University of Mumbai

Examination 2020 under cluster 9 (FAMT)

Examinations Commencing from 7th January 2021 to 20th January 2021

Program: **Mechanical Engineering**

Curriculum Scheme: **Rev2019 (C Scheme)**

Examination: **SE** Semester **III**

Course Code: MEC 301 and Course Name: Engineering Mathematics III

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.	$L[e^{-3t} \sin 2t] =$
Option A:	$\frac{s}{s+3)^2+4}$
Option B:	$\frac{2}{s-3)^2+4}$
Option C:	$\frac{2}{s+3)^2+4}$
Option D:	$\frac{2}{s+3)^2-4}$
2.	$L[t\, e^{2t}]$
Option A:	$1/(S-2)^2$
Option B:	$1/(S+2)^2$
Option C:	$1/(S-3)^2$
Option D:	$1/(S-2)^3$
3.	L[f(t)/t]
Option A:	$\int_0^\infty \emptyset(t)ds$
Option B:	$\int_s^\infty \emptyset(s)ds$
Option C:	$\int_s^a \emptyset(s)ds$
Option D:	$\int_0^\infty \emptyset(s)ds$
4.	$L^{-1}[\, 1/(S+2)^4\,]$
Option A:	$e^{-2t}.t^3/3$

Option B:	$e^{-2t}.t^4/6$
Option C:	$e^{-3t}.t^3/6$
Option D:	$e^{-2t}.t^3/6$
5.	The inverse Laplace transform of $\frac{s}{s^2+5s+6}$
Option A:	$3e^{-3t}-2e^{-2t}$
Option B:	$3e^{-3t}+2e^{-2t}$
Option C:	$3e^{-3t}-2e^{-t}$
Option D:	$3e^{-t}-2e^{-2t}$
6.	The inverse Laplace transform of $\log(\frac{s-5}{s-7})$
Option A:	$(e^{7t}+e^{5t})/t$
Option B:	$(e^{-7t}-e^{-5t})/t$
Option C:	$(e^{5t}-e^{7t})/t$
Option D:	$(e^{7t}-e^{5t})/t$
7.	$L^{-1}[\cot^{-1}3s]$
Option A:	[cos(t/3)] /t
Option B:	[sin(t/3)] /t
Option C:	[sin(t/2)] /t
Option D:	[sin(t/3)] .t
8.	Find analytic function where $u = x^2 + y^2 - 5x + y + 2$
Option A:	$z^2 - 5z - i\,z + c$
Option B:	$z^2 - 5z + i\,z + c$
Option C:	$z^2 + 5z - i\,z + c$
Option D:	$z^2 + 5z + i\,z + c$
9.	Which of following function is harmonic
Option A:	$u= e^x \cos y - x^3$
Option B:	u= sinx. cosy
Option C:	u= cosx. coshy
Option D:	u = sinhx. sinhy
10.	Which of following function is analytic
Option A:	$e^x(\cos y - i \sin y)$
Option B:	$z^2 - \bar{z}$
Option C:	$e^{-x}(\cos y - i \sin y)$
Option D:	$2x + ixy^2$
11.	For the Fourier Series $\frac{a_0}{2} + \sum a_n \cos nx + \sum b_n \sin nx$ of the function $f(x) = x\sin x, 0 \le x \le 2\pi$, the value of $a_0$is _____
Option A:	-2
Option B:	2
Option C:	1
Option D:	-3
12.	For the Fourier Series $\frac{a_0}{2} + \sum a_n \cos nx + \sum b_n \sin nx$ of the function $f(x) = 4 - x^2, 0 \le x \le 2$, the value of $a_n$is _____

Option A:	$-4/n^2\pi^2$
Option B:	$4/n^2\pi^2$
Option C:	$-8/n^2\pi^2$
Option D:	$8/n^2\pi^2$
13.	If f(x) is periodic function with period 2L defined in the interval C to C+2L then Fourier coefficient b_n is
Option A:	$\int_C^{C+2L} f(x)sin\frac{n\pi x}{L}\,dx$
Option B:	$\frac{1}{L}\int_C^{C+2L} f(x)sin\frac{n\pi x}{L}\,dx$
Option C:	$\frac{1}{L}\int_C^{C+2L} sin\frac{n\pi x}{L}\,dx$
Option D:	$\frac{1}{L}\int_C^{C+2L} f(x)cos\frac{n\pi x}{L}\,dx$
14.	Half Range Fourier sine Series of $f(x) = cosx,\ 0 \le x \le \pi$ is $\sum b_n sinnx$. What is the value of b_1?
Option A:	$1/\pi$
Option B:	$2/\pi$
Option C:	0
Option D:	$-2/\pi$
15.	The general solution of wave equation $\frac{\partial^2 u}{\partial t^2} - \alpha^2\frac{\partial^2 u}{\partial x^2} = 0$ is
Option A:	$u = a\,cos\,m\,x + b\,sin\,m\,x$ where a,b are constants
Option B:	$u = (a\,cos\,m\,x + b\,sin\,m\,x)c\,cos\,m\alpha t$ where a,b,c are constants
Option C:	$u = (a\,cos\,m\,x + b\,sin\,m\,x)(c\,cos\,m\alpha t + d\,sin\,m\,\alpha t)$ where a,b,c,d are constants
Option D:	$u = (a\,cos\,m\,\alpha x + b\,sin\,m\,\alpha x)(c\,cos\,m\alpha t + d\,sin\,m\,\alpha t)$ where a,b,c,d are constants
16.	Using method of separation of variable, solve $3\frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$,given $u(x,0) = 4e^{-x}$
Option A:	$u = e^{-(2x-3y)/2}$
Option B:	$u = 4e^{(2x-3y)/2}$
Option C:	$u = 3e^{-(2x-3y)/2}$
Option D:	$u = 4e^{-(2x-3y)/2}$
17.	Consider the one-dimensional heat equation: $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$ By using Crank-Nicholson formula, taking $h = \frac{1}{4}$ (the step size of x) we get k(step size of t)to be equal to
Option A:	1/16
Option B:	1/8
Option C:	1
Option D:	1/4

18.	If characteristic equation of matrix A of order 3×3 is $\lambda^3 - 3\lambda^2 + 3\lambda - 1 = 0$. Then by Cayley Hamilton theorem A^{-1} is equal to
Option A:	$A^3 - 3A^2 + 3A - I$
Option B:	$A^2 - 3A - 3I$
Option C:	$3A^2 - 3A - I$
Option D:	$A^2 - 3A + 3I$
19.	$A = \begin{bmatrix} 2 & 3 \\ -3 & -4 \end{bmatrix}$ then the value of A^{50}
Option A:	$\begin{bmatrix} 149 & -150 \\ 150 & 151 \end{bmatrix}$
Option B:	$\begin{bmatrix} -149 & -150 \\ 150 & 151 \end{bmatrix}$
Option C:	$\begin{bmatrix} -149 & 150 \\ 150 & 151 \end{bmatrix}$
Option D:	$\begin{bmatrix} -149 & -150 \\ 150 & -151 \end{bmatrix}$
20.	$A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}$ The eigen vector corresponding to eigen value $\lambda = -1$ is
Option A:	$\begin{bmatrix} 6 \\ -2 \\ 7 \end{bmatrix}$
Option B:	$\begin{bmatrix} -3 \\ -2 \\ 7 \end{bmatrix}$
Option C:	$\begin{bmatrix} -6 \\ -2 \\ 7 \end{bmatrix}$
Option D:	$\begin{bmatrix} -6 \\ -2 \\ 8 \end{bmatrix}$

