30	30
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is mean by composites?
2. Explain the need for composites.
3. List out the advantages of composite.
4. What are all the types composite based on matrix?
5. Draw neat sketches for (i) fiber (ii) particulate and (iii) laminar composites and mark the different constituents.
6. Mention various forms of fibers used for composite materials.
7. State any two functions of matrix in composite materials.
8. State any two functions of reinforcement in composite materials.
9. What is mean by Whiskers?
10. What is mean by Thermoset Matrix Materials?
11. State the benefits of polymer matrix composites.
12. Give two applications for composites in biomedical applications.
13. What is mean by lamina?
14. Define laminate.
15. What is meant by hybrid composites?
16. Write some of the application of filament winding method.
17. State any four advantages of RTM.
18. List any four defects in compression molded SMC part.
19. What is mean by Nonautoclave curing?
20. Define the term "Metal Matrix Composite".
21. Write down applications of Metal Matrix Composites.

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

22. List out the advantages of aluminium matrix composite.
23. What is mean by Rule of Mixture?
24. Define the term "squeeze casting"
25. What is the liquid state processes used for manufacturing MMCs?
26. What is mean by powder metallurgy?
27. State the benefits of powder metallurgy.
28. What are monolithic ceramics?
29. Explain the Chemical Vapor Infiltration processes.
30. Write the salient properties of ceramic materials.
31. State any two methods used for manufacturing Carbon/Carbon composites.
32. State any two applications of Carbon/ Carbon composites.
33. What is mean by oxidative etching?

Understand

1. How the composite differs from alloy?
2. What is the need of composite?
3. Why the composite is an orthotropic material?
4. What is use of fillers in composites?
5. Why small diameter fiber is preferred in composite?
6. What are the advantages of ceramics over metals as fibers?
7. Why Sol-gel technique is used for manufacturing glass fiber?
8. Why the polymer matrix composite used in large proportion in aerospace?
9. Why the hand lay-up process mostly preferred?
10. How composite is manufactured by RTM process?
11. What is the use of hardener in polymer matrix composite?
12. How the liquid state processes used for manufacturing of MMCs?
13. What is the use of control systems in an autoclave molding process?
14. How the volume fractions effect the overall performance of the composites?
15. What are all the various process involved in the recycling of PMC's
16. Where the ceramic matrix composite are mostly used?

Apply

1. How many elastic constants are required to describe stress to strain relation for an isotropic material, an orthotropic material and an anisotropic material?
2. What is ratio to be required for mixing the hardener in epoxy for curing purpose?
3. How the fiber angle can be changed in filament winding machine?
4. Find out the young's modulus of composite having 60% volume fraction of fiber. E_f = 68.9 GPa and E_m = 3.45GPa
5. Evaluate the effect of fiber volume fraction in composite.
6. Give the solution to avoid improper mixing of reinforcement in MMC.

Unit I

Introduction, Lamina Constitutive Equations & Manufacturing

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices– Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Q_{ij}), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding – Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

9 Hours

Unit II

Flat Plate Laminate Constitute Equations

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

9 Hours

Unit III

Lamina Strength Analysis

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

9 Hours

Unit IV

Thermal Analysis

Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

9 Hours

Unit V

Analysis of Laminated Flat Plates

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

9 Hours
Total: 45 Hours

Textbook(s)

1. Gibson, R.F., "Principles of Composite Material Mechanics", McGraw-Hill, 1994, Second Edition - CRC press in progress.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, 1998

References

1. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition – 2007
2. Mallick, P.K., Fiber –"Reinforced Composites: Materials, Manufacturing and Design", Maneel Dekker Inc, 1993.
3. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co.,1984.
4. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
5. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.

14U010- AUTOMOTIVE SAFETY

3 0 0 3.0

Objectives

- To understand the safety aspects in the vehicle
- To get the knowledge in sensors provided in the vehicle to avoid the crash and to detect the defects in the vehicle
- To familiarize the students in various systems that enhances vehicle safety, passenger comfort, recent technologies in automobile field etc.

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
g) Graduates will demonstrate skills to use modern engineering and information technology tolls necessary for engineering practice
k) Graduates will have knowledge of contemporary issues and modern practices

Course Outcomes (COs)

- Able to have good exposure to automotive safety aspects including the understanding of the various safety equipments
- Able to know the working of the compartment while moving of the vehicle, about the collapsible steering and tiltable steering column, about the collision avoidance system, front and rear object detection.
- Able to know about the rear vehicle detection system, and the braking system, the comfort and convenience system for the vehicle such as central locking system, garage door opening system and about the environment information system

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	30	30	30	30
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. What is meant by crumble zone?
2. Write down the energy equations when two moving vehicles are making a head on collision.
3. Discuss the energy equation for automotive vehicle safety system.
4. What is meant by conditional safety?
5. Discuss the design of vehicle body with respect to safety system?
6. Deceleration on impact with movable vehicle is less danger than the stationary object-justify.
7. How the engine location which help for safety system.
8. Deceleration on impact with movable vehicle is less danger than the stationary object-Justify.
9. What is safety sandwich construction?
10. Define active safety in vehicles.
11. What is meant by conditional safety?
12. What do you mean by external safety system?
13. Define –active and passive safety system
14. What do you mean by interior safety system?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

15. Give the merits and demerits of collapsible steering wheel.
16. What is passive safety?
17. What do you mean by operating safety?
18. What is perceptibility safety?
19. What is the principle of operation of an air bag in a vehicle?
20. Give the merits and demerits of tiltable steering wheel
21. What are the safety aspects of bumper design?
22. Give the merits and demerits of collapsible steering column.
23. What is the function of acceleration sensor in air bag?
24. Name the parts of seat belt tightner.
25. What is the role of seat belt in reducing accidents?
26. Name the parts of collapsible steering column.
27. What is electronic visibility?
28. What is active brake intervention?
29. How does the collision warning system in a vehicle work?
30. Explain the concept of frontal object detection briefly.
31. Give the short note on causes of rear and collision system.
32. Discuss the concept of rear object detection.
33. What is the function of radar in collision warning system?
34. What are the causes of rear end collisions?
35. List out the major components of vehicle object detection system.
36. Name the important parts of environment information system
37. What are the advantages of tyre pressure control system?
38. What are the advantages of central locking system?
39. Name the important parts of garage door opening system.
40. Discuss the principles of garage door opening system
41. State the principles of environment information system
42. List out the systems that are purely enhancing the comfort and convenience of the passengers in a vehicle
43. Differentiate collapsible steering and tilting steering

