

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

Curriculum Scheme: Rev2016 Examination: TE Semester VI

Course Code: AEC601 and Course Name: **Chassis and Body Engineering (CBE)**

Time 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	IBAS was designed patented and built by
Option A:	Nissan
Option B:	Mercedes
Option C:	TATA
Option D:	Mahindra
2.	BMW developed a world's first crankcase made of magnesium with a cast in ---- ----- insert
Option A:	Aluminium
Option B:	Molybdenum
Option C:	Titanium
Option D:	Iron
3.	In manufacturing of ULSAB following criteria is not considered
Option A:	D strength and ultra D strength steels
Option B:	Spinning Forming
Option C:	Tailored blanks
Option D:	Steel sandwich materials
4.	In the vehicle, the driver and crew are placed behind the engine
Option A:	Semi Forward
Option B:	Forward control
Option C:	Normal control
Option D:	Local Control

5. is a composite material or fibre-reinforced polymer made of a plastic reinforced by fine fibre made of glass.
Option A:	Fibre-reinforced plastic (FRP)
Option B:	Metal-reinforced plastic
Option C:	Glass Reinforced Plastic
Option D:	Carbon Fiber
6.	A _____ is a horizontal surface at the back of a car and serves as a lid to the trunk.
Option A:	Trunktop
Option B:	Deck
Option C:	Hood
Option D:	Backlight
7.	Which one of the car body shapes has largest internal dimensions?
Option A:	Coupe
Option B:	Saloon
Option C:	Convertible
Option D:	Estate
8.	Wake region is formed due to-----of fluid
Option A:	Laminar flow
Option B:	Turbulent flow
Option C:	Streamlined-flow
Option D:	Transit Flow
9.	Front end blind spots are not influenced by
Option A:	thickness of pillar
Option B:	angle of pillar
Option C:	angle of windshield
Option D:	position of B pillar
10.	As applied to specification of commercial heavy vehicle the abbreviation G.V.W is

Option A:	General vehicle width
Option B:	Gross vehicle weight
Option C:	Given variable wheel base
Option D:	Gross vehicle width
11.	Stagnant point is referred to a point where,
Option A:	Pressure is maximum and velocity is zero
Option B:	velocity is maximum pressure is zero
Option C:	pressure and velocity is equal
Option D:	pressure and velocity is unequal
12.	Which force is responsible for yawing moment?
Option A:	lift force
Option B:	aerodynamic drag
Option C:	lateral force
Option D:	Trust force
13.	Formula for Drag force $F_d =$ -----
Option A:	$C_d A \rho (V^2)/2$
Option B:	$C_d A \rho (V^3)/2$
Option C:	$C_d A \rho V/2$
Option D:	$C_d A \rho (V^2)/3$
14.	In the seat design mean preferred lumbar support apex location is about ___mm above the sitter"s hip joint centers
Option A:	152
Option B:	95
Option C:	144
Option D:	180
15.	The united nations European regional standard ECER44/04[8] categorizes _____ child seats in car
Option A:	1
Option B:	2
Option C:	3
Option D:	4
16.	Load Efficiency=
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
17.	Due to nature of resulting loads, loading symmetry w.r.t. _____ plane is lost
Option A:	Y-Z plane
Option B:	X-Y plane
Option C:	X-Z plane
Option D:	Y-Y plane
18.	For modern cars Critical lateral acceleration is equal to
Option A:	1.12 g
Option B:	1.22 g
Option C:	1.32 g
Option D:	1.42 g
19.	Kerb bumping causes D loads and results in
Option A:	Bending
Option B:	Rollover
Option C:	Skidding
Option D:	Pitching
20.	Dynamic load is equal to
Option A:	static load X dynamic load factor
Option B:	static load X factor of safety
Option C:	dynamic load factor X factor of safety
Option D:	equivalent load X static load

Q2. (20 Marks Each)	Solve any Two Questions out of Three	10 marks each
A	State the significance of the SSS panel with neat sketch illustration examples of SSS and non -SSS panels	
B	Describe the various aerodynamics forces and moments acting on the vehicle	
C	Explain load distribution in passenger cars ,justify with suitable example	

Q3. (20 Marks Each)	Solve any Two Questions out of Three	10 marks each
A	What are the requirements of automotive materials? Explain the any five automotive materials.	
B	Explain the recent trends in body design w.r.t. safety consideration.	
C	Write a short note on USLAB and Explain with neat sketch Tubular Hydra-forming.	