Option 1

Q2 . **(20 Marks Each)**	**Solve any Four out of Six** **5 marks each**
A	Evaluate $\int_0^\infty \frac{\cos 6t - \cos 4t}{t} dt$
B	Find Inverse Laplace transform by convolution theorem $\frac{1}{(s^2+9)(s^2+4)}$
C	Show that $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ is diagonalizable. Determine transforming and diagonal matrix.
D	Find Fourier series of $f(x) = x^2$ in the interval $(-\pi, \pi)$. Hence prove that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} \ldots\ldots = \frac{\pi^2}{6}$

E	Solve by Crank-Nicholson simplified formula $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0, 0 \leq x \leq 1$ subject to the condition $u(0,t) = 0, u(1,t) = 100,$ $u(x,0)$ =100 (x- x^2)h=0.25 for one time step.
F	Show that u = e^x (x cos y - y sin y) is harmonic Determine harmonic conjugate and find analytic function

Q3. **(20 Marks Each)**	**Solve any Four out of Six** **5 marks each**
A	Find the orthogonal trajectories of the curve is e^x cos y – xy =c
B	Find half range sine series of $f(x) = lx - x^2; o < x < l$ hence show that $\frac{1}{1^3} - \frac{1}{3^3} + \frac{1}{5^3} \ldots\ldots = \frac{\pi^3}{32}$
C	Solve $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial u}{\partial t} = 0$ by Bender-Schmidt method, given $u(0,t) = 0, u(5,t) = 0, u(x,0) = x^2 (25 - x^2)$ Assume h=1 & find the values of u upto t=3
D	If $A = \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$ Calculate e^A and 5^A
E	Using partial fractions find the inverse Laplace transforms of $\frac{5s+3}{(s-1)(s^2+2s+5)}$
F	Evaluate $\int_0^\infty e^t \sin 2t \cos 3t \, dt$

University of Mumbai

Examination 2020 under cluster 09 (FAMT)

Examinations Commencing from 7th January 2021 to 20th January 2021

Program: Mechanical Engineering

Curriculum Scheme: Rev 2019 C Scheme

Examination: SE Semester: III

Course Code: MEC302 and Course Name: Strength of Materials

Time: 2 hours 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.	Within the elastic limit the ratio of shear stress to shear strain is called
Option A:	Bulk Modulus
Option B:	Modulus of rigidity
Option C:	Modulus of elasticity
Option D:	Poisson's ratio
2.	For a given material the value of E= $1.8x10^5$ N/mm^2 and G= 82000 N/mm^2 , then the value of bulk modulus
Option A:	$0.7455x10^5$ N/mm^2
Option B:	$0.07455x10^5$ N/mm^2
Option C:	$1.42x10^5$ N/mm^2
Option D:	$1.85x10^5$ N/mm^2
3.	A rod of 10mm diameter and 400mm long is subjected to an axial compressive force of 4200N. If the material of the rod is having E= $2x10^5$ N/mm^2 , then the net compression is
Option A:	10.7mm
Option B:	0.0107mm
Option C:	1.07mm
Option D:	0.107mm
4.	The MI of quarter circle with diameter 35mm about XX axis passing through its centroid is
Option A:	8544.8 mm^4
Option B:	6788.4 mm^4
Option C:	5158.4 mm^4
Option D:	3159.95 mm^4
5.	When a rod of 12mm diameter and 1200mm long is heated from room temperature 32 deg Celsius to 100 deg Celsius. If the coefficient linear expansion and Young's Modulus of material are $12x10^{-6}$ per deg Celsius and $2x10^5$ N/mm^2, then the thermal stress induced in the material if the entire expansion is prevented
Option A:	163.2 N/mm^2
Option B:	195.5 N/mm^2
Option C:	16.32 N/mm^2
Option D:	1632 N/mm^2
6.	A simply supported beam of 5m span carries a point load of 22KN at a distance 2m from RHS. What is the BM at the center of the span
Option A:	66 KN-m

Option B:	22 KN-m
Option C:	33 KN-m
Option D:	44 KN-m
7.	A simply supported beam of span 4m is carrying a UDL of 10KN/m. What is the BM at a distance 1.5m to left of right hand support
Option A:	19.75 KN-m
Option B:	18.75 KN-m
Option C:	30 KN-m
Option D:	15 KN-m
8.	The rate of change of BM at any section represents
Option A:	BM at that section
Option B:	Shear force at the section
Option C:	Modulus of rigidity at that section
Option D:	Young's Modulus of material at that section
9.	A beam of rectangular section with width 200mm depth 400mm is subjected to an external BM of 25 KN-m. What is the maximum bending stress induced in the section
Option A:	4.69 N/mm^2
Option B:	46.9 N/mm^2
Option C:	469 N/mm^2
Option D:	0.469 N/mm^2
10.	A hollow circular section of 150mm outer diameter and 100mm inner diameter is subjected to 22KN-m external BM. Find the bending stress at the inner edge.
Option A:	5.516 N/mm^2
Option B:	110.16 N/mm^2
Option C:	82.74 N/mm^2
Option D:	55.16 N/mm^2
11.	The shear stress distribution for the triangular section is
Option A:	Linear
Option B:	Hyperbolic
Option C:	Parabolic
Option D:	Cubic
12.	A shaft has to transmit 30KW at 660rpm. The diameter and length of shaft are 30mm and 1.5m. If G= $0.8x10^5$ N/mm^2 , what is angle of twist
Option A:	5.864 deg
Option B:	6.584 deg
Option C:	0.564 deg
Option D:	58.64 deg
13.	A square rod 15mmx15mmx300mm is subjected to an axial pull of 12KN. If E= $2x10^5$ N/mm^2, find strain energy stored
Option A:	4800 N-mm
Option B:	48 N-mm
Option C:	960 N-mm
Option D:	480 N-mm
14.	If 'F' is the load acting on a C/s area 'A', then if the load is suddenly applied. The instantaneous stress induced is given by

Option A:	2(F/A)
Option B:	F/A
Option C:	F/2A
Option D:	4(F/A)
15.	A rectangular C/s beam 300mm wide and 450mm deep is simply supported over a span of 5m and carries a UDL of 90 N/mm. If E= $2.1x10^5$ N/mm^2, what is the deflection at the center
Option A:	-15.31mm
Option B:	-1.531mm
Option C:	-0.1531mm
Option D:	-153.1mm
16.	A solid shaft 32mm diameter transmitting 40 KW at 880rpm. The maximum shear stress induced in the shaft material is
Option A:	67.464 N/mm^2
Option B:	92.528 N/mm^2
Option C:	6.7464 N/mm^2
Option D:	9.2528 N/mm^2
17.	A pressure vessel is classified as thin when
Option A:	Diameter to thickness ratio is less than 20
Option B:	Diameter to thickness ratio is equal to 20
Option C:	Diameter to thickness ratio is greater than 20
Option D:	Diameter to thickness ratio is greater than 35
18.	The crippling load of a hollow cylindrical column, 150mm outer diameter and 100mm inner diameter and 4000mm long (both ends are fixed) and having E= $2x10^5$ N/mm^2 is
Option A:	492.043 KN
Option B:	4920.43 KN
Option C:	49.2043 KN
Option D:	49204.3 KN
19.	A point in a strained material is subjected to direct tensile stress of 200 N/mm^2 accompanied by a shear stress of 50N/mm^2. What is the value of major principal stress
Option A:	211.803 N/mm^2
Option B:	250 N/mm^2
Option C:	222.606 N/mm^2
Option D:	150 N/mm^2
20.	A rod of 15mm diameter and 1200mm long is subjected to a tensile load of 4000N and the elongation is found to be 0.20mm. Then the value of E of the rod material is
Option A:	$1.9x10^5$ N/mm^2
Option B:	$2x10^5$ N/mm^2
Option C:	178722.11 N/mm^2
Option D:	135812.22 N/mm^2

