SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
SreeSainath Nagar, A. Rangampet, Tirupati – 517 102

DEPARTMENT OF MECHANICAL ENGINEERING

Supporting Document for 1.1.2

Syllabus Revision carried out in 2020

Program: B.Tech.-Mechanical Engineering

Regulations: SVEC-20

This document details the following:

1. Courses where syllabus has been changed 20% and more.
2. Course-wise revised syllabus with changes highlighted.

Note:*For SVEC-20 revised syllabus, SVEC-19 (previous syllabus) is the reference.*

List of Courses where syllabus Content has been changed (20% and more)

S. No.	Course Code	Name of the course	Percentage of Content changed	Page Number in which Details are Highlighted
1.	20BT40333	MATLAB for Mechanical Engineers Lab	100	3
2.	20BT70333	Heating, Ventilation and Air Conditioning Lab	100	10
3.	20BT70332	Manufacturing systems and Operations Management Lab	100	12
4.	20BT703AC	3D Printing and Design	100	14
		Average %**(A)**	100	-
		Total No. of Courses in the Program **(T)**	134	
		No. of Courses where syllabus (more than 20% content) has been changed **(N)**	04	
		Percentage of syllabus content change in the courses **(C)=(A x N)/100**	04	
		Percentage of Syllabus Content changed in the Program **(P)= C/T*100**	**2.98**	

DEAN (Academics)

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Sree Sainath Nagar, A. RANGAMPET
CHITTOOR (DT.)-517 102, A.P.

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Chittoor (Dist.) - 517 102, A.P., INDIA.

II B. Tech. – II Semester

(20BT40333) MATLAB FOR MECHANICAL ENGINEERS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	1	2	2

PRE-REQUISITES:

Courses on any programming language, Basic Engineering Mechanics, Mechanical Vibrations.

COURSE DESCRIPTION:

Basics of MATLAB; Functions for plotting; Programming in MATLAB; Application of MATLAB code in Engineering Mechanics and Mechanical Vibrations.

COURSE OBJECTIVE:

CEO1: To impart the knowledge on MATLAB.

CEO2: To develop programming skills in MATLAB for solving Mechanical Engineering applications.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1: Demonstrate the knowledge on **syntax**, **built-in functions**, **mathematical operations** of MATLAB.
CO2: Analyze the syntax for preparing MATLAB **script file** and **function file**.
CO3: Analyze the given **data** through **visualization**.
CO4: Develop **MATLAB code forsolvingMechanical Engineering** problems.

DETAILED SYLLABUS:

UNIT- I: BASICS OF MATLAB

Arithmetic operations with scalars, display formats, math built-in functions, Arrays, Mathematical operations with arrays**.**

1. Calculate
   a) $\frac{35.7\ X\ 64-7^3}{45+5^2}$
   b) $\frac{5}{4}.7.6^2\frac{3^7}{(9^3-652)}$
   c) $(2+7)^3+\frac{273^{2/3}}{2}+\frac{55^2}{3}$
   d) $2^3+7^3+\frac{273^3}{2}+55^{3/2}$
2. Calculate
   a) $\frac{3^7\log(76)}{7^3+546}+\sqrt[3]{910}$

b) $43 . \frac{(\sqrt[4]{250}+23)^2}{e^{(45-3^3)}}$

3. Calculate

a) $cos^2\left(\frac{5\pi}{6}\right)\sin(\frac{7\pi}{8})^2 + \frac{\tan(\frac{\pi}{6}\ln 8)}{\sqrt{7}}$

b) $\cos(\frac{5\pi}{6})^2 Sin^2\left(\frac{7\pi}{8}\right) + \frac{\tan(\frac{\pi}{6}\ln 8)}{7.\frac{5}{2}}$

4. Define the variable x as x = 13.5. then evaluate

a) $x^3 + 5x^2 - 26.7\,x - 52$

b) $\frac{\sqrt{14\,x^3}}{e^{3x}}$

c) $\log|x^2 - x^3|$

5. Define the variable a, b, c and d as a = 16.9, b = -8.02, c = 68.74 and d = 0.8(ab-c)

Evaluate

a) $a + \frac{ab}{c}\frac{(a+d)^2}{\sqrt{|ab|}}$

6. Consider two matrices

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 2 & 3 & 4 \\ -1 & 6 & 7 \end{bmatrix} B = \begin{bmatrix} 7 & 4 & 2 \\ 3 & 5 & 6 \\ -1 & 2 & 1 \end{bmatrix}$$

Using MATLAB determine the following:

a) A + B
b) AB
c) A2
d) AT
e) B-1
f) BTAT
g) A2+B2-AB
h) Determinant of A, determinant of B and determinant of AB.