Understand

1. Enumerate the features of tyre pressure control system and rain sensor system with neat sketch.
2. Explain the working principles anti-theft, central locking system
3. Give the construction and working principles of control locking system
4. With relevant sketches explain the construction and working of the pressure control system.
5. Explain in detail frontal object detection system with a neat sketch.
6. With a schematic diagram the working of object detection system with braking system
7. Explain in detail the rear vehicle object detection system with neat sketch
8. With a schematic diagram explain the working of collision warning system
9. Briefly explain the construction and working principles of ABS system
10. Explain in detail the construction and working of environment information system with a neat sketch
11. With relevant sketches explain the construction and working of rain sensor system
12. List out the passive safety equipment used in a modern car and with the aid sketches, explain any two of them
13. Briefly explain various active safety systems in automobiles
14. With a neat sketch explain the deformation behaviour of vehicle body.
15. Explain the construction and working principles of air bag with electronic activating system.
16. Explain in detail the speed and acceleration characteristics of passenger compartment on impact with the relevant sketches.
17. Briefly explain the concept of safety sandwich construction

Apply

1. With the aid of circuit diagrams explain the working of a typical central locking system and remotely controlled door opening system.
2. What is G.P.S? How this system enhances the convenience of a passenger car?
3. Describe the features of central locking, rain sensor system with a neat sketch
4. What is meant by adaptive cruise control? Explain the working of a typical adaptive cruise control system used in a modern car
5. With a schematic diagram explain the concept of bumper design for safety
6. Explain the construction and working of automatic seat belt tightener system with neat
7. Explain the Deceleration on impact with stationary and movable obstacle with neat sketch.
8. Describe the techniques used to enhance the visibility of the driver of a passenger car.

9. Explain in detail the various aspects of designing a passenger car body for safety
10. With the aid of a circuit diagram, explain an electronic activating system for deployment of air bag and the working of the air bag system

Unit I

Introduction

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 crumble zone, safety sandwich construction.

9 Hours

Unit II

Safety Concepts

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.

9 Hours

Unit III

Safety Equipments

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.

9 Hours

Unit IV

Collision Warning and Avoidance

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

9 Hours

Unit V

Comfort and Convenience System

Steering and mirror adjustment, central locking system , Garage door opening system, tyre pressure control system, rain sensor system, environment information system

9 Hours

Total: 45 Hours

Textbook(s)

1. Bosch - “Automotive Handbook” - 5th edition - SAE publication - 2000.

References

1. J.Powloski - “Vehicle Body Engineering” - Business books limited, London - 1969.
2. Ronald.K.Jurgen - “Automotive Electronics Handbook” - Second edition- McGraw-Hill Inc., - 1999.

14U011- COMBUSTION THERMODYNAMICS AND HEAT TRANSFER

3 0 0 3.0

Objectives

- To know and understand the principle of engine combustion
- To introduce the various heat transfer models and its measuring methods

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
b) Graduates will be able to identify, formulate and solve automobile engineering problems

Course Outcomes (COs)

- Able to understand the engine heat release rate and various heat transfer models
- Able to know the experimental methods for combustion and heat transfer analysis in engines

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	25	25	25	25
2	Understand	25	25	25	25
3	Apply	20	20	20	20
4	Analyze/Evaluate	30	30	30	30
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define oxidizer
2. List the types of fuel
3. What are the modes of combustion
4. What is significance of stiochiometric equation?
5. Define ideal gas law
6. What are the stages in combustion?
7. Define Fick's law
8. What is abnormal combustion?
9. What is ignition delay?
10. Explain droplet combustion?

Understand

1. Differentiate laminar combustion and turbulent combustion
2. What is flame speed?
3. How to calculate burning velocity?
4. How to calculate adiabatic flame temperature
5. What is boundary layer?
6. What are the causes of abnormal combustion?
7. What are engine operating variables on combustion?
8. What is the parameter that causes ignition delay?
9. Compare droplet combustion and spray combustion?
10. What is diesel knock?

Apply

1. Draw and explain the various modes of combustion in engine.

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

2. Illustrate the physics of combustion
3. Describe the theories of detonation
4. Draw and explain the theory of flame propagation
5. Depict the P-θ diagrams of SI and CI engines

Unit I

Introduction to Combustion Processes

Definition for Fuel and Oxidizer – types – Various combustion modes- Combustion in premixed laminar and premixed turbulent combustion - Flame Speed – Burning Velocity - diffusion flames – Combustion process in IC engines.

9 Hours

Unit II

Thermodynamics of Combustion

Thermodynamics of combustion – Thermodynamic Properties – Ideal gas law – Gas mixture combustion – Stoichiometric combustion – Thermochemistry – Hess's law- Adiabatic flame temperature – Physics of combustion – Fick's law of species diffusion – Conservation equations – Boundary layer concept

9 Hours

Unit III

Normal, Abnormal Combustion in SI Engines

Stages of combustion – Flame propagation — Flame Limits –Flame Extinction -Rate of pressure rise – Cycle to cycle variation – Abnormal combustion – Theories of detonation – Effect of engine operating variables on combustion –Example problems.

9 Hours

Unit IV

Combustion and Heat Transfer in IC Engines

Droplet and spray combustion theory – delay period – Peak pressure – Heat release – Gas temperature – Diesel knock. Basic definitions – Convective heat transfer – Radiative heat transfer – Heat transfer, temperature distribution and thermal stresses in piston – Cylinder liner – Cylinder head – fins and valves.