Q2.	**Solve any Two Questions out of Three** **10 marks each**
A	A M.S. bar 28mm diameter and 500mm long is encased in a brass tube whose external diameter is 42mm and internal diameter 30mm. The ends of the assembly are rigidity connected. This composite bar is heated through 100 deg Celsius. Calculate the stress in each material and change in length Take $\propto_s = 12.5 \times 10^{-6}$ per deg Celsius $\propto_b = 16 \times 10^{-6}$ per deg Celsius $E_s = 2 \times 10^5$ N/mm^2 $E_b = 1 \times 10^5$ N/mm^2
B	ABCD is an overhanging beam overhung on both sides having supports at B and C. Take AB=2m BC=6m CD=3m. This is carrying a UDL of 10 KN/m for entire span. Draw SFD & BMD and show points of contrafluxure if any.
C	A cantilever beam of span 4m has T cross section. The flange is 200mm wide and 20mm thick. The web is 20m thick and over all depth of the section is 200mm. If the permissible tensile stress is 100MPa, find the maximum intensity of UDL that may be applied for the entire span length.

Q3.	**Solve any Two Questions out of Three** **10 marks each**
A	A shaft has to transmit 40KW at 440rpm. The material of shaft is having permissible shear stress of 50 N/mm^2 and G=0.8x10^5 N/mm^2. Also the permissible twist over a length of 2.5m is 1.5 deg. Determine the inner and outer diameter of hollow shaft if D/d=1.5.
B	A hollow CI column has outer diameter 1200mm and internal diameter of 700mm is 8m long and is fixed at one end and free at other and. Assume f_c=550 N/mm^2, $\propto = 1/1600$ and E=100 GPa. Determine crippling load a. By Euler's Equation b. By Rankine's Equation
C	A simply supported beam of 6m span carries a UDL of 8 KN/m for the entire span. If EI is constant then find a. Deflection at the center b. Strain energy stored in the beam.

University of Mumbai

Examination 2020 under cluster 09 (FAMT)

Program: MECHANICAL ENGINEERING

Curriculum Scheme: Rev 2019 C Scheme

Examination: SE Semester: III

Course Code: MEC303 and Course Name: PRODUCTION PROCESSES

Time: 2-hours 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 manufacturing processes uses amorphous raw material to produce a solid body as a final product?
Option A:	primary shaping process
Option B:	forming process
Option C:	joining process
Option D:	surface finishing process
2.	Which of the following moulding tools is used to make a series of small holes in sand mould to permit gases to escape while the molten metal is being poured?
Option A:	gate cutter
Option B:	strike off bar
Option C:	vent rod
Option D:	sprue pin
3.	In a gating system of sand mould, which of the following passage is used to carry molten metal from runner to mould cavity?
Option A:	sprue
Option B:	riser
Option C:	gate
Option D:	pouring basin
4.	Which type of moulding sand is preferred for machine moulding?
Option A:	parting sand
Option B:	system sand
Option C:	core sand
Option D:	loam sand
5.	Which of the following processes is used for joining similar metals by application of heat, with or without application of pressure and addition of filler material?
Option A:	welding
Option B:	cutting
Option C:	drilling
Option D:	riveting
6.	In oxy-acetylene welding, through which of the following part of welding equipment, the gases just pass prior to their ignition and burning?
Option A:	hose
Option B:	pressure regulator

Option C:	welding tip
Option D:	gas cylinder
7.	In which of the arc welding technique the arc is submerged below a layer of protective powder or alloying elements?
Option A:	submerged arc welding
Option B:	oxy-acetylene welding
Option C:	metal inert gas welding
Option D:	tungsten inert gas welding
8.	Which of the following welding technique uses frictional energy generated when two bodies slide on each other?
Option A:	ultrasonic welding
Option B:	explosive welding
Option C:	friction welding
Option D:	gas welding
9.	Which of the following components is mainly manufactured by performing metal forging?
Option A:	Piston
Option B:	Engine block
Option C:	Connecting rod
Option D:	Crankcase
10.	Which of the following can help in determining the behavior of the material in metal forming?
Option A:	Stress-strain curve
Option B:	Size of material
Option C:	Shape of material
Option D:	Color of material
11	_____is the change in width between the stock entering & leaving the stand in rolling pass.
Option A:	Draft
Option B:	Spread
Option C:	Elongation
Option D:	Indirect Extrusion
12	The process of punching a set of holes in a metal sheet is known as?
Option A:	Parting
Option B:	Perforating
Option C:	Notching
Option D:	Lancing
13	Non-Traditional machining is also called as?
Option A:	Partial Contact Machining
Option B:	Contact Machining
Option C:	Non-contact Machining
Option D:	Half Contact Machining

14	Which of the unconventional process can be used effectively for machining of plastic material?
Option A:	Electro chemical machining
Option B:	Laser beam machining
Option C:	Electric discharge machining
Option D:	Ultrasonic machining
15	Which of the following is NOT a function of electrolyte in ECM?
Option A:	It provides a non-reactive environment
Option B:	It carries away heat and waste product
Option C:	It helps in electrochemical reaction
Option D:	It completes the circuit
16	Ultrasonic Machining uses _____ method for material removal.
Option A:	Thermal melting
Option B:	Electrochemical Oxidation
Option C:	Anodic dissolution
Option D:	Abrasion
17	Which of the following is not traditional machining?
Option A:	turning
Option B:	abrasive jet machining
Option C:	milling
Option D:	drilling
18	Half nut is connected with.....
Option A:	Milling machine
Option B:	Locking device
Option C:	Jigs and fixture
Option D:	Thread cutting on lathe
19	A flat surface can be produced by a lathe machine, if the cutting tool moves _____
Option A:	Parallel to the axis of rotation of workpiece
Option B:	perpendicular to the axis of rotation of workpiece
Option C:	at an angle of 45^0
Option D:	at an angle of 60^0
20	Gear shaping is related to.....
Option A:	Template
Option B:	Form tooth process
Option C:	Hob
Option D:	Generating

Q2. **20 Marks**	**Solve any Four out of Six** **5 marks each**
A	With neat sketch explain the gating system required for sand moulding process.
B	Write short note on metal inert gas welding.
C	Write a short note on Rolling Defects.
D	Classify various Non-traditional Machining processes.
E	How is a lathe specified?
F	Write a note on secondary and finishing operation in powder metallurgy.

Q3. **20 Marks**	**Solve any Four out of Six** **5 marks each**
A	Write short note on shell moulding process.
B	With neat sketch explain the working principle of Gas welding technique.
C	Explain in brief: Pattern Allowances.
D	What is the difference between traditional and non-traditional machining processes?
E	Discuss the various types of chips produced during metal cutting?
F	Write stapes of manufacturing powder metallurgy parts.

