

University of Mumbai

Examination 2020 under cluster 8 (Lead College: PHCET, Rasayani)

**Examinations Commencing from 23rd December 2020 to 6th January 2021
and from 7th January 2021 to 20th January 2021**

Program: Automobile Engineering

Curriculum Scheme: R2016

Examination: TE Semester: VI

Course Code: AEC604 and Course Name: Mechanical Vibrations

Time: 2 hours

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	A mass of 1 kg rests on a sponge having only damping properties and has a damping coefficient of 100 Ns/m. Estimate the undamped natural frequency in rad/s.
Option A:	0
Option B:	10
Option C:	50
Option D:	100
2.	A steel cantilever beam has _____ number of degrees of freedom.
Option A:	0
Option B:	infinite
Option C:	5
Option D:	10
3.	A system has a mass 5 kg, and a spring of stiffness 1 kN/m. The undamped time period is _____ seconds.
Option A:	0.444
Option B:	14.14
Option C:	1.414
Option D:	4.44
4.	Which is an example of Deterministic Vibrations?
Option A:	Earthquakes
Option B:	Winds
Option C:	Frequency-squared excitations
Option D:	Random vibrations
5.	The ratio of successive amplitudes of a viscously damped single degree of freedom system is found to be 18: 1. The ratio of the successive amplitudes if the amount of damping is doubled will be approximately _____.
Option A:	14265
Option B:	15000
Option C:	12500
Option D:	10685
6.	The theoretical mean position for the case of Coulomb damping is _____
Option A:	is always zero

Option B:	is always 1
Option C:	never exists
Option D:	varies alternatively between F/k and $-F/k$ for each half cycle
7.	In a vibrating system, if the actual damping coefficient is 40 N-s/m and critical damping coefficient is 420 N-s/m, the logarithmic decrement is equal to
Option A:	0.2
Option B:	0.4
Option C:	0.6
Option D:	0.8
8.	_____ is the most suited for the determination of natural frequencies of structures.
Option A:	Holzer's method
Option B:	Dunkerleys method
Option C:	Rayleigh method
Option D:	Matrix Iteration method
9.	Rayleigh's method can be used for estimation of natural frequency for_____
Option A:	Random vibration
Option B:	Transverse vibration
Option C:	Torsional vibration
Option D:	Nonlinear vibration
10.	A shaft carrying three rotors will have _____ nodes.
Option A:	3
Option B:	2
Option C:	1
Option D:	0
11.	In vibration isolation system, if (ω/ω_n) greater than one, then the phase difference between the transmitted force and disturbing force is
Option A:	270 degree
Option B:	90 degree
Option C:	180 degree
Option D:	0 degree
12.	the speed at which resonance occurs is called _____.
Option A:	low speed
Option B:	high speed
Option C:	critical speed
Option D:	maximum speed
13.	In the case of support or base excitation, if frequency ratio is greater than $\sqrt{2}$,
Option A:	the magnitude of displacement transmissibility is small irrespective of damping in the system
Option B:	the magnitude of displacement transmissibility is large irrespective of damping in the system
Option C:	the magnitude of displacement transmissibility is small if damping ratio is greater than 2

Option D:	the magnitude of displacement transmissibility is large if damping ratio is greater than 2
14.	An automobile, weighing 1500 kg, vibrates in a vertical direction while traveling at 90 km/h on a rough road having a sinusoidal waveform with an amplitude 0.1 m and wavelength 3.7 m. Assuming that the automobile can be modeled as a single-degree-of-freedom system with stiffness 450 kN/m and damping ratio $\xi=0.2$, determine the amplitude of vibration of the automobile.
Option A:	2.7 cm
Option B:	5.6 cm
Option C:	7.5 cm
Option D:	10.2 cm
15.	In vibrometer, the relative motion between the mass and vibrating body is converted into proportional _____.
Option A:	current
Option B:	voltage
Option C:	resistance
Option D:	ampere
16.	In FFT Spectrum Analyzer, the filter is used to _____.
Option A:	reject unwanted signals
Option B:	sets the level of the signals to be fed to the A/D converter
Option C:	convert analog signals into digital signals
Option D:	converts digital signals into analog signals
17.	From the following, which one is also known as low-frequency Transducer?
Option A:	Stroboscope
Option B:	Accelerometer
Option C:	Vibrometer
Option D:	Tachometer
18.	The primary unbalanced force is maximum when the angle of inclination of the crank with the line of stroke is_____
Option A:	0°
Option B:	90°
Option C:	180°
Option D:	360°
19.	A body of mass 10kg with its C.G. 200mm from the axis of rotation is to be completely balanced by another mass B of 5 kg placed in the same plane. The radius at which the C.G. of mass B should be is
Option A:	500 mm
Option B:	400mm
Option C:	300 mm
Option D:	200 mm
20.	A disturbing mass m_1 , radius r_1 attached to a rotating shaft may be balanced by a single mass m_2 attached radius r_2 in the same plane of rotation as that of m_1 such that
Option A:	$m_1*r_2 =m_2*r_1$

Option B:	$m_1 \cdot r_1 = m_2 \cdot r_2$
Option C:	$m_1 = m_2 \cdot r_2 \cdot r_1$
Option D:	$m_2 = m_1 \cdot r_2 \cdot r_1$

Q2	Solve any four questions out of six:	5 marks each
A	Briefly explain the steps involved in vibration analysis.	
B	A semi-definite system consists of 2 lumped masses 2 kg each and a helical spring of stiffness 100 N/m connecting them. Estimate the values of natural frequencies in rad/s, and draw the corresponding model shape. Find the position of nodes, if any.	
C	Draw displacement vs. time plots for over damped, critically-damped, under-damped and undamped cases, all superimposed to a common scale. Comment on the nature of time period of oscillations for increasing values of damping.	
D	Explain what do you mean by the term 'critical speed' of rotating shaft? Derive necessary formulae for undamped system.	
E	Show that the inertia effect of a shaft of mass moment of inertia J_s can be taken into effect by adding 1/3rd of its value to the mass moment of inertia of the disc J fitted at its end, in order to compute the natural frequency of the system.	
F	Explain vibration-based condition monitoring and fault diagnosis in rotating machine.	