University of Mumbai
Examination May-June 2021 under cluster 9 (Lead College: FAMT)
Examinations Commencing from 1st June to 15th June 2021

Program: Automobile Engineering

Curriculum Scheme: Rev2016

Examination: TE Semester VI

Course Code AEC602 and Course Name: Machine Design-I

Time: 2 hour

Max. Marks: 80

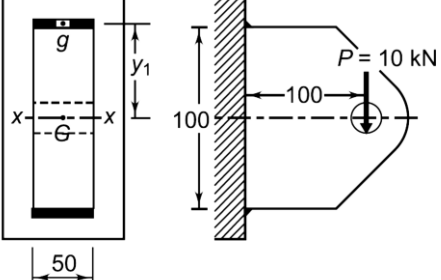
Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The ratio of the ultimate stress to the design stress is known as
Option A:	elastic limit
Option B:	strain
Option C:	factor of safety
Option D:	bulk modulus
2.	In cyclic loading, stress concentration is more serious in
Option A:	brittle materials
Option B:	ductile materials
Option C:	brittle as well as ductile materials
Option D:	elastic materials
3.	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:	$-p$
Option D:	$2p$
4.	Which of the following statement is incorrect in case of factors to be considered while Designing Machine Parts to Avoid Fatigue Failure?
Option A:	The variation in the size of the component should be as gradual as possible.
Option B:	The holes, notches and other stress raisers should be avoided.
Option C:	A smooth finish of outer surface of the component increases the fatigue life.
Option D:	The material with high fatigue strength should be avoided.
5.	Which of the following is a permanent fastening
Option A:	Bolts
Option B:	Rivets
Option C:	Keys
Option D:	Cotter
6.	Failure of a material is called fatigue when it fails
Option A:	at the elastic limit
Option B:	below the elastic limit
Option C:	at the yield point
Option D:	below the yield point

7.	The maximum bending stress, in a curved beam having symmetrical section, always occur, at the
Option A:	centroidal axis
Option B:	neutral axis
Option C:	outside fibre
Option D:	inside fibre
8.	Select an appropriate option for a diagram
Option A:	Completely reversed stress
Option B:	Repeated Stress
Option C:	Fluctuating Stress
Option D:	Non Repeated stress
9.	Which of the following type is not a type of End Connections for Compression Helical Springs?
Option A:	Plain ends
Option B:	Ground ends
Option C:	Squared ends
Option D:	Triangular ends
10.	The castings produced by forcing molten metal under pressure into a permanent metal mould is known As
Option A:	permanent mould casting
Option B:	slush casting
Option C:	die casting
Option D:	centrifugal casting
11.	According to IS : 1076 (Part I)–1985 (Reaffirmed 1990), which is not a preferred number of the basic series of R5
Option A:	1.50
Option B:	1.60
Option C:	2.50
Option D:	4.00
12.	Hooke's law holds good upto
Option A:	yield point
Option B:	elastic limit
Option C:	plastic limit
Option D:	breaking point

13.	Which of the following assumptions is not true in case of curved beams
Option A:	The material of the beam is perfectly homogeneous and isotropic
Option B:	The material of the beam obeys Hooke's law.
Option C:	The Young's modulus (E) is not the same in tension and compression
Option D:	Each layer of the beam is free to expand or contract, independently, of the layer, above or below it.
14.	The parts of circular cross-section which are symmetrical about the axis of rotation are made by
Option A:	hot forging
Option B:	hot spinning
Option C:	hot extrusion
Option D:	hot drawing
15.	Two close coiled helical springs with stiffness k_1 and k_2 respectively are connected in series. The stiffness of an equivalent spring is given by
	(a) $\frac{k_1 \cdot k_2}{k_1 + k_2}$
	(b) $\frac{k_1 - k_2}{k_1 + k_2}$
	(c) $\frac{k_1 + k_2}{k_1 \cdot k_2}$
	(d) $\frac{k_1 - k_2}{k_1 \cdot k_2}$
Option A:	C
Option B:	D
Option C:	A
Option D:	B
16.	The residual compressive stress by way of surface treatment of a machine member subjected to fatigue loading
Option A:	improves the fatigue life
Option B:	does not affect the fatigue life
Option C:	deteriorates the fatigue life
Option D:	immediately fractures the specimen
17.	In determining the strength of the knuckle joint for the various methods of failure, which of the assumptions is correct
Option A:	The stress is concentrated at pin
Option B:	The load is uniformly distributed over each part of the joint.
Option C:	The stress is concentrated at ends
Option D:	The load applied is different for every part
18.	In leaf springs, the longest leaf is known as
Option A:	Lower leaf
Option B:	Master leaf
Option C:	Upper leaf
Option D:	Middle leaf
19.	In a close coiled helical spring, the spring index is given by D/d where D and d

	are the mean coil diameter and wire diameter respectively. For considering the effect of curvature, the Wahl's stress factor K is given by
	$(a) \frac{4C-1}{4C+4} + \frac{0.615}{C}$ $(b) \frac{4C-1}{4C-4} + \frac{0.615}{C}$ $(c) \frac{4C+1}{4C-4} - \frac{0.615}{C}$ $(d) \frac{4C+1}{4C+4} - \frac{0.615}{C}$
Option A:	C
Option B:	D
Option C:	A
Option D:	B
20.	Torsional strength of shaft is written as
	$(a) \frac{\pi}{32} d^4 \tau$ $(b) d \log_e \tau$ $(c) \frac{\pi}{16} d^3 \tau$ $(d) \frac{\pi}{32} d^3 \tau$
Option A:	C
Option B:	D
Option C:	A
Option D:	B