7. Consider two matrices

$$C = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 4 \\ -1 & 6 & 7 \end{bmatrix} D = \begin{bmatrix} 13 & -15 & 8 \\ 1 & 25 & 9 \\ 8 & 70 & 6 \end{bmatrix}$$

Using MATLAB determine the following:

a) C + D
b) CD
c) C2
d) CT
e) D-1
f) DTCT
g) C2+D2-CD
h) Determinant of C, determinant of D and determinant of CD.

8. Consider two matrices.

$$E = \begin{bmatrix} 4 \\ -5 \\ 9 \end{bmatrix} \; ; \; F = \begin{bmatrix} 7 \\ 2 \\ -3 \end{bmatrix}$$

a) Determine E.F?

UNIT-II: PROGRAMMING IN MATLAB

Conditional statements, the switch-case statement, Loops, Nested loops, Nested conditional statements, break and continue commands, User defined Functions and Function files.

1. Write script file and a function file to print the square root of the even integers up to n, by using for loop. (*for both script and function file the output should be like)*

2 1.4142
4 2.0000
6 2.4495

2. Write a script file to test the integer is even or odd. (use*if-else*)
3. Write a program which calculates the tip in the restaurant according to the amount of the bill, if the bill is less than 10$ the tip is $1.80. If the bill is between $10 and $60 the tip is 18% of the bill, if the bill is above $60 the tip is 20% of the bill.
4. Write a function M-file that computes the following function, where *x* should be scalar.

$$f(x) = \begin{cases} \sin(x)/x & x \neq 0 \\ 1 & x = 0 \end{cases}$$

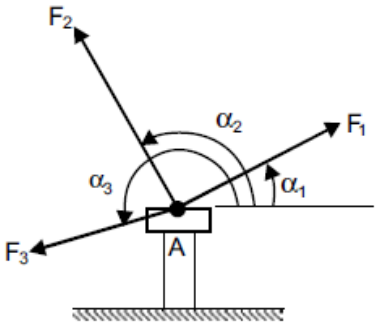
5. Write a script and function file by using *while* loop to display all powers of two from 2 to 10.
6. Write a for loop to compute the sum of the squares of all integers from 2 to 20:

$$2^2 + 3^2 + 4^2 + - - - - - - + 20^2$$

7. Write a script and function file for converting rectangular coordinates to polar coordinates, with a function name as *polarcoordinates* and the formulae are:

$r = \sqrt{x^2 + y^2}$ *and theta* $(\theta) = tan^{-1}\left(\frac{y}{x}\right)$

8. Write a script and function file that gives the factorial of a positive number. Use command name as *fact (use for loop)*
9. By using *for* loop in a function, write a program for *Fibonacci series* of generating *n* numbers? Use the command name as *fib.*
10. Write a MATLAB program to determine the magnitude and direction of the resultant of 3 coplanar forces applied at point A in figure. Use the following values. F1 = 20kN, F2 = 40kN, F3=200 kN, $\propto_1$=400, $\propto_2$ =250 and $\propto_3$=580.

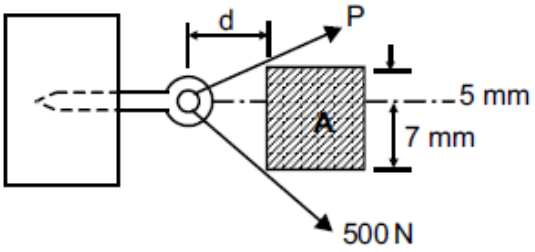


11. Figure shows two forces, one 500 N and the other P applied by cables on each side of the obstruction A in order to remove the spike. Write a MATLAB program to determine:

(i) the magnitude of P necessary to such that the resultant T is directed along the spike

(ii) the magnitude of T

(iii) plot P and T as a function of d. (Range of d between 1 and 20 mm).



UNIT- III: PLOTING

Plot of given data, plot of a function, multiple graphs in same plot, multiple plots in same page.