Q3	Solve any two questions out of three:	10 marks each
A	An automobile is modeled as a single degree of freedom system vibrating in the vertical direction while travelling over a rough road. The vehicle has a mass of 1000 kg. The suspension system has a spring constant of 350 KN/m and a damping ratio of 0.4. If the vehicle speed is 25 km/hr, determine the displacement amplitude of the vehicle. The road surface varies sinusoidally with an amplitude of $Y=0.04$ m and a wavelength of 5 m.	
B	An air-condition weighs 200kg and is driven by a motor at 500 r.p.m. what is the required static deflection of an undamped isolator to achieve 80% isolation?	
C	Four pulleys are equally spaced along a shaft and each has an out of balance mass at the same radius. The out of balance mass in second pulley is 3 kg and the third and fourth out of balance masses are at 72° and 220° to it. Determine the masses in the first, third and the fourth pulleys and also the angle of the first mass relative to second. if the complete balance is to be obtained.	

University of Mumbai

Examination 2020 under cluster 09(Lead College: FAMT)

Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021 to 20th January 2021

Program: BE AUTOMOBILE Engineering

Curriculum Scheme: Rev2016

Examination: Third Year Semester VI

Course Code: AEDLO6021 and Course Name: Mechatronics

Time: 2hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	PLC is
Option A:	Analog electronic device
Option B:	Digital electronic device
Option C:	Digital mechanical device
Option D:	Analog mechanical device
2.	The capacity of conventional relay systems for compound operations is ____ that of the PLCs
Option A:	poor than
Option B:	excellent than
Option C:	as good as
Option D:	unpredictable as
3.	An AND function implemented in ladder logic uses:
Option A:	Normally-closed contacts in series
Option B:	Normally-open contacts in series
Option C:	Normally-closed contacts in parallel
Option D:	Normally-open contacts in parallel
4.	When the number of zeroes is equal to the number of poles, how many branches of root locus tends towards infinity?
Option A:	3
Option B:	2
Option C:	0
Option D:	Equal to number of poles
5.	For a stable closed loop system, the gain at phase crossover frequency should always be
Option A:	less than 20 dB
Option B:	less than 6 dB
Option C:	more than 6 dB
Option D:	more than 0 dB
6.	In a bode magnitude plot, which one of the following slopes would be exhibited at high frequencies by a 4th order all-pole system
Option A:	- 80dB/decade

Option B:	- 40 dB/decade
Option C:	20 dB/decade
Option D:	60 dB/decade
7.	Which is the best example of a single channel data acquisition system?
Option A:	APM
Option B:	BPM
Option C:	CPM
Option D:	DPM
8.	Which of the scientific principle makes hydraulic systems feasible ?
Option A:	Pascal's principle
Option B:	Boyle's law
Option C:	Bernoulli's principle
Option D:	The fluid flow principle
9.	What does the numbers in 4/2 valve mean
Option A:	4 positions and 2 ports
Option B:	4 ports and 2 positions
Option C:	4 positions and 4 ports
Option D:	2 ports and 2 positions
10.	In pneumatic systems, AND gate is used for
Option A:	Check Valve
Option B:	Shuttle Valve
Option C:	Dual Pressure Valve
Option D:	Gate Valve
11.	Micro-controllers are _____ than the PLCs.
Option A:	Bulky And Expensive
Option B:	Bulky But Cheaper
Option C:	Cheaper And Portable
Option D:	Portable But Expensive
12.	In the real world, Data acquisition of all the physical quantities is done in
Option A:	Random mode
Option B:	Digital mode
Option C:	Analog mode
Option D:	Either analog mode or digital mode
13.	The capacity of data acquisition system (DAQ) can be specified in terms of number of
Option A:	Control Elements
Option B:	Channels
Option C:	Interfaces
Option D:	Functions
14.	Inductive proximity sensors can be effective only when the objects are of _____ materials
Option A:	Ferro magnetic

Option B:	Diamagnetic
Option C:	Para magnetic
Option D:	Trimagnetic
15.	A piezo-electrical crystal generates voltage when subjected to following type of force
Option A:	Electrical
Option B:	Mechanical
Option C:	Gravity
Option D:	Fluid
16.	Following acts as detector in Optical sensor
Option A:	Light emitting diode
Option B:	Photo diode
Option C:	Transistor
Option D:	Amplifier
17.	The mechatronics is an integrative field in which the disciplines those act together are
Option A:	Mechanical and Electronic systems
Option B:	Mechanical , Electronic systems and Information technology
Option C:	Electronic systems and Information technology
Option D:	Mechanical and Information technology
18.	Which of the following is not advantage of Mechatronics system?
Option A:	Products are of good quality
Option B:	High degree of flexibility
Option C:	Greater extent of machine utilization
Option D:	Initial cost
19.	The function of actuator is to
Option A:	Produce motion or cause some action
Option B:	Detect the state of system parameters
Option C:	Control the system
Option D:	Provide visual feedback to users.
20.	Ratio of Laplace transformation of controlled output to reference input is known as
Option A:	Transfer function
Option B:	Closed loop system
Option C:	Open loop system
Option D:	Block diagram

Q2	Solve any Two Questions out of Three 20 marks
A	<p>Determine the transfer function of the mechatronic system shown in figure</p>
B	Illustrate working of Stepper Motor. State Stepper Motor performance characteristics.
C	Illustrate working of different signal filters.