9 Hours

Unit V

Experimental Investigation of Combustion and Heat Transfer in IC Engines

Photographic studies of combustion processes – P-θ diagrams in SI and CI engines, Assembly – Temperature measurement in piston – cylinder liner – Cylinder head and engine valves.

9 Hours

Total:45 Hours

Textbook(s)

1. Spalding.D.B., "Some fundamentals of Combustion", Butterworth Science Publications, London, 1985.

References

1. Lewis,B., Pease,R.N. and Taylor,H.S., "Combustion Process, High Speed Gas dynamics and Jet Propulsion Series", Princeton University Press, Princeton, New Jersey, 1976.
2. Taylor,E.F., "The Internal Combustion Engines", International Text Book Co., Pennsylvania, 1982.
3. Ganesan,V., "Internal Combustion Engines", Tata McGraw Hill Co., 1994.
4. D.P.Mishra., "Fundamentals of Combustion", PHI .,2008

14U012- RUBBER TECHNOLOGY FOR AUTOMOBILES

3 0 0 3.0

Objectives

- To study the function of various rubber components used in automobiles.
- To know and understand the property relationship of rubber
- To study about the principle of vibration isolation
- To get the knowledge of couplings, its types and its manufacturing techniques.

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
d) Graduates will be able to design systems for automobiles
g) Graduates will demonstrate skills to use modern engineering and information technology tolls necessary for engineering practice

Course Outcomes (COs)

- Able to have good exposure to role of various Rubber components in Automobiles

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	30	30	30	30
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define the term Creep
2. What is Stress relaxation?
3. What is meant by Permanent Set?
4. Write down the applications of rubber in vibration isolation found in transportation.
5. Mention the types of molecular motion observed in rubber.
6. What is rebound resilience?
7. What is damping factor?
8. Write any four applications of rubber used in automobiles.
9. What are the factors considered for selecting rubber materials for auto vehicles.
10. Give the classification of rubber based on the chain structure.
11. List the various components forming a tyre structure.
12. List the rubbers used in tyre manufacture.
13. State the materials used for making rubber hoses.
14. List the various ingredients used in rubber compounding.

Understand

1. Explain the structure property relations in rubber.
2. Write about characteristic features of sinusoidal vibrations.
3. Why Nitrile Rubber shows superior oil resistance among all dienes?
4. How the low molecular weight compound differs from polymer?
5. Why is it difficult to make rubber product with close dimension tolerance?
6. What are the molecular-structural requirements for a material to act as a rubber?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

7. Explain the function of each component forming a tyre structure.
8. Discuss the construction of a rubber hose.
9. What are the benefits of rubber spring as compared to an air system and mechanical springs?
10. What technical requirements exist for brake fluids?
11. What properties must a brake fluid have?
12. What is the difference between DOT3 and DOT4 brake fluids?

Apply

1. By taking example of rubber mountings, discuss the phenomenon of vibration isolation
2. Diffusion and solubility of compounding ingredients in rubber are of great practical interest-explain this statement with suitable example.
3. Discuss the basic principles used in compounding of rubber. Give the role of each ingredients with suitable examples.
4. The rubber spring in a truck is touching the axle all the time. Will that hurt the truck? Explain.
5. When a 500 g mass is placed on a spring, it stretches by 12 cm. A second identical spring is now placed below the first. How far do the two springs in series stretch? What is the new spring constant in N m-1?

Unit I

Introduction

Identification of plastics / rubber components in automobiles – function – selection criteria.

9 Hours

Unit II

Structure-Property Relationship of Rubber

Resilience, creep, hysteresis and damping, stability, set and stress relaxation, behaviour in dynamic applications.

9 Hours

Unit III

Vibration and Rubber Spring

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.

9 Hours

Unit IV

Fluid Sealings and Flexible Couplings And Hoses

Seals for static and dynamic applications – effect of heat / oil ageing – frictional behaviour – fundamental of sealability.

9 Hours

Unit V

Compounding and Manufacture

Types of couplings – specification and selection – torque vs deflection relationships – brake fluid / hydraulic hoses, materials and manufacture.

9 Hours

Total: 45 Hours

Textbook(s)

1. Freakley,P.K., and Payne,A.R., “Theory and Practice of Engineering with Rubber”, Applied Science Publishers Ltd.

References

1. Hobel,E.F., “Rubber Springs Design”.
2. Blow,C.M. and Hepburn,C., “Rubber Technology and Manufacture”.

14U013- FUNDAMENTALS OF NANOSCIENCE

3 0 0 3.0

Objectives

- To study the basic Nano Technology and Nano Science.
- To understand interdisciplinary nature of this field.
- To understand the important role of Physics, Chemistry, Biology.
- To recognize that the rules of Nano Science are fundamentally different than those we experience.
- To study the Basic Fabrication Strategies of Nano Science.

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
d) Graduates will be able to design systems for automobiles
g) Graduates will demonstrate skills to use modern engineering and information technology tolls necessary for engineering practice

Course Outcomes (COs)

- Able to understand the importance, relevance and potentialities of this emerging field of study

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	25	25	25	25
2	Understand	25	25	25	25
3	Apply	30	30	30	30
4	Analyze/Evaluate	20	20	20	20
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Define nanotechnology.
2. Define nanoscience.
3. Define top down and bottom up approach.
4. Define nanostructured material. Classify nanomaterials and give examples for them.
5. List any four day to day commercial applications of nanotechnology.
6. Write down any four challenges that are faced by researchers in nanotechnology.
7. Define carbon nanotube.
8. Define bucky ball.
9. Define nanocomposite. What are the types of nanocomposites?
10. List any four material characterization techniques.
11. List any four bottom up approaches for the synthesis of nanopowders.
12. What is biomimetic approach?
13. Explain Feynman's statement.
14. What is the dimension of quantum dot?
15. Explain the principle behind lithography.
16. Mention the different types of lithography.
17. What is meant by photolithography?
18. Explain the principle behind vapour phase deposition.
19. What is meant by chemical vapour deposition?
20. Explain sputtering.
21. What is meant by plasma enhanced CVD?