Q2.	Solve any Two Questions out of Three	10 marks each
A	Design a Knuckle joint subjected to an axial pull of 10KN. Selecting suitable material for all the parts decide the allowable stresses. Design should include figures for the Joint and failure areas?	
B	A shaft is supported by two bearings placed 1 m apart. A 550 mm diameter pulley is mounted at a distance of 350 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 350 mm diameter is placed 210 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley.	
C	Draw a crane hook and check for critical sections for a load of 12 tonnes.	

Q3.	Solve any Two Questions out of Three 10 marks each	
A	<p>A bracket is welded to the vertical column by means of two fillet welds as shown in the figure. Determine the size of the welds, if the permissible shear stress in the weld is limited to 70 N/mm^2.</p>	
B	<p>Design a bushed-pin type of flexible coupling to connect a pump shaft to a motor shaft transmitting 22 kW at 960 r.p.m. The overall torque is 10 percent more than mean torque. The material properties are as follows :</p> <p>(a) The allowable shear and crushing stress for shaft and key material is 40 MPa and 80 MPa respectively. (b) The allowable shear stress for cast iron is 15 MPa. (c) The allowable bearing pressure for rubber bush is 0.8 N/mm^2. (d) The material of the pin is same as that of shaft and key. Draw neat sketch of the coupling.</p>	
C	<p>Design and draw a valve spring of a petrol engine for the following operating conditions : Spring load when the valve is open = 400 N, Spring load when the valve is closed = 250 N Maximum inside diameter of spring = 25 mm, Length of the spring when the valve is open = 40 mm, Length of the spring when the valve is closed = 50 mm, Maximum permissible shear stress = 400 MPa</p>	

University of Mumbai
Examination 2021 under cluster 9 (Lead College: FAMT)

Examinations Commencing from 1st June 2021 to 15th June 2021

Program: Automobile Engineering

Curriculum Scheme: 2016

Examination: TE Semester VI

Course Code: AEC603 and Course Name: Finite Element Analysis

Time: 2 hour

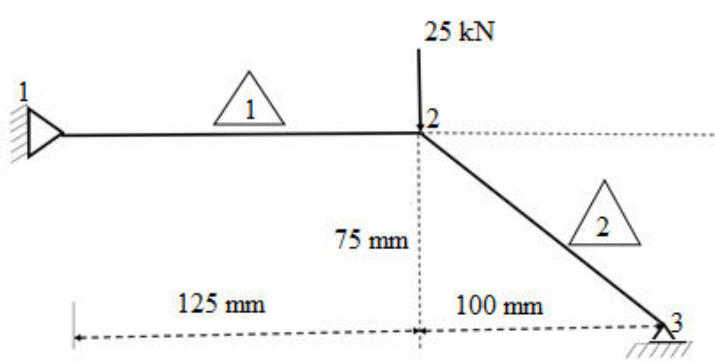
Max. Marks: 80


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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Which of the following is the advantage of FEM?
Option A:	FEM is an approximation and results are not correct
Option B:	Results depend on the experience and judgment of the designer
Option C:	Solve and analyze the complex geometry problems
Option D:	High end hardware is needed
2.	The process of stitching of all elements together is called as
Option A:	Assemblage
Option B:	Discretization
Option C:	Continuum
Option D:	Traction
3.	How Rayleigh-Ritz method can be differentiated from other numerical methods?
Option A:	Weighted residue
Option B:	Weak form type
Option C:	Non-weak form type
Option D:	Variational
4.	What is the axial rigidity of an axial bar of length 'L' with a uniform cross sectional Area 'A' and Modulus of Elasticity 'E'?
Option A:	EA
Option B:	E/A
Option C:	EA/L
Option D:	A/E
5.	What is number of internal nodes of a linear element?
Option A:	0
Option B:	2
Option C:	1
Option D:	3
6.	What is the order of a 1D quadratic element?
Option A:	1
Option B:	2
Option C:	3
Option D:	4