Q3	Solve any Two Questions out of Three 20 marks
A	<p>Two double acting pneumatic cylinders A and B are selected for an industrial application. The sequence of movement for piston of the cylinder is proposed as below. (AB)+ Delay(5sec) B- Delay(5sec) A- Develop the electro-pneumatic circuit using 5/2 double solenoid as final directional control valves. The piston motion mentioned in bracket is simultaneous.</p>
B	<p>Obtain the root locus for a unity feedback system with open loop transfer function. Comment on the stability of the system.</p> $G(s) = \frac{k}{s(s+4)(s+5)}$
C	<p>Material A and Material B are collected in a tank. These materials are mixed for a while. Mixed product is then drained out through Outlet valve.</p> <ul style="list-style-type: none"> To detect level of Material A and Material B, two separate level switches are used. To detect low level, one more level switch is used at the bottom of the tank. This gives output in digital terms that is when corresponding levels are detected. To control level of this system, Single Acting Piston valve (1 and 2) can be used which has two states, either fully open or fully close. To control mixing, agitator is used which is connected with Motor shaft. Particular time delay is used to mix the materials for a 60 sec. Outlet valve is then operated to drain the mixed product. <p>Develop a ladder logic diagram.</p>

University of Mumbai
Examination 2020 under cluster 9(Lead College: FAMT)

Program: AUTOMOBILE Engineering

Curriculum Scheme: Rev2016

Examination: TESemester VI

Course Code:AEDLO6022 and Course Name: Robotics

Time: 2 hour

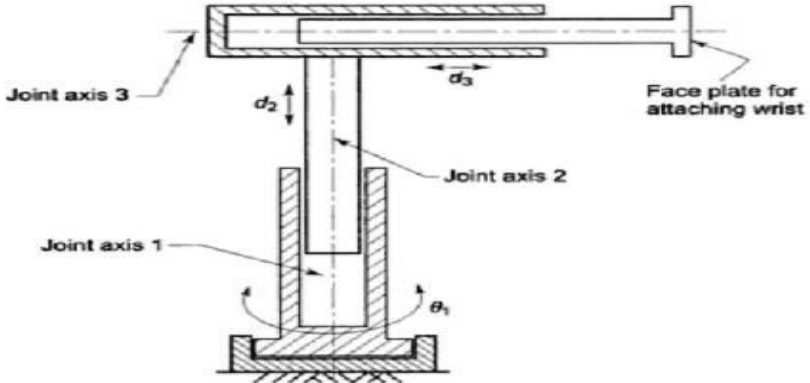
Max. Marks: 80

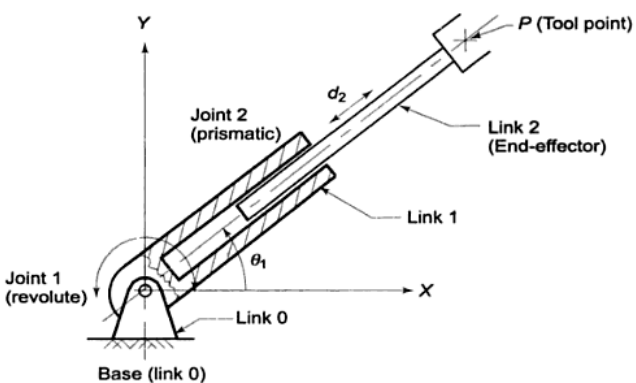
Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry two mark each.
1.	Which part of the Robot provides motion to the manipulator and end-effector?
Option A:	Controller
Option B:	Sensor
Option C:	Actuator
Option D:	Links
2.	The rotation matrix about z axis is
Option A:	$\begin{bmatrix} 1 & 1 & 0 \\ 0 & \cos \theta & -\sin \theta \\ 0 & \sin \theta & \cos \theta \end{bmatrix}$
Option B:	$\begin{bmatrix} \cos \theta & 0 & \sin \theta \\ 0 & 1 & 0 \\ -\sin \theta & 0 & \cos \theta \end{bmatrix}$
Option C:	$\begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$
Option D:	$\begin{bmatrix} 1 & 1 & 0 \\ 0 & \cos \theta & \sin \theta \\ 0 & -\sin \theta & \cos \theta \end{bmatrix}$
3.	Which among the following is not the functionality of Robots
Option A:	Reprogrammability
Option B:	Multifunctionality
Option C:	Efficient Performance
Option D:	Responsibility
4.	According to Denavit-Hartenberg's notations, Joint Angle can have
Option A:	positive value only
Option B:	negative value only
Option C:	zero value only
Option D:	either positive or negative or zero value
5.	According to Denavit-Hartenberg notations, joint angle is defined as the
Option A:	Angle between two Z axes measured about X axis
Option B:	Angle between two X axes measured about Z axis