University of Mumbai

Examination 2020 under cluster 09 (FAMT)

Program: Mechanical Engineering

Curriculum Scheme: Rev 2019 C Scheme

Examination: Second year Semester: III

Course Code: MEC304 and Course Name: Materials & Metallurgy

Time: 2 hours Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
Q1.	These are the examples of single crystals
Option A:	Rock salt, calcites, quartz
Option B:	Rock, sand, metals, salts
Option C:	brass, bronze, copper alloys
Option D:	steel, cast iron
Q2.	BCC structure has following number of atoms per unit cell
Option A:	1
Option B:	3
Option C:	2
Option D:	4
Q3.	Following is closed packed plane for FCC metals
Option A:	(100)
Option B:	(110)
Option C:	(111)
Option D:	(101)
Q4.	In Recovery following process take place
Option A:	strain free grains
Option B:	Reduction in point defect density
Option C:	change in grain size
Option D:	new grains are formed
Q5.	For pure metal solidification occurs at
Option A:	range of temperature
Option B:	fixed temperature
Option C:	any variable temperature
Option D:	no fixed temperature
Q6.	Nucleation refers to
Option A:	formation of new tiny crystal
Option B:	melting of crystal
Option C:	growth of crystal
Option D:	formation of big crystal
Q7.	In iron carbide diagram eutectoid reaction take place at
Option A:	927 degree centigrade & 0.8% Carbon
Option B:	527 degree centigrade & 0.8% Carbon
Option C:	727 degree centigrade & 0.8% Carbon

Option D:	727 degree centigrade & 0.08% Carbon
Q8.	For 0.4% carbon steel following will be microstructure at room temperature
Option A:	25% pearlite & 75% ferrite
Option B:	25% pearlite & 75% cementite
Option C:	5% pearlite & 95% ferrite
Option D:	50% pearlite & 50% ferrite
Q9.	Gray cast iron is used for machine bed application mainly due to
Option A:	its hardness & ductility
Option B:	its high temperature capability
Option C:	its damping capability & Self lubricating properties
Option D:	due to its brittleness & wear resistance
Q10.	In hardening of steels following thing happens
Option A:	Austenite transforms to pearlite
Option B:	Austenite transforms to backelite
Option C:	Austenite transforms to martensite
Option D:	Austenite transforms to ledeburite
Q11.	Endurance limit is defined for
Option A:	Ferrous materials
Option B:	Non ferrous materials
Option C:	Plastics
Option D:	Ceramics
Q12.	Fatigue life increases as
Option A:	decrease in surface finish
Option B:	increase in surface finish
Option C:	increase in temperature
Option D:	decrease in temperature
Q13.	Creep is the deformation that occurs at
Option A:	elevated temperature & under increasing stress
Option B:	low temperature & under decreasing stress
Option C:	low temperature & under increasing stress
Option D:	elevated temperature & under constant stress
Q14.	In full annealing following properties are obtained
Option A:	Hard and brittle
Option B:	hard & Tough
Option C:	Less corrosion resistance
Option D:	soft & ductile
Q15.	Subzero treatment is used for
Option A:	freezing metals & alloys
Option B:	enhance ductility
Option C:	removal of retained austenite

Option D:	addition of austenite
Q16.	In Austempering process
Option A:	Austenite is formed
Option B:	martensite is formed
Option C:	Banite is formed
Option D:	pearlite is formed
Q17.	Flame hardening is used for
Option A:	surface hardening
Option B:	full hardening
Option C:	both surface and full hardening
Option D:	for improving corrosion resistance
Q18.	Carbon fiber is a example of _____
Option A:	Ferrous materials
Option B:	Non ferrous materials
Option C:	Plastic materials
Option D:	Composite materials
Q19.	Main drawback of magnetic particle testing is
Option A:	Cannot be Used for non ferromagnetic materials
Option B:	Can be Used for ferromagnetic materials
Option C:	Cannot be Used for ferromagnetic materials
Option D:	Can be Used for non ferromagnetic materials
Q20.	For manufacturing boat hulls following process is used
Option A:	Injection molding
Option B:	Compression molding
Option C:	Spray up method
Option D:	Filament winding

Q2	Solve any Four out of Six (5 marks each)
A	Differentiate between edge & screw dislocation.
B	What is hardenability? Explain the test used for to test hardenability.
C	Explain Austempering process with the help of TTT diagram.
D	Explain S-N curve for ferrous & non Ferrous metals.
E	Classify Composite materials & give one examples of each.
F	Classify polymers & state advantage of polymers over metallic materials

Q3	Solve any Two out of Three (10 marks each)
A	What is recrystallization annealing? Explain the stages of recrystallization annealing & factors affecting it.
B	What is nondestructive testing of materials? Explain magnetic particle testing of materials with advantages & limitations.
C	Define Creep and explain each stage of creep curve in detail.

University of Mumbai

Examination 2020 under cluster 09 (FAMT)

Program: Mechanical Engineering

Curriculum Scheme: Rev2019 C Scheme

Examination: SE Semester: III

Course Code: MEC305 Course Name: THERMODYNAMICS

Time: 2 hours 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 among the following is not a boundary phenomenon?
Option A:	Work Transfer
Option B:	Heat transfer
Option C:	Mass Transfer
Option D:	Change of Temperature
2.	Change in enthalpy in a reversible process occurring in a closed system is equal to heat transfer, if the process occurs at constant
Option A:	Pressure
Option B:	Volume
Option C:	Temperature
Option D:	Entropy
3.	According to first law of thermodynamics_____
Option A:	mass and energy are mutually convertible
Option B:	heat and work are mutually convertible
Option C:	Carnot engine is most efficient
Option D:	heat flows from hot substance to cold substance
4.	Which of the following is not a property of the system?
Option A:	Temperature
Option B:	Pressure
Option C:	Specific volume
Option D:	Heat
5.	The second law of thermodynamics defines___
Option A:	Heat
Option B:	Work
Option C:	Enthalpy
Option D:	entropy
6.	In a Carnot engine, when the working substance gives heat to the sink __
Option A:	the temperature of the sink increases
Option B:	the temperature of the sink remains the same
Option C:	the temperature of the source decreases
Option D:	the temperatures of both the sink and the source decrease

7.	The property of a working substance which increases or decreases as the heat is supplied or removed in a reversible manner is known as
Option A:	enthalpy
Option B:	entropy
Option C:	internal energy
Option D:	external energy
8.	Which of the following statements is correct according to Clausius statement of second law of thermodynamics?
Option A:	It is impossible to transfer heat from a body at a lower temperature to a body at a higher temperature, without the aid of an external source.
Option B:	It is impossible to transfer heat from a body at a lower temperature to a body at a higher temperature.
Option C:	It is possible to transfer heat from a body at a lower temperature to a body at a higher temperature by using refrigeration cycle
Option D:	It is possible to transfer heat from a body at a lower temperature to a body at a higher temperature
9.	A refrigerator and heat pump operates between same temperature limits. If the COP of the refrigerator is 4, what is the COP of heat pump?
Option A:	3
Option B:	4
Option C:	5
Option D:	8
10.	Helmholtz function is expressed as
Option A:	(h – Ts)
Option B:	(u – Ts)
Option C:	(– sdT + vdp)
Option D:	(u + pv)
11.	Which one of the following represents unavailibility?
Option A:	To (ΔSo)
Option B:	T(ΔSo)
Option C:	To (ΔS)
Option D:	T(ΔS)
12.	Calculate the dryness fraction of steam which has 5.2 kg of water in suspension with 25 kg of dry and saturated vapour.
Option A:	0.21
Option B:	1.21
Option C:	0.78
Option D:	0.83
13.	The latent heat of evaporation at critical point is
Option A:	equal to zero
Option B:	less than zero
Option C:	greater than zero
Option D:	Unpredictable