7.	What is the balance of secondary variables at a given node in the absence of external secondary variable?
Option A:	One
Option B:	Zero
Option C:	Not equal to zero
Option D:	Exactly two
8.	What is the exact solution for ODE $3y''-y' = 0$; $0 \leq x \leq 1$? Boundary Conditions: $y(0) = 0$, $y(3) = 1$
Option A:	$-0.6814 + 0.6814e^x$
Option B:	$-0.5814 + 0.5814e^{x/3}$
Option C:	$-0.5814 + 0.5814e^x$
Option D:	$-0.6814e^{x/3} + 0.6814e^{x/3}$
9.	According to Lagrange polynomial the shape function at node one of a five noded element is given by
Option A:	$\Phi_1 = \frac{(x-x_2)(x-x_3)(x-x_4)(x-x_5)}{(x_1-x_2)(x_1-x_3)(x_1-x_4)(x_1-x_5)}$
Option B:	$\Phi_1 = \frac{(x_1-x_2)(x_1-x_3)(x_1-x_4)(x_1-x_5)}{(x_1-x_2)(x_1-x_3)(x_1-x_4)(x_1-x_5)}$
Option C:	$\Phi_1 = \frac{(x-x_2)(x-x_3)(x-x_4)(x-x_5)}{(x_2-x_1)(x_3-x_1)(x_4-x_1)(x_5-x_1)}$
Option D:	$\Phi_1 = \frac{(x-x_2)(x-x_3)(x-x_4)(x-x_5)}{(x_1-x_2)(x_1-x_3)(x_1-x_4)(x_1-x_5)}$
10.	In theelement, the load is assumed to act uniformly over the entire cross-section.
Option A:	Truss
Option B:	Plane strain
Option C:	Thin shell
Option D:	Thick shell
11.	The global stiffness matrix is always
Option A:	Square, un-symmetric, non-singular and positive definite.
Option B:	Square, symmetric, non-singular and negative definite.
Option C:	Non-square, non-symmetric, non-singular and positive definite.
Option D:	Square, symmetric, singular and positive definite.
12.	In a structure, if there are 2 fixed dof and the size of global stiffness matrix is 6 x 6, then as per elimination approach the storing stiffness matrix has the order of
Option A:	2 x 2
Option B:	3 x 3
Option C:	4 x 4
Option D:	6 x 6
13.	Serendipity elements are element with
Option A:	Only internal node
Option B:	Only external nodes
Option C:	Both internal and external nodes
Option D:	Only nodes at boundary

14.	Patch test is performed to ensure
Option A:	Formulation Criteria
Option B:	Discretization criteria
Option C:	Convergence criteria
Option D:	Divergence Criteria
15.	Which error is caused due to truncation
Option A:	Discretization error
Option B:	Formulation error
Option C:	Numerical error
Option D:	Convergence error
16.	In a CST element
Option A:	Displacement is constant
Option B:	Displacement is linear
Option C:	Displacement is quadratic
Option D:	Displacement is cubic
17.	The dimension of the Stress-Strain Relation (D) matrix for 2D analysis is
Option A:	2x2
Option B:	3x3
Option C:	4x4
Option D:	6x6
18.	The total DOF of a CST element is
Option A:	3
Option B:	4
Option C:	6
Option D:	8
19.	The size of the element mass matrix of a CST element for the plane stress condition is
Option A:	2 x 2
Option B:	4 x 4
Option C:	6 x 6
Option D:	8 x 8
20. represents a set of relative displacements in various degrees of freedom.
Option A:	Mode shape
Option B:	Eigenvalues
Option C:	Eigenvectors
Option D:	Characteristic equation

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. $\frac{d^2y}{dx^2} - 10x^2 - 5 = 0$ in the domain $0 \leq x \leq 1$ Boundary conditions are: $y(0) = 0$ and $y(1) = 0$
B	Determine the nodal displacement and stresses in each element. Consider the cross-sectional area of each member of truss as 100 mm^2 and modulus of elasticity as 100 GPa . 
C	The nodal coordinates of a three node triangular element are (4, 6), (13, 8) and (10, 12). Determine the shape functions at a point P (9, 8).

Q3 (20 Marks)	Solve any Four out of Six (5 marks each)
A	Solve the following governing differential equation using least square method. $3 \frac{dy}{dx} - x = 0$ in the domain $0 \leq x \leq 1$ Boundary condition is: $y(0) = 1$
B	Solve the following Governing Differential Equation considering the two linear elements by directly using Element Matrix Equation (Avoid its development) for displacements and forces at nodes. Take $A = 0.1 \text{ m}^2$, $E = 100 \text{ GPa}$. External force, $P = 10 \text{ kN}$ as shown in figure 1. $\frac{d}{dx} \left[AE \frac{du}{dx} \right] = 0 \quad 0 \leq x \leq 12 \text{ cms}$ 
C	Determine the nodal displacement for the step bar shown in figure. Consider, $L_1 = L_2 = 100 \text{ mm}$, $A_1 = 100 \text{ mm}^2$, $A_2 = 50 \text{ mm}^2$, $E_1 = E_2 = 100 \text{ GPa}$, and $P = 5,000 \text{ N}$.