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks

22. What is meant by bubblers?
23. Explain the principle behind MOVPE.
24. What are colloids?
25. What is nanosafety?
26. What is meant by surface induced effect?
27. How are nanomaterials defined?
28. What are the uses of nanoparticles in consumer products?

Understand

1. What is the difference between nanoscience and nanotechnology?
2. When and where Feynman delivered his lecture on nanotechnology and what is the name of his classical lecture?
3. What are the induced effects due to increase in surface area of nanoparticles?
4. What are the advantages and disadvantages in mechanical synthesis of nanopowders?
5. What are the characteristics of nanoparticles that should be possesed by any fabrication technique?
6. On what principle mechanical milling is based on?
7. How is LPE used to obtain nanowire or nanorods?
8. How is the template used to obtain nanowire or nanorods?
9. What is the role of nanotechnology in water purification?
10. Differentiate self-assembly from self-organisation.
11. How nanoparticles are stored?
12. List the important physical and chemical properties of nanomaterials?
13. How are nanomaterials detected and analysed?
14. How are nanomaterials prepared for biological testing?
15. What are the physical and chemical properties of nanoparticles?
16. How are nanoparticles formed?
17. Discuss the health effects of nanoparticles?

Apply

1. Why do we want nanotechnology in our life?
2. What is the role of nanotechnology in medicinal field?
3. Expand AFM.
4. What is the grain size range of nanostructure materials?
5. Differentiate top-down from bottom-up approach needed for nanosynthesis.
6. Why do nanostructured particles find potential applications?
7. How nanostructured particles are used in health applications?

Analyze/ Evaluate

1. Compare the relative merits of chemical, physical, biological and hybrid methods for the preparation of nanomaterials.
2. Compare the relative merits of the usage of photons and particles in lithography.
3. Differentiate glow discharge from RF sputtering.
4. How can we reduce/save our energy resources by using nanotechnology?
5. What is the relation between properties and applications of nanoparticles?
6. What is the current status of nanoscience and nanotechnology?
7. What are the potential harmful effects of nanoparticles?

Unit I

Introduction

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- Nano particles- quantum dots, Nanowires-Ultra-Thin Films-Multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

9 Hours

Unit II

Preparation Methods

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

9 Hours

Unit III

Patterning and Lithography for Nanoscale Devices

Introduction to optical / UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

9 Hours

Unit IV

Preparation Environments

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

9 Hours

Unit V

Charecterisation Techniques

X-ray diffraction technique, Scanning Electron Microscopy – environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nano indentation

9 Hours

Total: 45 Hours

Textbook(s)

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000

References

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999
2. Akhlesh Lakhtakia (Editor), “The Hand Book of Nano Technology,Nanometer Structure”, Theory, Modeling and Simulations”, Prentice-Hall of India (P) Ltd, New Delhi, 2007.

14U014- ADVANCED PRODUCTION PROCESS FOR AUTOMOTIVE COMPONENTS

3 0 0 3.0

Objectives

- To develop the ability to understand the advanced manufacturing techniques evolved in manufacturing scenario

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles

e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to understand Advanced forming and powder metallurgy
- Able to understand the gear manufacturing process
- Able to write CNC programs
- Able to know the rest technologies in the production of automobile components

ASSESSMENT PATTERN

S.No	Bloom's Taxonomy (New Version)	Test I[G]	Test II[G]	Model Examination[G]	Semester End Examination
1	Remember	30	30	30	30
2	Understand	30	30	30	30
3	Apply	20	20	20	20
4	Analyze/Evaluate	20	20	20	20
5	Create	-	-	-	-
Total		**100**	**100**	**100**	**100**

Remember

1. Define alloy and steel.
2. How the materials are classified?
3. How can you classify iron and steel?
4. Define engineering ceramics and composites.
5. Define boring
6. What are the various types of DC motors used in a CNC machine tools?
7. List out different types of milling cutters
8. List the various matrix materials used.
9. What are the factors affecting mechanical properties.
10. Define extrusion ratio.
11. What is press brake?
12. What is metal spinning?
13. Define stretch forming.
14. Define blanking and piercing.
15. Define drilling
16. Define tapping
17. What types of operations can be performed in planer?
18. List out various milling operations

[*] The marks secured in Test I and II will be converted to 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

19. Define milling
20. List out the basic parts of plain milling machine.
21. What are the advantages of AC servo motors over DC servomotors for axes feed drivers?
22. What is a machining center? How it differs from conventional CNC milling?
23. List out the functions of a post-processor in a CNC system.
24. When a Dwell function is to be used in the part programming?
25. What is mean by Tool change cycle?
26. Define reaming

Understand

1. When the materials attain their required properties.
2. How cast iron differ from steel in carbon content?
3. What are the types of testing carried out to test the mechanical properties
4. How the deformation of materials taken place?
5. How hydraulic presses are comparing with mechanical press?
6. Why number of passes required rolling a steel bar?
7. How the metal is prepared for drawing operation?
8. How can the cutting force be reduced in sheet metal operation?
9. Name the machining process which uses single point cutting tool
10. Compare drilling and reaming operation.
11. What is the difference between planer and shaper?
12. How the milling differs from turning in lathe?
13. How gear hobbing differ from gear shaping process?
14. What is the difference between a fixed and swiveling head vertical milling machine?
15. Why surface finish is an important in manufacturing process?
16. Why surface finish is an important in manufacturing process?
17. State the advantages of CNC machines over conventional machines
18. What are the advantages of rapid prototyping?
19. Before starting programming what are the various items one must check in a CNC machine.
20. The four factors that govern the selection of tooling for CNC machines are?
21. Why linear tooling is preferred in some CNC Chuckers?
22. What are the importances's of feedback devices in a CNC Machine tool?
23. What's the importance for automating a company's storage operations?
24. Compare the advantages of automated system over manual work system and worker-machine system.
25. Why axis identification is necessary in CNC machine system? Explain the axis identification in milling with simple diagram.