14.	In a Rankine cycle with superheated steam
Option A:	the specific steam consumption increases
Option B:	the workdone increases
Option C:	the enthalpy decreases
Option D:	the dryness fraction of steam after isentropic expansion decreases
15.	Rankine cycle comprises of _____
Option A:	two isentropic processes and two constant volume processes
Option B:	two isothermal processes and two constant volume processes
Option C:	two isothermal processes and two constant pressure processes
Option D:	two isentropic processes and two constant pressure processes
16.	For same maximum pressure & temperature
Option A:	thermal efficiency of Diesel cycle is greater than that of Dual cycle
Option B:	thermal efficiency of Diesel cycle is less than that of Dual cycle
Option C:	thermal efficiency of Diesel cycle is same as that for Dual cycle
Option D:	thermal efficiency of Diesel cycle cannot be predicted
17.	A cycle consisting of two constant volume and two isothermal processes is known as
Option A:	Carnot cycle
Option B:	Joule cycle
Option C:	Diesel cycle
Option D:	Stirling cycle
18.	The volume occupied by the working fluid, when piston reaches the top dead centre, is known as
Option A:	piston volume
Option B:	clearance volume
Option C:	swept volume
Option D:	Total volume
19.	A fluid is compressible fluid when its density
Option A:	increases with temperature
Option B:	decreases with temperature
Option C:	increases with pressure
Option D:	remains constant with pressure and temperature
20.	If the exit pressure from a nozzle is less than critical pressure , the mass flow rate will be
Option A:	constant
Option B:	increasing
Option C:	decreasing
Option D:	unpredictable

Q2	
A	**Solve any Two** **5 marks each**
i.	Show that Entropy is a property of system.
ii.	Calculate the Volume, Enthalpy and Entropy of 2Kg of steam at 80°C and having a dryness fraction 0.85
iii.	A heat engine receives heat from a source at 1200 K at a rate of 500 kJ/s and rejects the waste heat to a medium at 300 K . The power output of the heat engine is 180 kW. Determine the reversible power and the irreversibility rate for this process.
B	**Solve any One** **10 marks each**
i.	0.06 m^3 of air at 5 bar and 200°C expands isentropically until the pressure becomes 2 bar. It is then heated at constant pressure until the enthalpy increase during this process is 80 KJ. Draw the cycle on P-V diagram and Calculate the work done in each process and the total work done.
ii.	Derive an expression of air standard efficiency for Otto cycle.

Q3	
A	**Solve any Two** **5 marks each**
i.	Define and Explain: a) Stagnation pressure b) Stagnation density c) Sonic Velocity d) Mach number
ii.	What will be loss in the ideal efficiency of a Diesel engine with compression ratio 14, if the fuel cut-off is delayed from 6% to 9% ?
iii.	What do you mean by Steady flow process, Apply Steady flow energy equation to Nozzle & Compressor.
B	**Solve any One** **10 marks each**
i.	A reversible heat engine operates between two reservoirs at temperatures 600°C and 40°C. The engine drives a reversible refrigerator which operates between reservoirs at temperatures of 40°C and – 18°C. The heat transfer to the engine is 2100 kJ and the network output of the combined plant is 370 kJ. Determine the heat transfer to the refrigerator and the net heat transfer to the 40°C reservoir.
ii.	A simple Rankine cycle works between pressures 35 bar and 0.2 bar, the steam at inlet to turbine is dry saturated. Assume flow rate of 9.5kg/sec. Calculate: a) cycle efficiency b) work ratio c) specific steam consumption d) heat rate

University of Mumbai

Examination 2021 under cluster 9 (Lead College: FAMT)

Examinations Commencing from 10th April 2021 to 17th April 2021

Program: **Mechanical Engineering**

Curriculum Scheme: **Rev2019**

Examination: **SE** Semester **III**

Course Code: MEC 301 and Course Name: EM III

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.	What is the Laplace transform of $\int_0^t \sin 5u \, du$?
Option A:	$\frac{5}{s\left(s^2+25\right)}$
Option B:	$\frac{5}{s\left(s^2-25\right)}$
Option C:	$\frac{1}{s\left(s^2-25\right)}$
Option D:	$\frac{1}{s^2+25}$
2.	The Parseval's identity for a function $f(x)$ in the interval $(c, c+2\pi)$ is given by
Option A:	$\int_c^{c+2\pi} \left[f(x)\right]^2 dx = a_0^2 + \frac{1}{2}\sum_{n=1}^{\infty}\left(a_n^2+b_n^2\right)$
Option B:	$\frac{1}{2\pi}\int_c^{c+2\pi} \left[f(x)\right]^2 dx = a_0^2 + \frac{1}{2}\sum_{n=1}^{\infty}\left(a_n^2+b_n^2\right)$
Option C:	$\frac{1}{2\pi}\int_c^{c+2\pi} \left[f(x)\right] dx = a_0^2 + \frac{1}{2}\sum_{n=1}^{\infty}\left(a_n^2+b_n^2\right)$
Option D:	$\frac{1}{2\pi}\int_c^{c+2\pi} \left[f(x)\right]^2 dx = a_0^2 + \frac{1}{2}\sum_{n=1}^{\infty}\left(a_n+b_n\right)$
3.	What is the inverse Laplace transform of $\frac{1}{4s-5}$?
Option A:	$\frac{1}{4}e^{\frac{5t}{4}}$
Option B:	e^{5t}
Option C:	$e^{\frac{5t}{4}}$
Option D:	$\frac{1}{4}e^{5t}$

4.	Find the constant a if $f(z) = x^2 + 2xy - y^2 + i\left(ax^2 + 2xy + y^2\right)$ is analytic.
Option A:	a = 1
Option B:	a = 2
Option C:	a = –2
Option D:	a = –1
5.	The value of $\int_0^\infty e^{-t}t^3 dt$ is
Option A:	3
Option B:	2
Option C:	6
Option D:	1
6.	The equation $\frac{\partial^2 y}{dt^2} = c^2 \frac{\partial^2 y}{dx^2}$ is known as
Option A:	one dimensional wave equation
Option B:	one dimensional heat equation
Option C:	two dimensional heat equation
Option D:	Laplace equation
7.	If $f(x) = x^2$ in $(0, 2\pi)$, then the Fourier coefficient a_n is
Option A:	0
Option B:	$\frac{4}{n^2}$
Option C:	$-\frac{4}{n^2}$
Option D:	$\frac{4}{n}$
8.	What is the inverse Laplace transform of $\frac{1}{s^2 - 36}$?
Option A:	$\frac{1}{6}\cosh 6t$
Option B:	$\frac{1}{6}\sin 6t$
Option C:	$\frac{1}{6}\cos 6t$
Option D:	$\frac{1}{6}\sinh 6t$
9.	If $A = \begin{bmatrix} \pi & \frac{\pi}{4} \\ 0 & \frac{\pi}{2} \end{bmatrix}$, then $\cos A =$