D	Explain Jacobian Matrix
E	A iso parametric four node quadrilateral element ABCD has coordinates A(10,5), B(12,6) , C(15,8) and D(8,4). Determine the Cartesian coordinate of a point P which has local coordinate $\xi= 0.8$ and $\eta= 0.2$
F	<p>Determine the natural frequency of vibration using consistent mass matrix with one bar element. An aluminum bar has a uniform cross-section, length 1 m and made up of a material having $E = 70 \times 10^9 \text{ N/m}^2$ and $\rho = 2700 \text{ kg/m}^3$.</p>

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: TE / Sem VI / R2016

Curriculum Scheme: 2016

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.	Which of the given equations satisfies the condition of Resonance?
Option A:	When $\omega_n = \omega_p$
Option B:	When $\omega_d = \omega_p$
Option C:	When $\omega_n = \omega$
Option D:	When $\omega = \omega_p$
2.	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
3.	The mass of a simple pendulum is doubled from its initial value keeping its length constant. What effect does it have on the time period of oscillations?
Option A:	Doubled
Option B:	Halved
Option C:	Increases by 4 times
Option D:	Remains same
4.	In which of the following cases of roots, overdamping occurs?
Option A:	real, unequal, negative
Option B:	real, negative, equal
Option C:	complex conjugate
Option D:	independent of the equation
5.	Which of the following is NOT TRUE with respect to Viscous Damping Coefficient (c) ?
Option A:	c is a function of dynamic viscosity of fluid
Option B:	c is a function of area of shear
Option C:	c is a function of distance of moving plate with respect to stationary plate
Option D:	c is a function of velocity of moving piston
6.	A spring mass damper system has mass, $m=2$ kg and spring stiffness, $k=500$ N/m. An initial amplitude of 1 cm is given to the mass and it is released from rest. After 5 complete cycles its amplitude is found to be 0.5 cm. Determine the friction force, assuming the damping to be purely Coulomb.

Option A:	0.125
Option B:	0.25
Option C:	1.125
Option D:	3.125
7.	-----is trial and error method used to find the natural frequency and mode shape of multimass lumped parameter system for free and forced vibrations.
Option A:	holzers method
Option B:	dunkerleys method
Option C:	rayleigh method
Option D:	matrix iteration method
8.	According to Maxwell reciprocal theorem, for a linear system, which of the following is correct.
Option A:	$A_{ij} = A_{ji}$
Option B:	$A_{ij} < A_{ji}$
Option C:	$A_{ij} > A_{ji}$
Option D:	$A_{ij} \neq A_{ji}$
9.	Eigen value indicates _____
Option A:	ωn
Option B:	ωn^2
Option C:	ωn^3
Option D:	$\sqrt{\omega n}$
10.	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
11.	In a Damped System Under Rotating Unbalance, the magnitude of rotating unbalance approaches unity,
Option A:	If frequency ratio approaches infinity irrespective of damping in the system
Option B:	If frequency ratio approaches unity irrespective of damping in the system
Option C:	If frequency ratio approaches infinity and damping ratio is equal to 1
Option D:	If frequency ratio approaches unity and damping ratio is equal to 1
12.	A weight of 50 N is suspended from a spring of stiffness 4000 N/m and is subjected to a harmonic force of amplitude 60 N and frequency 37.7 rad/s. If the static displacement of the spring due to the maximum applied force is 15 mm and natural frequency is 28 rad/s, Find the amplitude of forced motion of the weight.
Option A:	18.45 mm
Option B:	0.01845 mm
Option C:	12.5 mm
Option D:	0.0125 mm
13.	A 50 kg machine is mounted on four parallel springs each of stiffness 0.25 MN/m. When the machine operates at 40 Hz, the machine's steadystate amplitude is measured as 2 mm. What is the magnitude of the excitation force provided to the machine at this speed?

Option A:	4316.54 N
Option B:	5336.2 N
Option C:	1542.7 N
Option D:	6823.5 N
14.	The frequency range of a vibrometer is generally _____.
Option A:	1 Hz to 5 Hz
Option B:	10 Hz to 50 Hz
Option C:	100 Hz to 500 Hz
Option D:	1000 Hz to 5000 Hz
15.	An accelerometer is an instrument used to measure the _____ of a vibrating body.
Option A:	displacement
Option B:	velocity
Option C:	acceleration
Option D:	momentum
16.	The accelerometer is used as a transducer to measure earthquake in Richter scale. Its design is based on the principle that _____.
Option A:	its natural frequency is very low in comparison to the frequency of vibration
Option B:	its natural frequency is very high in comparison to the frequency of vibration
Option C:	its natural frequency is equal to the frequency of vibration
Option D:	measurement of vibratory motion is without any reference point
17.	In FFT Analyzer, the digital signals converted into analog signals and send to the _____.
Option A:	cathode ray oscilloscope
Option B:	cathode ray tube
Option C:	anode ray oscilloscope
Option D:	anode ray tube
18.	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:	$m_1 \cdot r_2 = m_2 \cdot r_1$
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:	$m_2 = m_1 \cdot r_2 \cdot r_1$
19.	In order to balance the reciprocating masses
Option A:	primary forces and couples must be balanced
Option B:	secondary forces and couples must be balanced
Option C:	primary & secondary , forces and couples must be balanced
Option D:	Only primary forces must be balanced
20.	-----is used to find the natural frequency of the system when transverse point load are acting on the beam or shaft.
Option A:	holzers method
Option B:	dunkerleys method
Option C:	rayleigh method
Option D:	matrix iteration method