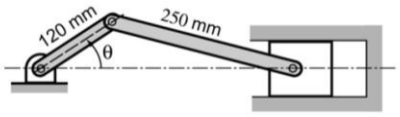
1. Let us draw the graph of two polynomials; Write the code in script file? Range [-10,10]
   a) $f(x) = 3x^4 + 2x^3 + 7x^2 + 2x + 9$ and
   b) $g(x) = 5x^3 + 2x + 2$
2. Write the script for plotting the cardioid curve with the following parametric equations with at range of $0 : \frac{\pi}{100} : 2\pi$; Take a =3 (can check for any value)

$$x = a(2\cos t - \cos 2t)\ ;\ y = a(2\sin t - \sin 2t)$$

3. Plot the function $y = 3x^3 - 26x + 10$, and its first and second derivatives, for $-2 \leq x \leq 4$, all in the same plot.

4. The piston-rod-crank mechanism is used in many engineering applications. In the mechanism shown in the following figure, the crank is rotating at a constant speed of 500 rpm. Calculate and plot the position, velocity, and acceleration of

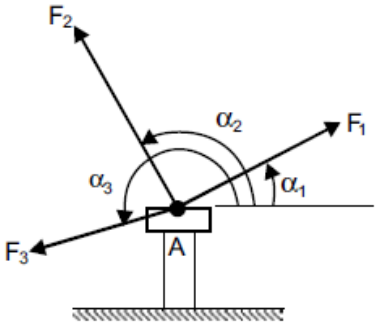
the piston for one revolution of the crank. Write MATLAB commands to make the three plots on the same page. Set angle = 0^0 when t=0.



UNIT-IV: MATLAB APPLICATION IN ENGINEERING MECHANICS

Preparing MATLAB codes for Resultant and equilibrium force of coplanar force system.

1. Write a MATLAB program to determine the magnitude and direction of the resultant of 3 coplanar forces applied at point A in figure. Use the following values. F1 = 20kN, F2 = 40kN, F3=200 kN, $\propto_1=40^0$, $\propto_2=25^0$ and $\propto_3=58^0$.

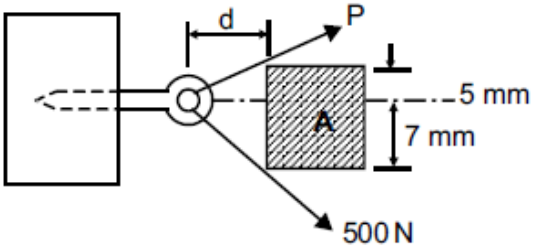


2. Figure shows two forces, one 500 N and the other P applied by cables on each side of the obstruction A in order to remove the spike. Write a MATLAB program to determine:

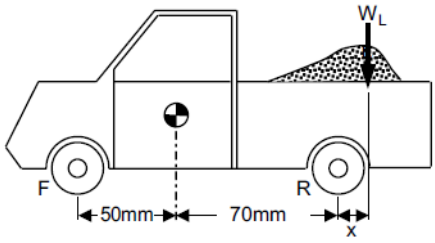
(i) the magnitude of P necessary to such that the resultant T is directed along the spike

(ii) the magnitude of T

(iii) plot P and T as a function of d. (Range of d between 1 and 20 mm).



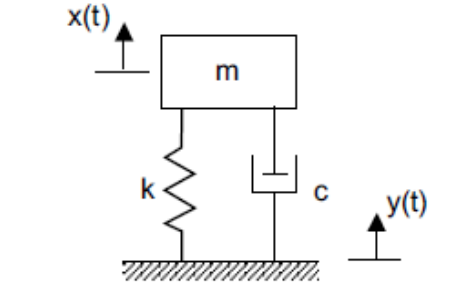
3. Figure shows the location of the center of gravity of a 5000 N truck for the unloaded condition. The location of the added load W_L is at a distance of x inches behind the rear axle. Write a MATLAB program and plot W_L as a function of x for x ranging from 0 to 60 mm.



UNIT-V: MATLAB APPLICATION IN MECHANICAL VIBRATIONS

Preparing MATLAB codes for Free vibration of Single Degree of Freedom Systems, free vibration of damped system.

1. Write a MATLAB script for plotting
   (i) the one-dimensional response magnitude for a system with harmonically moving base shown in Fig.
   (ii) the response phase angle for system with harmonically moving base.