Apply

1. What changes would you expect in the strength, hardness, and ductility of metal after being drawn through dies?
2. How can u tell whether a certain part is forged or cast?
3. Rolling reduces the thickness of plates and sheets. However it is possible to reduce the thickness by simply stretching the material .Would this be a feasible process?
4. On what attributes similar parts can be distinguished?
5. How a Hierarchical structure differs from Chain –type structure?
6. How a firm can automate the task of process planning using computers?
7. Importance and necessity for making the manufacturing system automated?
8. Justify the need to automate the manufacturing process.
9. How a machining center differs from conventional CNC milling machine?

Unit I

Powder Metallurgy

Process flow chart – Production of metal powders and their raw materials – Manufacture of friction lining materials for clutches and brakes – Testing and inspection of PM parts.

9 Hours

Unit II

Forming Process

Forging – process flow chart, forging of valves – connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles. Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydroforming: Process, hydroforming of manifold and comparison with conventional methods – Hydro forming of

tail lamp housing. Stretch forming – Process, stretch forming of auto body panels – Super plastic alloys for auto body panels.

9 Hours

Unit III

Gear Manufacturing

Different methods of Gear manufacture – Gear hobbing and gear shaping machines specifications – gear generation – different methods – gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

9 Hours

Unit IV

Concept & Programming of CNC Machines

NC, CNC & DNC – types of CNC – constructional features – drives and control systems – feedback devices – manual part programming – steps involved – sample program in Lathe & milling

9 Hours

Unit V

Recent Trends in Manufacturing of Auto Components

Powder injection moulding – Shotpeen hardening of gears – Production of aluminium MMC liners for engine blocks – Plasma spray coated engine blocks and valves – Recent developments in auto body panel forming – Squeeze casting of pistons – aluminium composite brake rotors.

9 Hours

Total : 45 Hours

Textbook(s)

1. Heldt, P.M., “High Speed Combustion Engines”, Oxford Publishing Co., New York,1990.

References

1. Haslehurst, S.E., “Manufacturing Technology”, ELBS, London, 1990.
2. Rusinoff, “Forging and Forming of metals”, D.B. Taraporevala Son & Co. Pvt.Ltd., Mumbai, 1995.
3. Subroff, A.M. & Others, “Forging Materials & Processes”, Reinhold Book Corporation, New York, 1988.
4. “High Velocity Forming of Metals”, ASTME, Prentice Hall of India (P) Ltd., New Delhi, 1990.
5. Groover.M.P., “Automatic production systems and computer integrated manufacturing”, Prentice-Hall, 1990.
6. GE Thyer, “Computer Numerical Control of Machine Tools”, BH.Newners, 1991.

14U015- HYDRAULIC AND PNEUMATIC SYSTEMS

3 0 0 3.0

Objectives

- To learn hydraulic fluid / Pneumatic air fundamentals including generation and distribution
- To understand working principles, operation of hydraulic and pneumatic components
- To expose to various techniques of circuit building in pneumatics
- To create exposure to diagnose / troubleshoot Hydraulic pneumatic, electro pneumatic circuits

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
b) Graduates will be able to identify, formulate and solve automobile engineering problems
d) Graduates will be able to design systems for automobiles

Course Outcomes (COs)

- Able to identify, understand, and draw fluid power symbols.
- Able to demonstrate the knowledge of basic fluid power theory and fluid conditioning.
- Able to describe the construction and operation of basic fluid power components.

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I*	Test II*	Model Examination*	Semester End Examination
1	Remember	20	20	20	20
2	Understand	30	30	30	30
3	Apply	30	30	30	30
4	Analyze/Evaluate	20	20	20	20
5	Create	--	--	--	--
Total		**100**	**100**	**100**	**100**

Remember

1. Define the term fluid power.
2. Name three basic methods of transmitting power?
3. Define the term mass density.
4. Define the term absolute viscosity and kinematic viscosity.
5. Define surface tension, capillarity.
6. What is oxidation stability?
7. What are fluid power symbols?
8. State Pascal's law.
9. State the continuity equation.
10. What are the various energy losses occur when liquid flows through a pipe?
11. What is the function of pump?
12. What is the function of hydraulic actuator?
13. What are the types of hydraulic cylinder?
14. What is the function of a Hydraulic motor?
15. Name the basic types of rotary actuators?
16. What is the function of direction control valve?
17. What is check valve? What are its functions?
18. What is pressure control valve?
19. What is flow control valve?
20. What is sequence valve?

*The marks secured Test I and Test II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

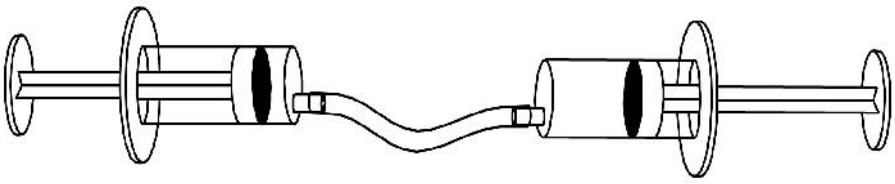
21. What is the function of an accumulator?
22. Define the term intensifier ratio.
23. What is the use of pressure switch?
24. List the various types of accumulator.
25. What are limit switches?
26. What do you meant by electrical relay?
27. What is the purpose of a timer?
28. Define pneumatics.
28. State Boyle's law, Charles law.
30. What is the function of air filter?
31. What do you mean by FRL unit?
32. What is the function of pneumatic actuator?
33. What do you meant by sequencing of cylinders?
34. What is hydro pneumatic circuit?
35. What is servo system?
36. What is the function of servo amplifier?
37. What is fluidics?
38. State the coanda effect.
39. What is PLC?
40. What are the fluid sensors?
41. What is meant by contact sensing?
42. What do you meant by SRT-Flipflop?