Option A:	$\begin{bmatrix} -1 & -\frac{1}{2} \\ 0 & 0 \end{bmatrix}$
Option B:	$\begin{bmatrix} 1 & \frac{1}{2} \\ 0 & 0 \end{bmatrix}$
Option C:	$\begin{bmatrix} -1 & -\frac{1}{2} \\ 0 & 1 \end{bmatrix}$
Option D:	$\begin{bmatrix} 1 & \frac{1}{2} \\ 0 & -1 \end{bmatrix}$
10.	If $f(z) = u + iv$ is an analytic function, then
Option A:	only u is harmonic function
Option B:	only v is harmonic function
Option C:	both u and v are harmonic functions
Option D:	both u and v are not harmonic functions
11.	The eigen values of the matrix $\begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ are
Option A:	1, 2, 3
Option B:	1, –1, 2
Option C:	–1, –2, 3
Option D:	1, 2, –2
12.	The Laplace transform of te^{-4t} is
Option A:	$\frac{1}{(s-4)^2}$
Option B:	$\frac{1}{(s+4)^2}$
Option C:	$\frac{-1}{(s-4)^2}$
Option D:	$\frac{-1}{(s+4)^2}$
13.	If $f(x)=1-x^2$ in $(-1,1)$, then the Fourier coefficient b_n is
Option A:	$\frac{-4(-1)^n}{n^2\pi^2}$
Option B:	$\frac{4(-1)^n}{n^2\pi^2}$

Option C:	0
Option D:	$\frac{-4(-1)^n}{n^3\pi^3}$
14.	If $A=\begin{bmatrix}1 & 5\\ 0 & 2\end{bmatrix}$, then the eigen values of A^3 are
Option A:	1, 4
Option B:	1, 2
Option C:	1, 5
Option D:	1, 8
15.	The inverse Laplace transform of $\frac{s-2}{s^2-4s+5}$ is
Option A:	$e^{-2t}\sin t$
Option B:	$e^{2t}\cos t$
Option C:	$e^{-2t}\cos t$
Option D:	$e^{2t}\sin t$
16.	The sum of eigen values of the matrix $\begin{bmatrix}2 & 2 & 1\\ 1 & 3 & 1\\ 1 & 2 & 2\end{bmatrix}$ is
Option A:	0
Option B:	5
Option C:	7
Option D:	3
17.	If $f(z)=u+iv$, then the Cauchy-Riemann equations are given by
Option A:	$u_x=-v_y$ and $u_y=v_x$
Option B:	$u_x=-v_y$ and $u_y=-v_x$
Option C:	$u_x=v_y$ and $u_y=v_x$
Option D:	$u_x=v_y$ and $u_y=-v_x$
18.	The equation of one dimensional heat flow is given by
Option A:	$\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}$
Option B:	$\frac{\partial^2 u}{\partial t^2}=c^2\frac{\partial^2 u}{\partial x^2}$
Option C:	$\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$
Option D:	$\frac{\partial u}{\partial t}=c^2\left(\frac{\partial^2 u}{\partial x^2}-\frac{\partial^2 u}{\partial y^2}\right)$

19.	What is the Laplace transform of $\cos 3t$?
Option A:	$\frac{1}{\left(s^2+9\right)}$
Option B:	$\frac{s^2}{\left(s^2+9\right)}$
Option C:	$\frac{s}{\left(s^2-9\right)}$
Option D:	$\frac{s}{\left(s^2+9\right)}$
20.	The inverse Laplace transform of $\frac{3+2s+s^2}{s^3}$ is
Option A:	$\frac{3t^3}{2}+2t^2+1$
Option B:	t^2+t+1
Option C:	$\frac{3t^2}{2}+2t+1$
Option D:	$t^3+\frac{t^2}{2}+1$

Q2.	**Solve any Four out of Six 5 marks each**
A	Find half range cosine series for $f(x)=x,\ 0<x<2$.
B	Using Convolution theorem, find the inverse Laplace transform of $F(s)=\frac{s}{\left(s^2+4\right)^2}$.
C	Solve $\frac{\partial^2 u}{\partial x^2}-2\frac{\partial u}{\partial t}=0$ by Bender-Schmidt method, given $u(0,t)=0,\ u(4,t)=0,\ u(x,0)=x(4-x)$. Assume h = 1 and find the values of u up to t = 2.
D	Find the Laplace transform of $f(t)=e^{-3t}\cosh 5t \sin 4t$.
E	Using Cayley-Hamilton theorem, find the matrix represented by $A^8-5A^7+7A^6-3A^5+A^4-5A^3+8A^2-2A+I$ where $A=\begin{bmatrix}2&1&1\\0&1&0\\1&1&2\end{bmatrix}$.
F	Find k such that $\frac{1}{2}\log\left(x^2+y^2\right)+i\tan^{-1}\left(\frac{kx}{y}\right)$ is analytic.

Q3.	**Solve any Four out of Six 5 marks each**
A	Show that the matrix $A=\begin{bmatrix}4&1\\2&3\end{bmatrix}$ is diagonalisable. Find the transforming

	matrix and the diagonal matrix.
B	Evaluate $\int_0^{\infty} e^{-t} \int_0^{t} \frac{\sin u}{u} du \; dt$.
C	Find the Fourier expansion of $f(x) = x$ in $(-\pi, \pi)$.
D	Solve by Crank-Nicholson simplified formula $\frac{\partial^2 u}{\partial x^2} - 16\frac{\partial u}{\partial t} = 0, \; 0 < x < 1, \; t > 0$ given $u(x,0) = 0, \; u(0,t) = 0, \; u(1,t) = 200t$ taking $h = \frac{1}{4}$ for one-time step.
E	Find the inverse Laplace transform of $F(s) = \log\left(\frac{s^2 + a^2}{\sqrt{s+b}}\right)$.
F	Find an analytic function whose real part is $e^x \cos y$.

University of Mumbai

Examination April 2021 under cluster 09 (Lead College: FAMT)