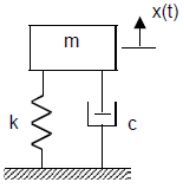
2. An analytical expression for the response of a damped single degree of freedom system to given initial displacement and velocity is given by

$$x(t) = Ce^{-\xi\omega_n t}\cos(\omega_t - \emptyset)$$

where C and Ø represent the amplitude and phase angle of the response, respectively having the values

$$C = \sqrt{x_0^2 + \left(\frac{\zeta\omega_n x_0 + v_0}{\omega_d}\right)^2}, \phi = \tan^{-1}\left(\frac{\zeta\omega_n x_0 + v_0}{\omega_d x_0}\right)$$

and $\omega_d = \sqrt{1-\zeta^2}\omega_n$



Plot the response of the system using MATLAB for ω_n =5 rad/sec ξ=0.05, 0.1, 0.2 subjected to the initial conditions x(0) = 0, v_0= 60 cm/s.

TEXT BOOKS:

1. Rao V. Dukkipati, *MATLAB: An Introduction with Application*, New Age International Publishers, Second edition, 2010
2. Amos Gilat, *MATLAB: An Introduction with Applications*, John Wiley & Sons, Fourth Edition.

REFERENCE BOOKS:

1. Rudra Pratap. Getting Started With MATLAB, Oxford University Press. Seventh edition, 2019

IV B. Tech – I Semester

(20BT70333) HEATING, VENTILATION AND AIR CONDITIONING LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	1	-	2	2

PRE-REQUISITES:

A course on Thermal Engineering -II

COURSE DESCRIPTION:

Performing fundamental operations required for refrigeration and Air conditioning, getting knowledge of principles of refrigeration and Air Conditioning, Determining the coefficient of performance of refrigerator, vapor absorption system, Ice plant, cooling tower and Air Conditioning System

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1. Analyze the refrigeration systems for performance characteristics.

CO2. Design and simulate HVAC systems and assess their performance.

CO3. Work independently or in teams to solve problems with effective communication

DETAILED SYLLABUS:

LIST OF EXPERIMENTS:

1. Perform fundamental operations like Cutting, bending and joining of copper tubing by brazing.
2. Perform Fundamental operations Flaring, Swaging and silver soldering.
3. Study the mechanical components of refrigerator and their types (Compressor/ Expansion devices/heat exchangers/evaporators).

4. Study different control devices of a refrigeration system.
5. Performance test onvapor compression refrigeration system by using different expansion devices.
6. Performance test on Water cooler.
7. Performance test on vapor absorption test rig
8. Study various components of room/central air conditioning system.
9. Study electrical circuits, leak testing, gas charging, Trouble shooting of refrigeration & air-conditioning system
10. Study the Complete Guide to ASHRAE Standards for Commercial HVAC Manufacturers
11. Find the performance parameters of Ice Plant.
12. Performance test on Air conditioning system.
13. Find the performance parameter of cooling tower.
14. Perform the experiment & calculate various Performance parameters on a blower apparatus (Air handling unit)
15. Design of Air conditioning Systems and ducts for a given space
16. Simulate air conditioning systems for the given application.

Software's used:

NOTE: Student shall perform minimum of twelve experiments

IV B. Tech. – I Semester
(20BT70332) MANUFACTURING SYSTEMS AND OPERATIONS MANAGEMENT LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	-	-	3	1.5

PRE-REQUISITES: Numerical Methods, Probability and Statistics, Operations Research and Industrial Engineering and Management.

COURSE DESCRIPTION:
Exercises on Regression and Hypothesis Testing; ANOVA; DOE; Simplex method; Transportation and assignment problems; Inventory models; Network models; Statical analysis.

COURSE OBJECTIVES:

CEO1: To impart the knowledge on simulation of manufacturing systems.
CEO2: To develop skills in simulation of manufacturing systems.

COURSE OUTCOMES:
On successful completion of this course, the students will be able to:
CO1: Apply simulation tools for operations management.
CO2: Apply software tools in solving operation research problem.
CO3: Develop codes and use software tools in solving statical problems.
CO4: Work independently or in teams to solve problems with effective communication

SYLLABUS:
LIST OF EXPERIMENTS

ANY **TWELVE** EXPERIMENTS ARE TO BE CONDUCTED.

Operation Management Exercises:

1. Exercises on job scheduling using simulation software.
2. Design and simulation of a simple manufacturing system
3. Build simulation models for manufacturing operations with layout and transport system
4. Line balancing using manufacturing systems simulation software
5. Simulation of Service Operations
6. Develop a JIT model using Kanban tool.