Understand

1. What is the fundamental difference between Hydraulics and pneumatics?
2. State the effect of temperature and pressure on viscosity of liquids?
3. What is the difference between the force and pressure?
4. Differentiate between the laminar and turbulent flow?
5. Where the hydrodynamic displacements pumps are employed? Why?
6. Which pump-external gear, internal gear, screw vane and piston –generates the least noise? Why?
7. Why are centrifugal pumps not preferred for fliud power application?
8. Why are double acting cylinders known as differential cylinders?
9. Which hydraulic motor is generally the most efficient? Why?
10. State the difference between the hydraulic motor and hydraulic pump?
11. When do you prefer poppet type hydraulic valves?
12. Distinguish between a pressure control valve and pressure relief valve?
13. Why is pressure measurement considered as a crucial process in the hydraulic system?
14. For what type of application, you would prefer to use pneumatic systems rather than hydraulic system?
15. Why are mufflers used in pneumatic system?
16. Why is extension stroke faster than the retraction stroke in a regenerative circuit?
17. What is the difference between an OR Gate and an EXCLUSIVE –OR Gate?
18. Where the fluidics control system preferred than other control system?
19. If a pump is delivering insufficient oil what are the possible causes and also give remedies for them?
20. What will you do to reduce /prevent excessive heating of oil in a hydraulic system?

Apply

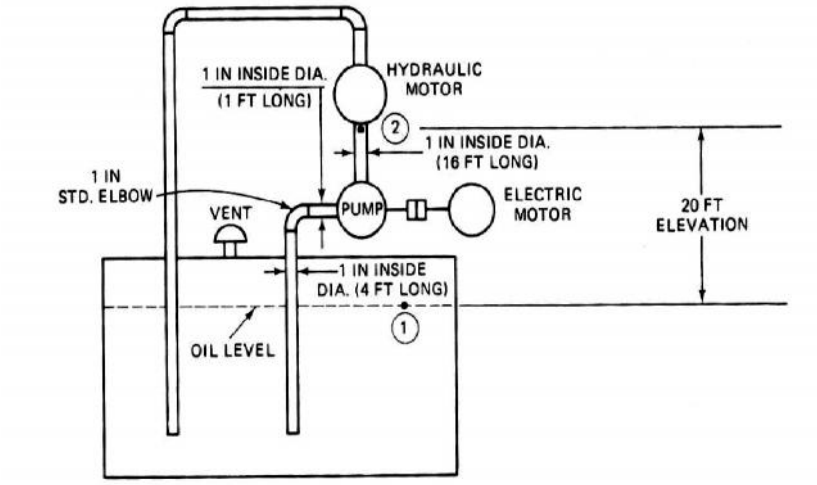
1. To investigate a hydraulic and pneumatic system
   Requirements: Two syringes of equal size.
   A plastic tube of about 10 cm that will fit tightly over the opening of both syringes



   Draw out the plunger (piston) of one syringe and push in the plunger of the other syringe.
   Connect the two syringes by means of the plastic tube.
   Push in the plunger of one syringe.
   Draw that plunger out again.

2. For the Hydraulic System shown, following data are given:
   - Pump is adding 5 hp (3730 W) to fluid
   - Pump flow is 0.001896 m^3/s
   - Pipe has 0.0254 m inside dia
   - Sp. Gravity of oil = 0.9
   - Kinematic viscosity of oil is 100 CS
   - Elevation difference between station 1 & 2 is 6.096 m
   - Pipe lengths: 1 ft = 0.305 m, 4 ft = 1.22 m, 16 ft = 4.88 m

   Find pressure available at inlet to hydraulic motor. The pressure at the oil top surface level in the hydraulic tank is atmospheric (01 MPa).



Unit I

Introduction

Introduction to fluid power, properties - hydraulic fluids, air. Selection of hydraulic fluids, comparison between hydraulics and pneumatics. Symbols of pneumatic elements and hydraulic elements.

9 Hours

Unit II

Pneumatic Systems

Basic requirement of Pneumatic system. Elements of Pneumatics, Constructional details of Air Compressors, Air motors, Control valves, Actuators and Mountings, filter, Lubricator, Regulator. General approach of system design, travel step diagram. Types - Sequence control, Cascade, Step counter method. K.V.Mapping for minimization of logic equation. Simple circuits.

9 Hours

Unit III

Hydraulic Systems

Pumps and motors- Types, characteristics. Cylinders, types, construction details. Valves for control of direction, flow and pressure, types, construction details. Power pack–elements, design. Pipes- material, pipe fittings. seals and packing. Maintenance of hydraulic systems. Selection criteria for cylinders, valves, pipes.

9 Hours

Unit IV

Advanced Topics in Hydraulics and Pneumatics

Electro pneumatics, ladder diagram. Servo and Proportional valves - types, operation, application. Hydro-Mechanical servo systems. PLC-construction, types, operation, programming.

9 Hours

Unit V

Automotive Applications

Hydraulic tipping mechanism, power steering, fort lift hydraulic gear, hydro-pneumatic suspension, air brake and maintenance and trouble shooting of pneumatic circuits.

9 Hours

Total: 45 Hours

Textbook(s)

1. Anthony Esposito," Fluid Power with Applications", PHI / Pearson Education, 2005.

References

1. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
2. Majumdar, S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata Mc-Graw Hill, 2001
3. Majumdar, S.R., "Pneumatic Systems – Principles and Maintenance", Tata Mc-Graw Hill, 2007.
4. Micheal J, Pinches and Ashby, J.G., "Power Hydraulics", Prentice Hall, 1989.
5. Dudelyt, A Pease and John J Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

14U016- SPECIAL TYPES OF VEHICLES

3 0 0 3.0

Objectives

- To introduce the concept and principle of operation of special vehicles such as Bulldozers, Ditchers, Bucket excavators, farm equipments, military vehicles etc.
- To study the tipping mechanism of a dumper
- To study the operation of a truck crane
- To understand the vehicle operation and control of farm vehicles

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
d) Graduates will be able to design systems for automobiles
g) Graduates will demonstrate skills to use modern engineering and information technology tolls necessary for engineering practice

Course Outcomes (COs)

- Able to know about the combat vehicles
- Able to understand the application of the special types of vehicles in the excavation of earth
- Able to describe the construction of farm equipments and the working of power trains in heavy vehicles

ASSESSMENT PATTERN

S. No.	Bloom's Taxonomy (New Version)	Test I†	Test II†	Model Examination†	Semester End Examination
1	Remember	40	40	40	40
2	Understand	30	30	30	30
3	Apply	30	30	30	30
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
	Total	**100**	**100**	**100**	**100**

Remember

1. Draw the layout of tractor dozer and list out its applications
2. List various attachments of crawler loader and state their use
3. What is lambda sensor?
4. State: remote keyless entry system
5. List the various types of rippers
6. Enlist various applications of dragline
7. Define and classify earth moving machine.
8. List the selection parameters for ripper tip
9. List the various types of fork lift truck and its safety parameters.
10. Describe the construction of track shoe.