Examinations Commencing from 10th April 2021 to 17th April 2021

Program: Mechanical Engineering

Curriculum Scheme: Rev 2019 C Scheme

Examination: SE Semester: III

Course Code: MEC302 and Course Name: Strength of Materials

Time: 2 hours Max. Marks: 80

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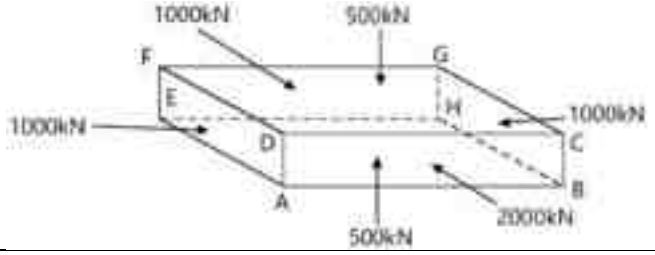
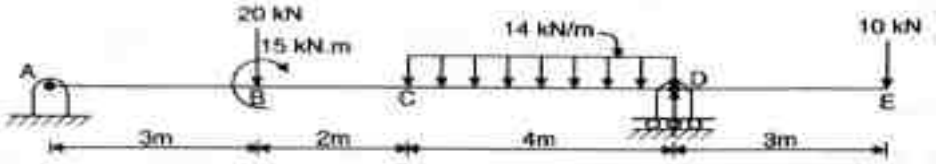
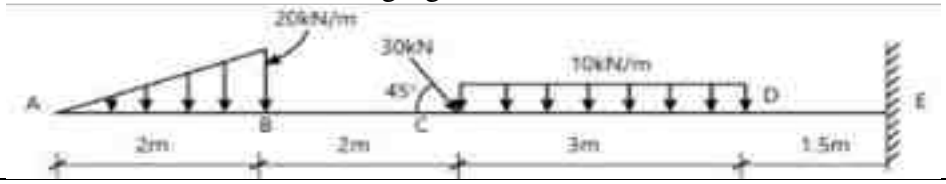
Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1	Point of contra-flexure in beam is a
Option A:	Point where Shear force is maximum
Option B:	Point where Bending moment is maximum
Option C:	Point where Bending moment is zero
Option D:	Point where Bending moment zero but also changes sign from positive to negative
2	A simply supported beam of length 6 m carries a UDL of 12 KN/m over the entire span. If E= $2x10^5$ and I= $6x10^{10}$ mm^4 what is the deflection at the centre of the beam.
Option A:	1.6875 mm
Option B:	16.875 mm
Option C:	168.75 mm
Option D:	0.16875 mm
3	The strain energy in a member is proportional to _____
Option A:	Product of stress and the strain
Option B:	Total strain multiplied by the volume of the member
Option C:	The maximum strain multiplied by the length of the member
Option D:	Product of strain and Young's modulus of the material
4	The columns whose slenderness ratio is less than 80, are known as
Option A:	Short columns
Option B:	Long columns
Option C:	Weak columns
Option D:	Medium columns
5	Using Euler's equation, the crippling load for a hollow cylindrical column, 100 mm outer and 80 mm inner diameter and 3000 mm (both ends hinged) having E= $2x10^5$ N/mm^2
Option A:	63.56 KN
Option B:	6671 KN
Option C:	6.35 KN
Option D:	635.63 KN
6	Gas pipes is examples of _____
Option A:	Thick shells
Option B:	Thin cylinders
Option C:	Hoop cylinders
Option D:	Longitudinal cylinders
7	A simply supported beam of span 8 m carries a UDL of 10 KN/m for a span of 3 m starting from right hand support. What is the bending moment at the Centre.
Option A:	22.5 KN-m
Option B:	24.375 KN-m

Option C:	5.625 KN-m
Option D:	45 KN-m
Q8	A tensile load of 50kN is gradually applied to a circular bar of 5cm diameter and 5m long. What is the strain energy absorbed by the rod (E = 200GPa)?
Option A:	14 N-m
Option B:	15.9 N-mm
Option C:	15.9 N-m
Option D:	14 N-mm
Q9	What is the maximum bending moment for simply supported beam of 10 m length and carrying a point load 10 kN at its centre?
Option A:	2 kNm
Option B:	25 kNm
Option C:	30 kNm
Option D:	40 kNm
Q10.	Which of the following method is used to determine the slope and deflection at a point?
Option A:	Arithmetic increase method
Option B:	Mathematical curve setting
Option C:	Macaulay's method
Option D:	Lacey's method
Q11.	The longitudinal stress in the cylindrical shell is _____
Option A:	pd/3t
Option B:	pd/4t
Option C:	pd/2t
Option D:	pd/6t
Q12.	In simply supported beams, the slope is _____ at supports.
Option A:	Minimum
Option B:	Zero
Option C:	Maximum
Option D:	Uniform
Q13	A simply supported beam carries uniformly distributed load of 20 kN/m over the length of 5 m. If flexural rigidity is 30000 $kN.m^2$, what is the maximum deflection in the beam?
Option A:	5.4 mm
Option B:	1.08 mm
Option C:	6.2 mm
Option D:	8.6 mm
Q14	A simply supported beam of span 4 m carries a point load of 10 KN at a distance 1 m from left hand support. What is the bending moment at centre of span.
Option A:	15 KN-m
Option B:	5 KN-m
Option C:	10 KN-m
Option D:	2.5 KN-m
Q15	Which of the following formulae is used to calculate tangential stress, when a member is subjected to stress in mutually perpendicular axis and accompanied by a shear stress?
Option A:	$[(\sigma_x - \sigma_y)/2]\sin\theta - \tau\cos 2\theta$
Option B:	$[(\sigma_x - \sigma_y)/2] - \tau\cos 2\theta$
Option C:	$[(\sigma_x - \sigma_y)/2]\sin\theta - \tau^2\cos\theta$
Option D:	$[(\sigma_x - \sigma_y)/2]\text{Cos}\,\theta - \tau\cos 2\theta$

Q16	Which of the following is the differential equation to find the slope and deflection of a elastic curve.
Option A:	$MEI= d^2y/ dx^2$
Option B:	$M\ d^2y/ dx^2 = EI$
Option C:	$EI\ d^2y/ dx^2 = M$
Option D:	$EIM\ d^2y/ dx^2= 0$
Q17	In Mohr's circle method, compressive direct stress is represented on ____
Option A:	positive x-axis
Option B:	positive y-axis
Option C:	negative y-axis
Option D:	negative x-axis
Q18	A cantilever beam of 4 m carries a point load of 10 KN at the free end. If EI is constant then the maximum deflection is.
Option A:	$2.133x10^{14}/ EI$
Option B:	$6.4x10^{14}/ EI$
Option C:	$1.53x10^{9}/ EI$
Option D:	7.59 mm
Q19	A rectangular bar has volume of 1.5×10^6 mm^3. What is the change in volume, if stresses in x, y and z direction are 100 Mpa, 150 Mpa and 160 Mpa respectively. (Assume $K = 2 \times 10^5$ N/mm^2 & $\mu = 0.3$)
Option A:	1000 mm^3
Option B:	1540 mm^3
Option C:	1230 mm^3
Option D:	2000 mm^3
Q20	In a cantilever carrying a uniformly varying load starting from zero at the free end, the shear force diagram is
Option A:	A horizontal line parallel to x-axis
Option B:	Follows a parabolic law
Option C:	Follows a cubic law
Option D:	A line inclined to x-axis

Q2	Solve any Four out of Six 5 marks each
A	Calculate the safe compressive load on hollow Column (OD-200, ID-130mm). The column 9m long and both ends are fixed. If FOS 4, E= 105Gpa. Use Euler's Equation.
B	The princpal tensile stesses across two perpendicular planes are 80N/mm^2 & 40 N/mm^2. Determine normal, shear and resultant stresses using Mohr's circle method. If plane inclined at 20^0 with major principal stress.
C	Determine instantaneous stress and deformation of a rod of diameter 8mm, length 1.2m, if mass of 100kg falls through a height of 120mm and strikes the bottom of the rod. The rod is freely suspended and fixed at the top, Take E=210Gpa
D	A beam of 10m length is simply supported at it ends and carries a UVL of 20Kn/m on entire span. It is varying from left hand support (zero) to right hand support (20Kn/m). Draw Shear force Diagram.
E	A beam of 8m length is simply supported at it ends and it carries a point loads of 10kn and 20Kn at 2m and 4m from left hand support. Determine slope at LHS.
F	A closed cylindrical vessel made of steel plates 4mm thick with plane ends carries fluid under a pressure of 3N/mm^2. The diameter of cylinder is 250mm and the length is 750mnm. Calculate longitudinal and hoop stresses in cylinder wall and determine changes in diameter and length. Take E= 2.1 x 10^5 N/mm^2, 1/m = 0.286

Q3	Solve any Two out of Three 10marks each
A	Compute change in dimensions, change in volume, stress and strain induced in all directions for Figure. Take μ=0.3, E=210Gpa, AB=500mm, BC=200mm and AE= 400mm 
B	Determine slope and deflection at point B & D 
C	Draw SFD and BMD for following figure 