Subjective / Descriptive questions

Option 1

Q2 (20 Marks)	Solve any Four out of Six:	5 marks each
A	Explain with suitable example how condition monitoring can be used to avoid catastrophic failures.	
B	Define whirling speed. Derive the equation for the critical speed of a light shaft with a single disc without damping.	
C	A viscously damped spring mass-damper systems has mass of 10 kg, damping coefficient of 150 N-s/m, and spring stiffness of 1000 N/m. Determine the values of the damping ratio, damped natural frequency logarithmic decrement	
D	Briefly explain the steps involved in vibration analysis	
E	Explain the terms: Logarithmic decrement, Magnification Factor and Transmissibility	
F	Write short note on Holzer's method.	

Q3. (20 Marks)	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	Four masses A,B,C and D are completely balanced . Masses C and D make angles of 90^0 and 195^0 respectively with that of mass B in the counter-clockwise direction. The rotating masses have following properties- $m_B = 25$ kg, $m_C = 40$ kg, $m_D = 35$ kg, $r_A = 150$ mm, $r_B = 200$ mm, $r_C = 100$ mm, $r_D = 180$ mm. Planes B and C are 250 mm apart. Determine –(i) the mass A and angular position w.r.t. mass B (ii) The position of all the planes relative to plane of the mass A.	
C	A Spring-mass system, having a static deflection of 10 mm and negligible damping is used as a vibrometer. when mounted on a machine operating at 4000 rpm, the relative amplitude is recorded as 1 mm. Find the maximum value of displacement, velocity, and acceleration of the machine. .	

University of Mumbai
Examination May-June 2021 under cluster 9(Lead College: FAMT)

Examinations Commencing from 1st June 2021

Program: Automobile Engineering

Curriculum Scheme: Rev2016

Examination: Third Year Semester VI

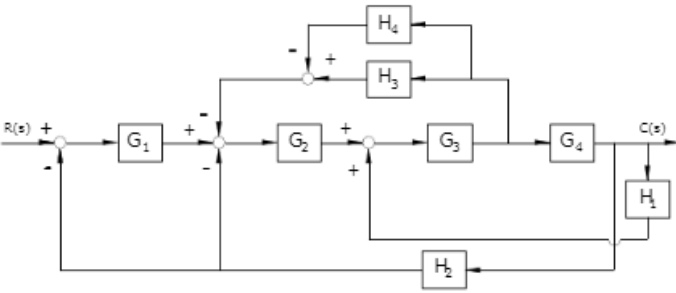
Course Code: AEDLO6021 and Course Name: Mechatronics

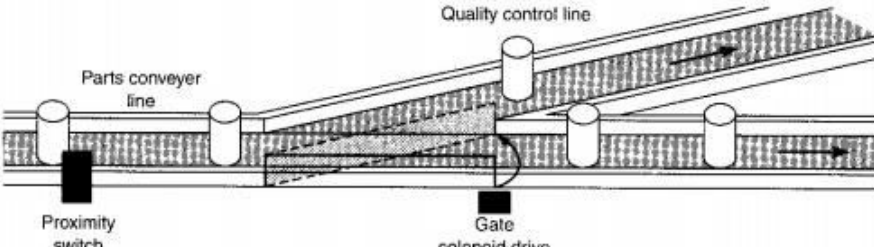
Time: 2hour Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	A one-way valve that lets air into the reservoir of a compressor, but doesn't let it out, is a
Option A:	Check valve
Option B:	Control valve
Option C:	Receiver valve
Option D:	Three way valve
2.	Which of the following logic valve is known as shuttle valve?
Option A:	OR gate
Option B:	AND gate
Option C:	NOR gate
Option D:	NAND
3.	What is the notation used for the sequence of operations mentioned below? 1. Cylinder B undergoes forward stroke 2. Cylinder A undergoes forward stroke 3. Cylinder A undergoes backward stroke 4. Cylinder B undergoes backward stroke
Option A:	B- A- A+ B+
Option B:	(BA)- (A B)+
Option C:	B+ A+ A- B-
Option D:	(BA)+ (A B)-
4.	Consider the open loop transfer function $(K(s+5)) / ((s+2)(s+6))$. In the root locus diagram the centroid will be located at:
Option A:	-1
Option B:	-2
Option C:	-3
Option D:	-4
5.	PID controller stands for
Option A:	Proportional-Internal-Divider Controller
Option B:	Proportional-Integral-Derivative Controller
Option C:	Practical-Internal-Differential Controller
Option D:	Practical-Integral-Derivative Controller
6.	Which of the following cannot be an input that is given to the PLC?
Option A:	Manual switch