Understand

1. List any four applications of earth moving machines
2. Draw the labeled sketch of crane and explain its working principle
3. Describe the working of crawler loader with neat labelled sketch.
4. Compare tyred and crawler tractor on basis of construction.

† The marks secured in Test I and II will be converted 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated by giving equal weightage (50%) for both Civil and Mechanical Engineering

5. Draw labelled sketch of fork lift truck.
6. Describe the working of wheel loader.
7. Draw neat sketch of road roller and list out its type.
8. Draw the labelled sketch of loading and hauling unit.
9. Describe the operation of hydraulic excavators.
10. State the various attachment and applications of power tiller.
11. Explain "Role of Earth Moving Machine in road laying and disaster management."
12. Describe the working and construction of tractor power take off
13. List the different types of scrapper and describe construction of any one.
14. Give the safety operation for safe working of tipper.
15. List the various safety precautions taken for dozer operation.

Apply

1. Compare between general automobile and earth moving machine on basis of following parameters.
    a. travelling speed
    b. controls
    c. fuel and fuel consumption
    d. driving license
    e. power take off
    f. hydraulics
2. Identify different dozer blades and describe construction and use of any two.
3. Identify the role of Indian Tractor Industry in growth of agricultural sector.
4. Compare tractor with an automobile on basis of
    a. Speed
    b. Fuel efficiency
    c. Handling
    d. Application

Unit I

Earth Moving and Constructional Equipments

Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, excavators, backhoe loaders, scrappers, motor graders etc. criteria for selection of prime mover front dumpers and front end loaders based on vehicle performance characteristics.

9 Hours

Unit II

Power Train Concepts

Engine – converter match curves. Hauling & cyclic type transmissions. Selection criteria for universal joints. Constructional details of steerable and drive axles of dumper.

9 Hours

Unit III

Vehicle Systems, Features

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects on dumper body, loader bucket and water tank of sprinkler.

9 Hours

Unit IV

Special Purpose Vehicles for Industrial Applications

Constructional features, capacity and stability of jib cranes. Vibratory compactors.

9 Hours

Unit V

Farm Equipments, Military and Combat Vehicles

Ride and stability characteristics, power take off, special implementations. Special features and constructional details of tankers, gun carriers and transport vehicles.

9 Hours

Total: 45 Hours

Textbook(s)

1. Abrosimov. K. Bran berg.A. and Katayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2. SAE Handbook Volume III
3. Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York, 1987.

References

1. B. Geleman and M. Moskovin, “Farm tractors”, MIR publishers, Moscow.
2. “Off the road wheeled and combined traction devices” - Ashgate Publishing Co. Ltd. 1998.
3. Bart H Vanderveen, “Tanks and Transport vehicles”, Frederic Warne and Co ltd., London.
4. Astokhov, “Truck Cranes”, MIR Publishers, Moscow.

14U017- TRACTOR AND FARM EQUIPMENTS

3 0 0 3.0

Objectives

- To provide knowledge about Tractors and Farm equipments

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
b) Graduates will be able to identify, formulate and solve automobile engineering problems
e) Graduates will have ability to function effectively as an industrial, as a part of team and in a multi disciplinary environment

Course Outcomes (COs)

- Able to know
  1. The general design of tractors.
  2. Control of the tractors and fundamentals of Engine operation.
  3. Engine Frame work and Valve mechanism of Tractor.
  4. Cooling system, lubrication system and Fuel system of tractors.
  5. Farm equipments

ASSESSMENT PATTERN

S.No	Bloom's Taxonomy (New Version)	Test I[G]	Test II[G]	Model Examination[G]	Semester End Examination
1	Remember	30	30	30	30
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
Total		**100**	**100**	**100**	**100**

Remember

1. What is a tractor?
2. What are the main components of a tractor?
3. What are the safety rules of a tractor?
4. Name the controls available in a tractor
5. Name the engine types used in tractors
6. List some of the tractor manufacturers in India
7. What is the purpose of cooling system in a tractor?
8. What is the purpose of lubrication system in a tractor?
9. List the main components of the lubrication system in a tractor
10. Enumerate the uses of a tractor
11. List the farm equipments that are attached in a tractor
12. What is the purpose of engine balancing?
13. What are the auxiliary equipments used in a tractor?
14. What is the purpose of trailors?

Understand

1. What is the purpose of safety rules for a tractor?

[*] The marks secured in Test I and II will be converted to 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

2. Classify tractors
3. Explain the operation of tractor engine
4. Define the basic engine performance characteristics
5. Draw the working cycle diagram for the tractor engine
6. How connecting rods are manufactured?
7. How a tractor engine is balanced?
8. What are the troubles arise in a valve mechanism of a tractor engine?
9. How the valve mechanism is operated?
10. Classify the engine cooling systems.
11. Explain the working of liquid cooling system
12. List the purpose of air cleaner and turbocharger
13. What is the purpose of lubrication?
14. Explain the working of trailers and tipping mechanism
15. Classify tractor farm equipements

Apply

1. Explain ROPS (Rollover Protective Structure)
2. Explain in detail about the stability of a tracor
3. Explain the daily maintenance and safety checks of a tractor
4. You've been hired to drive a tractor to rake hay and you have never operated the tractor you will have to drive. What is the best way for you to familiarize yourself with the machine?
5. You are driving a tractor on a paved highway at 17 miles per hour. When you turn around to look at the implement you are pulling, you inadvertently steer the tractor to the right. The tractor goes off the edge of the pavement and starts down a steep ditch. What should you do?
6. If you are operating a tractor and it hits a power pole guy wire and the power line falls on the tractor, what you should do?
7. If you are plowing and a light or gauge on the tractor's instrument panel indicates low oil pressure, what you should do?