Option C:	Angle between two Y axes measured about X axis
Option D:	Angle between two X axes measured about Y axis
6.	Motion planning aims to
Option A:	Provide teaching to a robot
Option B:	Control a robot
Option C:	Determine collision free path for the robot
Option D:	Ensure smooth variation of joint angles of a robot
7.	The twist angle for the second frame for 2-DOF serial manipulator shown below, is _____.
Option A:	0 degree
Option B:	90 degree
Option C:	180 degree
Option D:	45 degree
8.	Spot welding and Arc welding are the examples of
Option A:	Point-to-point tasks
Option B:	Continuous path tasks
Option C:	Continuous path task and point-to-point tasks, respectively
Option D:	Point-to-point and continuous path tasks, respectively
9.	In which of the following operations Continuous Path System is used?
Option A:	Pick and Place
Option B:	Loading and Unloading
Option C:	Continuous welding
Option D:	Conveyor
10.	Determine the Nyquist rate of the signal $x(t) = 1 + \cos 2000\pi t + \sin 4000\pi t$.
Option A:	2000 Hz
Option B:	4000 Hz
Option C:	1 Hz
Option D:	6000 Hz
11.	Joint space technique are used for _____.
Option A:	Spline motion
Option B:	Point to point motion
Option C:	Continous motion

Option D:	Hapazard motion
12.	SCARA robot is very suitable in which kind of operation
Option A:	Single Operations
Option B:	Assembly Operations
Option C:	Rotary Operations
Option D:	Translatory Operations
13.	Ability of sensor to reproduce the results for same input is known as_____.
Option A:	Accuracy
Option B:	Precision
Option C:	Resolution
Option D:	Linearity
14.	Which of the following is NOT static characteristics of sensor?
Option A:	Threshold
Option B:	Drift
Option C:	Sensitivity
Option D:	Fidelity
15.	Optical encoder is used to detect_____.
Option A:	Linear displacement
Option B:	Angular displacement
Option C:	Linear speed
Option D:	Angular speed
16.	Any vision system apart from capturing images also perform_____.
Option A:	Image extraction and compression
Option B:	Image processing and image analysis
Option C:	Image capture and compression
Option D:	Image capture and storage
17.	If a rotor pitch of hybrid stepper motor is 36° and step angle is 9° , the number of phases will be_____.
Option A:	4
Option B:	2
Option C:	3
Option D:	6
18.	The difference between the actual-state and the target-state leads to_____.
Option A:	Motive
Option B:	Gaze
Option C:	Balancing
Option D:	Movement
19.	A single-turn rotary potentiometer with a 330° measurement range is used to provide angular-position feedback information for a positioning application. A 5-V DC voltage is applied across the potentiometer leads, and the potentiometer output is connected to a 12-bit A/D convertor with a 5 V range. The

	potentiometer resistance is 50 . Determine the effective resolution of this sensor.
Option A:	1.61°
Option B:	16.1°
Option C:	0.161°
Option D:	161°
20.	Recognition of known object and pattern is performed using _____.
Option A:	Force sensor
Option B:	Laser sensor
Option C:	Vision sensor
Option D:	Optical sensor

Q.2	Solve any Four out of Six, 5 marks each
Q2. A	<i>Describe the term Degrees of freedom of planer robot.</i>
Q2. B	<p><i>Find out the D-H parameter for 3-DOF manipulator shown in figure</i></p> 
Q.2. C	<i>Explain the working principle of servomotor. Why servomotor is preferred in the joint for positioning.</i>
Q.2. D	<i>Explain degree of maneuverability about Mobile robot</i>
Q.2. E	<i>Define the terms sensors and transducers. How Sensors are selected for particular applications?</i>
Q.2. F	<i>Explain applications of Humanoids in medical field. Explain the classification of medical robots with examples.</i>

Q.3	Solve any Two Questions out of Three, 10 marks each
A	<p><i>Determine the transformation matrix for end point P for a 2-DOF planner manipulator arm as shown in figure</i></p> 
B	<i>Design a single polynomial trajectory which starts from the initial position</i>

	<i>of $\theta(0) = 10^\circ$, passes via a point $\theta(1) = 5^\circ$, and then stops at final angular position $\theta(2) = 50^\circ$. The velocity at start and stop are zero.</i>
C	<i>Explain ten Principles and considerations in material handling systems design</i>

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Examination 2020 under cluster 8 (Lead College: Rasayani)

Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021 to 20th January 2021

Program: Automobile Engineering

Curriculum Scheme: 2016

Examination: TE Semester VI

Course Code: AEDLO6023 and Course Name: AUTOMOTIVE MATERIALS

Time: 2-hour

Max. Marks: 80

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks (2Marks each) 40
1.	Aluminum is about ----- times lighter than steel per unit volume, but can be made just as strong using certain
Option A:	6
Option B:	5
Option C:	3
Option D:	1.5
2.	Which process is most preferably used for of manufacturing of cylindrical shape composites?
Option A:	Pultrusion Process
Option B:	Filament Winding
Option C:	Hand layup
Option D:	Open Mold Process
3.	The basic mechanism of pultrusion system is similar to that of the metal ----- process.
Option A:	Sheet metal forming
Option B:	Hydro forming
Option C:	Extrusion
Option D:	Forging
4.	What is the need of shift to new material for car body design
Option A:	Competition
Option B:	For fuel economy & reduction in CO ₂ emission
Option C:	Regulation by government
Option D:	Comfort
5.	What is difference between stress strain diagram of Aluminium & Steel
Option A:	Aluminium has continuous stress strain curve
Option B:	Steel has continuous stress strain curve
Option C:	Aluminium has discontinuous stress strain curve
Option D:	No difference