Operations Research:

7. Solve linear programming problem using simplex method.
8. Solve Transportation and assignment problems
9. Solve Inventory Models
10. Solve Network Models

Statistical Exercises:

11. Correlation: How to calculate the correlation between two variables. How to make scatter plots. Use the scatter plot to investigate the relationship between two variables with R programming
12. Estimating a Linear Relationship: A Statistical Model for a Linear Relationship, Least Squares Estimates, The R Function lm and Scrutinizing the Residuals with R programming.
13. Solve a problem on regression and hypothesis testing.
14. Solve a problem on ANOVA.
15. Test the Goodness of fit for the given quality characteristic
16. Analysis of DoE results using statistical software

Software's used: Promodel, Matlab, Arena, Quest, Witness, Extend, Simio, Opensource ware, ARENA, Minitab; SPSS, SYSTAT, Kanban, Excel, FlexSim and Simcad

IV B. Tech. – I Semester

(20BT703AC) 3D Printing and Design

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	2	-	-	-

PRE-REQUISITES:

Courses on Manufacturing Technology and CAD/CAM.

COURSE DESCRIPTION:

Classifications, Advantages, Additive v/s Conventional Manufacturing processes, Applications, Material science aspects in additive manufacturing, CAD Data formats, Data translation, Data loss, STL format, Additive Manufacturing Application Domains, Stereo lithography, LOM, DMLS, Principle of operation, Machine details; Applications; Thermal jet printer; Indirect Rapid tooling, Direct Tooling; Quick cast process; Rapid Tool; Software For RP; STL files; Rapid manufacturing process optimization; Vacuum Casting, Surface digitizing; data transfer to solid models, Reverse Engineering.

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

CO1. CO1**.** Demonstrate the knowledge on 3D printing for developing complex components.

CO2. CO2. Develop CAD models for 3D printing and generate .stl files for simple to complex components.

CO3. CO3. Demonstrate the knowledge on additive manufacturing techniques, and processes for various applications.

CO4. CO4. Apply material selection techniques for specific processes considering post processing and quality challenges.

CO5. CO5. Analyze the functional characteristics of 3D printing and reverse engineering techniques for engineering applications.

DETAILED SYLLABUS:

UNIT I:3D PRINTING (6 periods)

Introduction, Process, Classifications, Advantages, Additive v/s Conventional Manufacturing processes, Applications, Material science aspects in additive manufacturing.

UNIT II: CAD FOR ADDITIVE MANUFACTURING (6 periods)

CAD Data formats, Data translation, Data loss, STL format.

Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools

UNIT III: ADDITIVE MANUFACTURING TECHNIQUES (6 periods)

Introduction, Types- Stereo- Lithography, LOM, FDM, SLS, SLM and Binder Jet technology- Design and Process parameters, Process Selection for various applications.

UNIT IV: MATERIALS, POST PROCESSING AND PRODUCT QUALITY

(6 periods)

Materials: Polymers, Metals, Non-Metals, Ceramics Process, Process parameter, Process Selection for various applications, Support Materials

Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties.

Post Processing: Support Removal, Sanding, Acetone treatment, polishing

Product Quality: Inspection and testing, Defects and their causes

UNIT-V: REVERSE ENGINEERING WITH 3D PRINTING TECHNOLOGY (6 periods)

3D printing software: STL files, Overview of Solid view, Magics, Magic communicator, Internet based software.

Allied processes: Vacuum casting, Surface digitizing, Surface generation from point cloud, Surface modification, Data transfer to solid models.

Reverse Engineering: Capturing and reading the scan data, Align point clouds and simplify data, Polygon meshing and editing, Defining surface boundaries, applying nurbs, Exporting data, Reverse engineering update.

Total Periods: *30*

TEXT BOOKS:

1. Paul F. Jacobs, *Stereo lithography and other RP and M Technologies*, SME, New York, 3rd edition, 1996.
2. Frank W. Liou, *Rapid Prototyping and Engineering Applications*, CRC Press Taylor and Francis Group, New York, Special Indian Edition, 2011.

REFERENCE BOOKS:

1. C. K. Chua, K. F. Leong, C. S. Lim, *Rapid Prototyping - Principles and Applications*, Yesdee publications Pvt. Ltd., Mumbai, India, 2nd edition, 2010.
2. Hari Prasad, K.S. Badarinarayan, *Rapid Prototyping and Tooling*, SIP PageTuners, Bangalore, 1st Edition, 2013.
3. Fiham D.T, Dinjoy S. S, *Rapid Manufacturing*, Verlog, London, 4th edition, 2002.