Option B:	Relay
Option C:	Sensor
Option D:	LED Bulb
7.	For the programming of Programming Logic Controller (PLC) we use
Option A:	C-Programming
Option B:	Python Programming
Option C:	Ladder logic programming
Option D:	CNC Programming
8.	An example of discrete (digital) control is
Option A:	Varying the volume of a music system
Option B:	Turning a lamp ON or OFF
Option C:	Varying the brightness of a lamp
Option D:	Controlling the speed of a fan
9.	According to Hurwitz criterion the characteristic equation $S^3 + s^2 + 2s + 24 = 0$ is
Option A:	Stable
Option B:	Marginally stable
Option C:	Conditionally stable
Option D:	Unstable
10.	In Nyquist criterion roots of the characteristic equation are given by
Option A:	Zeros of open loop transfer function
Option B:	Zeros of closed loop transfer function
Option C:	Poles of closed loop transfer function
Option D:	Poles of open loop transfer function
11.	_____ is the time required for the response to reach 50% of the final value in the first attempt.
Option A:	Rise time
Option B:	Peak time
Option C:	Settling time
Option D:	Delay time
12.	With a stator having 8 teeth and a rotor having 6 teeth in a stepper motor, step angle will be
Option A:	7.5°.
Option B:	15°.
Option C:	30°.
Option D:	45°.
13.	Transducer is used to convert a _____
Option A:	physical quantity into an electrical signal
Option B:	electrical signal into a physical quantity
Option C:	physical quantity into a mechanical quantity
Option D:	physical quantity into a chemical quantity
14.	A low-pass filter has a cutoff frequency of 1.5 kHz. Determine the bandwidth of the filter.

Option A:	0.75 kHz.
Option B:	1.50 kHz.
Option C:	2.25 kHz
Option D:	3.00 kHz
15.	the output impedance of the R-2R resistor network is always equal to _____, regardless of the size (number of bits) of the network.
Option A:	0.5R
Option B:	R
Option C:	2R
Option D:	3R
16.	What is the input of the data acquisition system (DAQ) to which a transducer is connected called?
Option A:	control element
Option B:	interface
Option C:	channel
Option D:	function
17.	If blocks are in parallel, and the gain is G1 and G2. What will be the gain of resultant block
Option A:	G1+G2
Option B:	G1/G2
Option C:	G1*G2
Option D:	1+G1G2
18.	Match the following notations with their meanings: A. G(s) ----- 1) Laplace of error signal B. H(s) ----- 2) Laplace of output signal C. C(s) ----- 3) Forward transfer function D. E(s) ----- 4) Feedback transfer function
Option A:	A- 2, B- 3, C- 1, D- 4
Option B:	A- 3, B- 4, C- 2, D- 1
Option C:	A- 2, B- 3, C- 4, D- 1
Option D:	A- 1, B- 2, C- 3, D- 4
19.	While shifting a take-off point after the summing point, which among the following should be added?
Option A:	Summing point in series with take-off point
Option B:	Summing point in parallel with take-off point
Option C:	Block of reciprocal transfer function
Option D:	Block of inverse transfer function
20.	What does the numbers in 3/2 valve mean?
Option A:	3 positions and 2 ports
Option B:	2 positions and 2 ports
Option C:	2 positions and 3 ports
Option D:	3 positions and 3 ports

Q2	Solve any Two Questions out of Three	10 marks each
A	Determine the transfer function of the mechatronic system shown in figure. 	
B	Illustrate working of i) Tactile sensor ii) Thermocouple. Enlist four applications for each of this sensor.	
C	Illustrate with a circuit diagram the working of i) R-2R circuit ii) ADC Successive Approximation .	

Q3	Solve any Two Questions out of Three	10 marks each
A	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. A+ B+ DelayA- B- Develop an electro-pneumatic circuit using 5/2 double solenoid as final directional control valves.	
B	Sketch the Bode plots for the following transfer function. Determine phase margin, gain margin, phase crossover frequency, gain crossover frequency. Comment on the stability of the system. $G(s) = \frac{80}{s(s+2)(s+10)}$	
C	Develop a ladder logic diagram to implement the process illustrated in Figure. An up-counter must be programmed as part of a batch-counting operation to sort parts automatically for quality control. The counter is installed to divert 1 part out of every 1000 for quality control or inspection purposes. The circuit operates as follows: <ul style="list-style-type: none"> • A star/stop pushbutton station is used to turn the conveyor motor on and off. • A proximity sensor counts the parts as they pass by on the conveyor. • When a count of 1000 is reached, the counter's output activates the gate solenoid, diverting the part to the inspection line. • The gate solenoid is energized for 2 s, which allows enough time for the part to continue to the quality control line. • The gate returns to its normal position when the 2 s time period ends. • The counter resets to 0 and continues to accumulate counts. • A reset pushbutton is provided to reset the counter manually. 	