6.	What is the key function of airbag cushion
Option A:	To absorb the impact
Option B:	To provide comfort to passenger
Option C:	To adjust the load
Option D:	For smooth driving
7.	To impart heat stability in brake pad which filler material is used?
Option A:	Mica
Option B:	Cashew dust
Option C:	Rubber dust
Option D:	Barium sulphate
8.	Polyester fiber is ----- heavier than the fabric made from Nylon6,6
Option A:	80%
Option B:	60%
Option C:	40%
Option D:	20%
9.	Following which is not the output of compression molding
Option A:	High volume production
Option B:	High quality surface finish
Option C:	Short cycle time
Option D:	High machine cost
10.	Ceramic friction material is made from which of the 2 main ingredients?
Option A:	Aluminium + Ceramic Fiber
Option B:	Copper + Ceramic Fiber
Option C:	Nickel + Ceramic Fiber
Option D:	Mild steel + Ceramic Fiber
11.	Hand lay-up process predominantly uses
Option A:	unidirectional fibers
Option B:	bidirectional fibers
Option C:	multidirectional fibers
Option D:	Tridirectionally fibers
12.	The basic method of moulding thermo plastics is
Option A:	Compression moulding
Option B:	Injection moulding
Option C:	Transfer moulding
Option D:	Sand moulding
13.	Not an example for laminar composite
Option A:	Wood
Option B:	Bimetallic
Option C:	Coatings/Paints
Option D:	Claddings
14.	Manufacturing of components having continuous lengths and the constant cross-

	sectional shape is done by -----process.
Option A:	Roving
Option B:	Pultrusion
Option C:	Curing
Option D:	Pulling
15.	Composite materials can be
Option A:	Light
Option B:	Strong
Option C:	Light & strong
Option D:	Soft
16.	Coating the nano crystals with the ceramics is carried that leads to -----
Option A:	Corrosion
Option B:	Corrosion resistant
Option C:	Wear and tear
Option D:	Soft
17.	What is 96% silica glass used for?
Option A:	Heat shield
Option B:	Combustion tubes
Option C:	Electronic tubes
Option D:	Temperature thermometers
18.	What is the maximum service temperature of aluminosilicate glass?
Option A:	220°C.
Option B:	460°C.
Option C:	650°C.
Option D:	1200°C.
19.	Brake Pads require to maintain a sufficiently ----- friction coefficient with the brake disc.
Option A:	high
Option B:	Low
Option C:	equal
Option D:	negative
20.	Aluminum alloy is characterized by a -----specific gravity approximately one third that of steel and a -----specific strength.
Option A:	low, high
Option B:	high, low
Option C:	high, high
Option D:	low, low

Q2	Solve any Two Questions out of Three (10 marks each)	20
A	Briefly describe need to shift new materials and risk in adopting new materials	
B	Explain different characteristic features of Plastics.	
C	What are characteristics of Composite materials? Explain in brief.	

Q3	Solve any Two Questions out of Three (10 marks each)	20
A	Explain various approaches in tempering of glass for improved toughness.	
B	What is MR fluid. Enlist application of MR fluid in Automobile Industry.	
C	Write a case study of materials development by Honda in the making of automobiles	

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Examination 2020 under cluster 8 (Lead College: PHCET,Rasayani)

Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021 to 20th January 2021

Program: AUTOMOBILE

Curriculum Scheme: Rev2016

Examination: TE Semester VI

Course Code: AEC601 and Course Name: Chassis & Body Engineering

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1. is a French term and was initially used to denote the frame parts or Basic Structure of the vehicle.
Option A:	Body
Option B:	Chassis
Option C:	Aerodynamics
Option D:	Sub frame
2.	The metal cover over the engine compartment is known as
Option A:	Bonnet
Option B:	Grill
Option C:	Wheel Arch
Option D:	Door
3.	What is the advantage of Front Engine Front wheel drive over Front Engine Rear wheel drive?
Option A:	Tends to have a higher towing capacity
Option B:	Front-wheel drive cars tend to under steer.
Option C:	CV joints/boots in FWD vehicles tend to wear out sooner
Option D:	Provide better traction when climbing hills
4. buses are used for mass transport.
Option A:	Single-decker
Option B:	Mini
Option C:	Double-decker
Option D:	Split Level
5.	Classification of different type of vehicle structure is based on
Option A:	shear forces at the edges of panels
Option B:	Forces acting at front axle
Option C:	Forces acting at rear axle
Option D:	Forces acting on components of Engine
6.	In Double skin Construction skin will take part in load carrying , skin will be fixed in such a way that it can be replaced easily.
Option A:	outer, inner
Option B:	inner, outer

Option C:	inner, middle
Option D:	outer, side
7.	Boat tailing helps to _____ the drag.
Option A:	Increase
Option B:	Amplify
Option C:	decrease
Option D:	keep constant
8.	The friction drag along the underside of the vehicle is reduced with the aid of _____
Option A:	friction free bumper
Option B:	flat mudguard
Option C:	front radiator grill
Option D:	a front spoiler
9.	The aerodynamic drag D, as well as the other force components and moments, increases with
Option A:	the cube of the vehicle
Option B:	the vehicle speed
Option C:	square root of the vehicle speed
Option D:	the square of the vehicle speed V
10.	What is formula Price per unit tare weight in the running cost
Option A:	Pay load/ Tare Weight
Option B:	Vehicle power/ vehicle weight
Option C:	Usable surface area/total surface area
Option D:	Price of vehicle/tare weight
11.	_____ parameters include the contour of seat and relative position and orientation of the seat cushion and backrest.
Option A:	Support
Option B:	Design
Option C:	Feel
Option D:	Fit
12.	Sensitive manikins are used for measuring _____ which based on distribution of small load cells over the contacting surface
Option A:	Seat comfort
Option B:	Seat Discomfort
Option C:	Seat normal position
Option D:	Adjustable seat
13.	During cornering, loads on vehicles are balanced by.....
Option A:	Centrifugal force
Option B:	Axial force
Option C:	Side wind force
Option D:	Drag force
14.	The product of Static load , Dynamic load factor and Safety factor is known as