Unit I

General Design of Tractors

Classification of Tractors – Main components of tractor – Safety rules.

9 Hours

Unit II

Control of the Tractor and Fundamentals of Engine Operation

Tractor controls and the starting of the tractor engines – Basic notions and definition – Engine cycles – Operation of multicylinder engines – General engine design – Basic engine performance characteristics.

9 Hours

Unit III

Engine Frame Work and Valve Mechanism of Tractor

Cylinder and pistons – Connecting rods and crankshafts – Engine balancing – Construction and operation of the valve mechanism – Valve mechanism troubles.

9 Hours

Unit IV

Cooling System, Lubrication System and Fuel System of a Tractor

Cooling system – Classification – Liquid cooling system – Components, Lubricating system servicing and troubles – Air cleaner and turbo charger – Fuel tanks and filters – Fuel pumps.

9 Hours

Unit V

Farm Equipments

Working attachment of tractors – Farm equipment – Classification – Auxiliary equipment – Trailers and body tipping mechanism.

9 Hours

Total : 45 Hours

Textbook(s)

1. Rodichev and G.Rodicheva, “Tractor and Automobiles”, MIR Publishers, 1987.

References

1. Kolchin,A., and V.Demidov, “Design of Automotive Engines for Tractor” MIR Publishers, 1972.

14U018- FLEET MANAGEMENT

3 0 0 3.0

Objectives

- To know about different aspects related to transport system and management
- To know about features of scheduling, fixing the fares
- To know about the motor vehicle act and maintenance aspects of transport.

Program Outcomes (POs)

a) Graduates will apply knowledge of mathematics, science and engineering fundamentals for the solution of problems related to automobiles
g) Graduates will demonstrate skills to use modern engineering and information technology tolls necessary for engineering practice
h) Graduates will have knowledge of professional and ethical responsibilities

Course Outcomes (COs)

- Able to manage a transport fleet and their related activities for minimizing operational cost

ASSESSMENT PATTERN

S.No	Bloom's Taxonomy (New Version)	Test I[G]	Test II[G]	Model Examination[G]	Semester End Examination
1	Remember	30	30	30	30
2	Understand	40	40	40	40
3	Apply	30	30	30	30
4	Analyze/Evaluate	-	-	-	-
5	Create	-	-	-	-
Total		**100**	**100**	**100**	**100**

Remember

1. Define fleet scheduling
2. List out the objectives of training.
3. Define the term preventive maintenance.
4. What is LMV?
5. Name some traffic control devices.
6. What are the different types of costs in a transport company?
7. Mention the various types of taxes applicable to goods vehicles.
8. Define the term traffic navigation.
9. Name the government organizations that deal with goods transport.
10. What is break down analysis?

Understand

1. Write the Limitations of Third party insurance?
2. Enumerate the duties of conductors in fleet operation.
3. Write the basic requirements of a Depot.
4. Explain how cost Vs benefits are calculated in transport operation
5. State four functions of an Automobile Engineer in running Transport Organization.
6. Describe the procedure for obtaining permanent driving license.
7. Explain various methods of ticketing systems adopted in public transport with merits and demerits.
8. Describe the role of computers in fleet management.

[*] The marks secured in Test I and II will be converted to 20 and Model Examination will be converted to 20. The remaining 10 marks will be calculated based on assignments. Accordingly internal assessment will be calculated for 50 marks.

9. Draw an organization structure at Depot Level of Bus Transportation and explain the functions of Depot Manager.

Apply

1. Prepare a maintenances schedule for a depot with 100 LMV assuming a suitable data
2. How does training help in determining and evaluating future organizational capabilities, needs and anticipated problems? How to use the training management policies and procedure?
3. Prepare a report on causes for accidents and the preventive measures required to control it.
4. With the help of flow chart give the structure of motor transport management.

Unit I

Management Training and Operations

Basic principles of supervising. Organising time and people. Job instruction training – Training devices and techniques – Driver and mechanic hiring – Driver checklist – Lists for driver and mechanic – Trip leasing – Vehicle Operation and types of operation.

9 Hours

Unit II

Vehicle Maintenance

Scheduled and unscheduled maintenance – Planning and Scope – Evaluation of PMI programme – Work scheduling – Overtime – Breakdown Analysis – Control of repair backlogs – Cost of options.

9 Hours

Unit III

Vehicle Parts, Supply Management And Budget

Cost of inventory – Balancing inventory cost against downtime – Parts control – Bin tag systems – Time management – Time record keeping – Budget activity – Capital expenditures – Classification of vehicle expenses – Fleet management and data processing – Data processing systems – Software. Models – Computer controlling of fleet activity – Energy management.

9 Hours

Unit IV

Scheduling and Fare Structure

Route planning – Scheduling of transport vehicles – Preparation of timetable, Costs, fare structure – Methods of fare collection – Preparation of fare table.

9 Hours

Unit V

Motor Vehicle Act

Schedules and Sections – Registration of motor vehicles – Licensing of drivers – Control of permits – Limits of speed – Traffic signs – Constructional regulations – Description of goods carrier, Delivery man, Tanker, Tipper, Municipal, Fire fighting and Break down service vehicle.

9 Hours

Total: 45 Hours

Textbook(s)

1. John Dolu, “Fleet management”, Mc Graw Hill Co., 1984.

References

1. Government Publication, “The Motor vehicle Act”, 1989.
2. Kitchin,L.D., “Bus operation”, Illiffe and Sons Ltd., London, III Edition, 1992.
3. Kadiyali,L.R., “Traffic engineering and Transport Planning”.