University of Mumbai
Examination June 2021 under Cluster 8 (Lead College: PHCET)

Examinations Commencing from 1st June 2021

Program: Automobile Engineering

Curriculum Scheme: Rev2016

Examination: TE Semester VI

Course Code: AEDLO6023 and Course Name: Automotive Materials

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Sintered friction materials are used in automobiles to make.....
Option A:	Wheels
Option B:	Engines
Option C:	Brakes
Option D:	Car body
2.	Which process is commonly used to make Engines?
Option A:	Forging
Option B:	Casting
Option C:	Rolling
Option D:	Bending
3.	What is the main factor that influences selection of material for reduction of weight of the car?
Option A:	Cost
Option B:	Availability of material
Option C:	Property of material
Option D:	Process parameters
4.	What are three main areas of the car where weight reduction is largely possible
Option A:	Chassis, Interior & Glazing
Option B:	Powertrain, Interior & Closures
Option C:	Body structure, Interior & Glazing
Option D:	Chassis, Body structure & Power train
5.	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
6.	What is risk in adopting new material in car designing
Option A:	Cost and material characterization
Option B:	Joining techniques
Option C:	Simulation and process parameters
Option D:	All of them

7.	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:	Aluminiumhas discontinuous stress strain curve
Option D:	No difference
8.	What material is used to make headliner
Option A:	Nylon fabrics
Option B:	Foam
Option C:	Polypropylene
Option D:	Ceramic
9.	In autoclave process ----- welding is used to avoid any relative movement in between the prepreg sheets.
Option A:	Spot
Option B:	TIG
Option C:	MIG
Option D:	Other
10.	The basic mechanism of pultrusion system is similar to that of the metal ----- process.
Option A:	Forging
Option B:	Sheet metal forming
Option C:	Hydro forming
Option D:	Extrusion
11.	Injection molding is noted for.....
Option A:	High cost production of plastic parts in large quantities
Option B:	low cost production of plastic parts in large quantities
Option C:	low cost production of plastic parts in Small quantities
Option D:	Medium low cost production of plastic parts in large quantities
12.	Fluid viscosity increases within MR damper as electromagnet intensity
Option A:	Decreases
Option B:	Increases
Option C:	Remains unchanged
Option D:	Becomes zero
13.	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
14.	A technique that uses vacuum pressure to drive resin into a laminate known as
Option A:	Injection Moulding
Option B:	Autoclave Process
Option C:	Compression Moulding

Option D:	Vacuum Infusion Process
15.	Approximately what % of weight is contributed by interior to total weight of car?
Option A:	14
Option B:	25
Option C:	40
Option D:	50
16.	The engine block of the automobile is mounted on vibration isolators which perform the dual function ofthe engine from vibrations
Option A:	isolating, isolating
Option B:	isolating, engaging
Option C:	engaging, engaging
Option D:	engaging, isolating
17.	Shape Memory Tumble flaps are placed inthe air intake manifolds of the engine and are used to control the supply of..... leading to tumble flow such thatis improved.
Option A:	water, combustion
Option B:	air, combustion
Option C:	air, damping
Option D:	Nitrogen, Mixing
18.	Selection of materials for specific property requirement for particular applications can be done using
Option A:	Ashby charts
Option B:	Millers charts
Option C:	Soderberg charts
Option D:	Gantt charts
19.	Need for as well as environmental regulations and policies and customer demand forces the auto maker companies to focus on developing new materials and re designing of the existing oneand selecting materials reasonably.
Option A:	higher weight and better fuel efficiency
Option B:	weight minimisation alone
Option C:	higher fuel efficiency and weight minimization
Option D:	higher fuel efficiency and bigger car body
20.	Two properties most often used in deciding the performance index for automotive components are
Option A:	E and ρ
Option B:	E and G
Option C:	ρ and m
Option D:	E and cp

Q2 (20 Marks)	Solve any Four out of Six (5 marks each)
A	Explain body design concepts with focus on light weighting.
B	Write down different types of plastics and its applications in Automobiles
C	With the help of neat sketch explain Hand lay-up processes.
D	Mention properties and composition of glass used in automobiles
E	What is MR fluid. Enlist application of MR fluid in Automobile Industry.
F	Explain Car seat consideration and material used.

Q3. (20 Marks)	Solve any Two Questions out of Three (10 marks each)
A	Describe need to shift new materials and risk in adopting new materials
B	With the help of neat sketch explain Resin Transfer Moulding Process
C	Explain Ashby charts for making a good selection of materials in automobiles