Option A:	Cornering Force
Option B:	Equivalent load
Option C:	Drag
Option D:	Lift
15.	When both wheels of a car encountered an obstruction simultaneously, vertical inertia force is with respect to longitudinal of the vehicle.
Option A:	normal
Option B:	asymmetrical
Option C:	symmetrical
Option D:	zero
16.	Which one of these is a common parameter when vehicle is in operating condition having instantaneous overloads and fatigue damage
Option A:	Large bump
Option B:	Panic braking
Option C:	Service loads
Option D:	Large potholes
17.	Which of the following is a latest trend in Manufacturing of Vehicles
Option A:	Milling
Option B:	Welding
Option C:	Rapid Prototyping
Option D:	Sheet stamping
18.	External Panels such as fenders and bonnet are commonly made by which manufacturing process?
Option A:	Milling
Option B:	3D printing
Option C:	Stamping
Option D:	Casting
19.	What does SSS panel stand for?
Option A:	Simple Structural surface
Option B:	Soft Structural surface
Option C:	Single Structural surface
Option D:	Strong Structural surface
20.	_____ -series aluminum contains both silicon and magnesium which forms magnesium silicide and makes the aluminum alloy heat-treatable.
Option A:	5000
Option B:	6000
Option C:	600
Option D:	500

Q2 (20 Marks Each)	
A	Solve any Two 5 marks each
i.	Write a short note on Rolling moment.
ii.	Write a short note on spot welding.
iii.	Explain the different loads to which chassis is subjected?
B	Solve any One 10 marks each
i.	Explain with neat sketch vertical symmetric loading showing all calculations for condition of maximum height.
ii.	Draw and explain various types of Bus body styles.

Q3. (20 Marks Each)	Please delete the instruction shown in front of every sub question
A	Solve any Two 5 marks each
i.	Explain Longitudinal loading case.
ii.	Write a note on vehicle weight distribution.
iii.	Explain any five car body styles.
B	Solve any One 10 marks each
i.	Explain latest trend in manufacturing of automobile
ii.	Explain overall design criteria for the comparison of the vehicle.

University of Mumbai
Examination 2020 under cluster 09 (FAMT)

Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021 to 20th January 2021

Program: BE AUTOMOBILE Engineering
Curriculum Scheme: Revised 2016
Examination: **Third Year Semester VI**
Course Code: **AEC602** and Course Name: **Machine Design-I**

Time: 2 hours

Max. Marks: 80

Question Paper Set No.1

Note : Each question is for 2 marks.

Multiple Choice Questions (MCQ)	
Q.1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Which design consideration deals with appearance of the product?
Option A:	Ergonomics
Option B:	Aesthetics
Option C:	System design
Option D:	Creative design
2.	A cotter joint is transmitting a load of 60KN, cotter thickness is 13mm and allowable shear stress is 32 N/mm ² find the mean width of cotter considering double shear failure.
Option A:	72.11mm
Option B:	85mm
Option C:	65.11mm
Option D:	60mm
3.	The criterion of failure for machine parts subjected to fluctuating stresses is
Option A:	Ultimate tensile strength
Option B:	Yield strength
Option C:	Endurance limit
Option D:	Modulus of elasticity
4.	Find diameter of a shaft if torque transmitted by the shaft is 150 kN-mm and permissible shear stress for shaft material is 52 N/mm ² .
Option A:	38mm
Option B:	25mm
Option C:	18mm
Option D:	48mm
5.	A symbol Fe360 indicates a steel with
Option A:	Minimum Tensile Strength 360 N/mm ²
Option B:	Maximum Tensile Strength 360 N/mm ²
Option C:	Minimum shear Strength 360 N/mm ²
Option D:	Maximum shear Strength 360 N/mm ²
6.	In the assembly of pulley, key and shaft :
Option A:	pulley is made the weakest
Option B:	key is made the weakest
Option C:	key is made the strongest
Option D:	all the three are designed for equal strength

7.	In a thick cylindrical shell, the maximum radial stress at the outer surfaces of the shell is
Option A:	Zero
Option B:	P
Option C:	$p/2$
Option D:	$2p$
8.	In case of leaf spring, find the load exerted on the band after assembling the spring for a load $(2W) = 70 \text{ kN}$, total number of leaves = 18, number of graduates leaves = 15.
Option A:	9860 N
Option B:	7256 N
Option C:	5690 N
Option D:	4487 N
9.	A self-locking screw has
Option A:	Fine threads
Option B:	Coarse threads
Option C:	Friction angle $>$ helix angle
Option D:	Hole for insertion of split pin
10.	The resistance to fatigue of a material is measured by
Option A:	Elastic limit
Option B:	Young's modulus
Option C:	Ultimate tensile strength
Option D:	Endurance limit
11.	The thickness of thick cylindrical shell with closed ends and made of brittle material is determined by
Option A:	Barlow's equation
Option B:	Clavarino's equation
Option C:	Birnie's equation
Option D:	Lame's equation
12.	A Rigid Flange coupling is used to two shafts
Option A:	Which are perfectly aligned.
Option B:	Which are not in exact alignment.
Option C:	Have lateral misalignment.
Option D:	Whose axes intersect at a small angle.
13.	The solid length of the spring is given by_____. Where, n = total number of coils; d = diameter of wire
Option A:	n d
Option B:	$(n + 1) d$
Option C:	$(n + 3) d$
Option D:	$(n + 4) d$
14.	Which of the following is a permanent fastening
Option A:	Bolts
Option B:	Keys
Option C:	Cotter
Option D:	rivets
15.	A key way lowers
Option A:	the strength of the shaft
Option B:	the rigidity of the shaft
Option C:	both the strength and rigidity of the shaft

Option D:	the ductility of the shaft
16.	Wahl's stress factor _____
Option A:	is independent of change in spring index
Option B:	decreases first and then starts increasing with the increase in spring index
Option C:	increases more rapidly as spring index decreases
Option D:	increases more rapidly as spring index increases
17.	The ----- is used to adjust axial length between two rods.
Option A:	Cotter joint
Option B:	Knuckle joint
Option C:	Turn buckle
Option D:	Coupling
18.	Spring index for a helical spring is 5 and diameter of the wire is 6 mm. Calculate outer diameter of the coil.
Option A:	10 mm
Option B:	24 mm
Option C:	36 mm
Option D:	16 mm
19.	A Bolt of M24×2 means that
Option A:	The pitch of thread is 24mm and depth is 2 mm.
Option B:	The cross sectional area of the thread is 24 mm^2
Option C:	Nominal diameter of bolt is 24mm and pitch is 2 mm.
Option D:	Effective diameter of bolt is 24mm and there are 2 threads per cm.
20.	Flexible coupling is used because.....
Option A:	It is easy to disassemble
Option B:	It is easy to engage and disengage
Option C:	It transmits shocks gradually
Option D:	It prevents shock transmission and eliminates stress reversals

SUBJECTIVE/DESCRIPTIVE QUESTIONS

Q2	Solve any Four Questions out of Six Each question is for 5 marks.
A	Explain Notch sensitivity and Endurance limit related to design of machine elements subjected to variable loads.
B	What is preferred number? Explain use of preferred number in engineering design?
C	Explain the nipping of the leaf spring with neat sketch.
D	What are the assumptions made in analysis of curved beam
E	Explain aesthetic consideration in design with suitable examples.
F	What is the necessity of theories of failure? List different theories of failure

Q3	Solve any Two Questions out of Three Each question is for 10 marks.
A	Design screw, nut, and handle of screw jack to lift a load of 90kN through a height of 400mm. select suitable material and factor of safety to design screw jack.
B	Design flange coupling to connect the output shaft of an electrical motor to the shaft of centrifugal pump. The motor delivers a power of 20KW at 960rpm. The overall torque for motor is 18% higher of mean torque.
C	Design socket and spigot joint for a load of 100kN. Select suitable material, factor of safety and draw neat sketch.

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University of Mumbai
Examination 2020 under cluster 09 (Lead College: FAMT)

Program: BE AUTOMOBILE Engineering

Curriculum Scheme: Rev 2016

Examination: TE Semester VI

Course Code: AEC603 and Course Name: Finite Element Analysis

Time: 2 hour

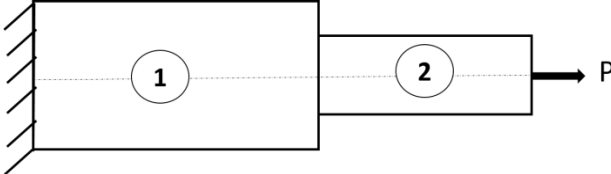
Max. Marks: 80

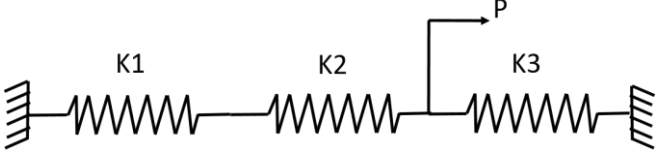
Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Which one of the following is not the recent proposed modified FEM?
Option A:	Partition of Unity Method
Option B:	h-p Cloud Method
Option C:	Meshless Method
Option D:	Point Cloud Method
2.	The order and degree of differential equation is
	$3 \frac{d^2y}{dx^2} - \frac{dy}{dx} + 8 = 0$
Option A:	0 and 1 respectively
Option B:	1 and 2 respectively
Option C:	2 and 1 respectively
Option D:	2 and 2 respectively
3.	The art of subdividing the structure into a convenient number of smaller elements is known as
Option A:	Assemblage
Option B:	Continuum
Option C:	Traction
Option D:	Discretization
4.	Number of node/s in a quadratic bar element is/are _____
Option A:	2
Option B:	3
Option C:	4
Option D:	1
5.	Beam element is
Option A:	1D element with 1 degree of freedom
Option B:	1D element with 2 degree of freedom
Option C:	2D element with 1 degree of freedom

Option D:	2D element with 2 degree of freedom
6.	The order of shape functions for CST element is
Option A:	Linear
Option B:	Quadratic
Option C:	Constant
Option D:	Either quadratic or constant
7.	Which one of the following is not a part of steps involved in assembly of different matrices?
Option A:	Rules for primary variables
Option B:	Rules for secondary variables
Option C:	Rules for stiffness matrix
Option D:	Impose local boundary conditions
8.	The governing equation for horizontal bar is
Option A:	$\frac{d}{dx} \left[EA \frac{du}{dx} \right] + f = 0$
Option B:	$\frac{d}{dx} \left[EA \frac{du}{dx} \right] = 1$
Option C:	$\frac{d}{dx} \left[EA \frac{du}{dx} \right] - f = 0$
Option D:	$\frac{d}{dx} \left[EA \frac{du}{dx} \right] = 0$
9.	What is the approximate function to be assumed?
Option A:	A polynomial function only
Option B:	A trigonometric function only
Option C:	Either polynomial or trigonometric function
Option D:	Neither polynomial nor trigonometric function
10.	Which of the following method is nothing but finite element method?
Option A:	Rayleigh Ritz method
Option B:	Piece-wise Rayleigh Ritz method
Option C:	Galerkin method
Option D:	Collocation method
11.	The element stiffness matrix equation for a eight node 2D element is of order
Option A:	4x4
Option B:	6x6
Option C:	8x8
Option D:	16x16
12.	Plane stress conditions are preferred when

Option A:	Thickness is very large compared to size of the domain
Option B:	Thickness is very less compared to size of the domain
Option C:	Thickness is negligible compared to size of the domain
Option D:	Thickness is same as compared to size of the domain
13.	The degree of freedom of 4-noded quadrilateral element at each node is
Option A:	1
Option B:	3
Option C:	2
Option D:	4
14.	The ratio of biggest side of element to its smallest side is called
Option A:	Path ratio
Option B:	Element ratio
Option C:	Coordinate ratio
Option D:	Aspect ratio
15.	The Stress-Strain Relation (D) Matrix for 2D Plane Stress Condition is of the order
Option A:	2x2
Option B:	3x3
Option C:	4x4
Option D:	6x6
16.	The element Stiffness matrix is given by
Option A:	$\int_v [B]^T [D][B] dv$
Option B:	$\int_t [B]^T [D][B] dt$
Option C:	$\int_a [B]^T [D][B] da$
Option D:	$\int_x [B]^T [D][B] dx$
17.	For a beam element, the Consistent mass matrices is given by,
Option A:	$\frac{\rho Al}{420} \begin{bmatrix} 156 & 22l & -54 & 13l \\ 22l & 4l^2 & -13l & 3l^2 \\ -54 & -13l & 156 & -22l \\ 13l & 3l^2 & -22l & 4l^2 \end{bmatrix}$
Option B:	$\frac{\rho Al}{420} \begin{bmatrix} 156 & 22l & 54 & -13l \\ 22l & 4l^2 & -13l & 3l^2 \\ 54 & -13l & 156 & -22l \\ -13l & 3l^2 & -22l & 4l^2 \end{bmatrix}$

Option C:	$\frac{\rho Al}{420} \begin{bmatrix} 156 & 22l & 54 & -13l \\ 22l & 4l^2 & 13l & -3l^2 \\ 54 & 13l & 156 & -22l \\ -13l & -3l^2 & -22l & 4l^2 \end{bmatrix}$
Option D:	$\frac{\rho Al}{420} \begin{bmatrix} 156 & 22l & 54 & 13l \\ 22l & 4l^2 & 13l & 3l^2 \\ 54 & 13l & 156 & 22l \\ 13l & 3l^2 & 22l & 4l^2 \end{bmatrix}$
18.	Jacobian matrix for 2D analysis is a
Option A:	2x2 matrix
Option B:	3x3 matrix
Option C:	4x4 matrix
Option D:	6x6 matrix
19.	Which of the following analysis is not an example of dynamic analysis
Option A:	Crash Analysis of a Car
Option B:	Impact Analysis of a missile
Option C:	Earthquake Excitation
Option D:	Truss Analysis
20.	The mass matrices as a result considering the mass of the element at the nodes is
Option A:	Lumped mass matrices
Option B:	Consistent mass matrices
Option C:	Diagonal mass matrices
Option D:	Singular mass matrices

Q2 (20 Marks)	Solve any Two Questions out of Three (10 marks each)
A	Solve the following differential equation and determine y at $x=0.5$ using Galerkin Method. $-\frac{d^2y}{dx^2} - 9y + 2x^2 = 0$ in the domain $0 \leq x \leq 1$ Boundary conditions are: $y(0) = 0$ and $\frac{dy}{dx}(1) = 1$
B	 <p>Determine the nodal displacement and stress for the step bar shown in figure. Consider, $L_1 = L_2 = 200$ mm, $A_1 = 200$ mm², $A_2 = 100$ mm², $E_1 = E_2 = 200$ GPa and $P = 10,000$ N.</p>
C	Determine the natural Frequency of axial vibration of bar ($E = 2.3 \times 10^{11}$ N/m ² , $\rho = 7800$ kg/m ³ , $L=1$ m) fixed at one end using lumped mass matrices and using two linear element.

Q3. (20 Marks)	Solve any Four out of Six, 5 marks each
A	What are the major five limitations of the FEA?
B	State the properties of the shape function. Write the shape functions ϕ_1 and ϕ_2 for a linear element at node 1 and 2 and show its variation over the element.
C	Find the displacement at internal nodes of the system shown. $K_1 = 2$ N/mm, $K_2 = 4$ N/mm, $K_3 = 6$ N/mm and $P = 20$ N. 
D	The shape function at a point P inside a CST element is 0.3, 0.4 and 0.3 respectively. If the nodal temperature values (T) at the nodes are [102, 85, 128] degrees respectively, determine the value of temperature in degree Celsius at point P.
E	Explain convergence and state the convergence criteria.
F	Explain lumped mass matrix.