University of Mumbai

Examination April 2021 under cluster 09 (Lead College: FAMT)

Examinations Commencing from 10th April 2021 to 17th April 2021

Program: Mechanical Engineering

Curriculum Scheme: Rev 2019 C Scheme

Examination: SE Semester: III

Course Code: MEC303 and Course Name: PRODUCTION PROCESSES

Time: 2 hours 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.	In which of the following processes the final product is formed by pouring molten metal in the mould and allowing it to solidify?
Option A:	machining
Option B:	turning
Option C:	casting
Option D:	welding
2.	Which of the following manufacturing processes uses amorphous raw material to produce a solid body as a final product?
Option A:	primary shaping process
Option B:	forming process
Option C:	joining process
Option D:	surface finishing process
3.	Which of the following casting defects is caused due to core misplacement or mismatching of top and bottom parts of the casting usually at the parting line?
Option A:	swell
Option B:	shift
Option C:	poured short
Option D:	misrun
4.	In large castings, which of the following passageway is used to carry the molten metal from the sprue base to several gates around the cavity?
Option A:	riser
Option B:	sprue
Option C:	gate
Option D:	runner
5.	Which of the following is an example of solid-state welding technique?
Option A:	arc welding
Option B:	oxy-acetylene welding
Option C:	air-acetylene welding
Option D:	diffusion welding
6.	Which of the following processes is used for joining similar metals by application of heat, with or without application of pressure and addition of filler material?
Option A:	welding
Option B:	cutting

Option C:	drilling
Option D:	riveting
7.	Which of the following fusible alloy or metal is used for uniting two metals in soldering process?
Option A:	solder
Option B:	spelter
Option C:	tungsten
Option D:	thermit
8.	Which of the following welding processes is done by burning a combustible gas with air or oxygen in a concentrated flame of high temperature?
Option A:	tungsten inert gas welding
Option B:	metal inert gas welding
Option C:	gas welding
Option D:	submerged arc welding
9.	Which of the following processes is NOT the type of metal forming process?
Option A:	Extrusion
Option B:	Injection moulding
Option C:	Forging
Option D:	Drawing
10.	The important mechanical property for a material to be successfully rolled or forged is
Option A:	Brittleness
Option B:	Ductility
Option C:	Malleability
Option D:	Elasticity
11.	_____is the change in width between the stock entering & leaving the stand in rolling pass.
Option A:	Draft
Option B:	Spread
Option C:	Elongation
Option D:	Indirect Extrusion
12.	The process of punching a set of holes in a metal sheet is known as?
Option A:	Parting
Option B:	Perforating
Option C:	Notching
Option D:	Lancing
13.	The operation of cutting a sheet metal along a straight-line length is known as?
Option A:	Cutting
Option B:	Lacing
Option C:	Notching
Option D:	Slitting
14.	The height of each tooth of a broach is

Option A:	same throughout
Option B:	in progressively decreasing order
Option C:	in progressively increasing order
Option D:	In progressively first decreasing and then increasing
15.	The maximum number of tool heads in planer can be
Option A:	one
Option B:	two
Option C:	three
Option D:	four
16.	The grinding operation is a
Option A:	Shaping operation
Option B:	Forming operation
Option C:	Surface finishing operation
Option D:	Dressing operation
17.	Compression moulding is the ideal method of processing.....
Option A:	Plastics
Option B:	Thermo-setting plastics
Option C:	Thermoplastics
Option D:	Non-ferrous materials
18.	The plastics which soften when heat is applied with or without pressure, but requires cooling to set them to shape are called as
Option A:	Thermo softing materials
Option B:	Thermo setting materials
Option C:	Thermo plastic materials
Option D:	Thermo conductive materials
19.	Wastage of material in powder metallurgy as scrap is _____
Option A:	large
Option B:	small
Option C:	depends on other factors
Option D:	medium
20.	Which method is used to make powder of metals having low melting point?
Option A:	Mechanical pulverization
Option B:	Electrolytic process
Option C:	Chemical reduction
Option D:	Atomization

Q2. **(20 Marks Each)**	**Solve any Four out of Six** **5 marks each**
A	Write short note on 'CO_2 moulding process'
B	Write short note on 'Die casting'
C	Write short note on tungsten inert gas welding.
D	Write short note on oxy-acetylene welding technique.
E	With neat sketch explain the working principle of arc welding.
F	Differentiate between piercing and blanking operation

Q3. **(20 Marks Each)**	**Solve any Four out of Six** **5 marks each**
A	Explain Taylor's tool life equation's parameter
B	Explain gear milling operation
C	Write a note on selection of grinding wheels.
D	What do you understand by wire drawing operation?
E	Write application of plastic in mechanical engineering field.
F	List the stapes of making powder metallurgy parts. Explain any one of them?

University of Mumbai

Examination April 2021 under cluster 09 (Lead College: FAMT)

Examinations Commencing from 10th April 2021 to 17th April 2021

Program: Mechanical Engineering

Curriculum Scheme: Rev 2019 C Scheme

Examination: SE Semester: III

Course Code: MEC 304 and Course Name: **Materials and Metallurgy**

Time: 2 hours 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 among the following is not a type of Non-destructive testing?
Option A:	ultrasonic testing
Option B:	radiographic testing
Option C:	magnetic particle test
Option D:	Izod Impact Test
2.	Which of the following methods of inspection uses high frequency of sound waves for the detection of flaws in the castings?
Option A:	Penetrant test
Option B:	Radiography
Option C:	Pressure test
Option D:	Ultrasonic inspection
3.	Which of the following types of rays is used in radiography for the inspection of castings?
Option A:	X- rays
Option B:	Infrared rays
Option C:	Ultraviolet rays
Option D:	Visible rays
4.	The size of nanoparticles is between _____ nm.
Option A:	100 to 1000
Option B:	0.1 to 10
Option C:	1 to 100
Option D:	0.01 to 1
5.	Which ratio of nano materials plays an important role in nanotechnology & nanosciences
Option A:	Weight/volume
Option B:	Surface area / volume
Option C:	Pressure/volume
Option D:	Volume/weight
6.	Which of the following materials is generally considered as better conductor of electricity?
Option A:	ceramics
Option B:	polymers

Option C:	metals
Option D:	Rubber
7.	Which material is primarily used in Shape Memory Alloys?
Option A:	Copper
Option B:	Nitinol
Option C:	Polystyrene
Option D:	Polypropylene
8.	Time dependent yield of a material at high temperature is known as
Option A:	fracture
Option B:	fatigue
Option C:	Torsion
Option D:	Creep
9.	Which test is used for DBTT (Ductile to Brittle transition Temperature)study
Option A:	Tensile Test
Option B:	Charpy impact Test
Option C:	Fatigue Test
Option D:	Creep Test
10.	Fatigue curve (S N Curve) plotted during fatigue testing of a material, is a log-log graph of…….
Option A:	Stress versus strain under fatigue loading
Option B:	Strain versus time under fatigue loading
Option C:	Stress amplitude versus no of stress cycles
Option D:	Strain versus no of stress cycles
11.	If the surface crack causing fracture in a brittle material is made twice as deep, the fracture strength will……..
Option A:	Decrease by a factor of √2
Option B:	decrease by a factor of 2
Option C:	Decrease by a factor of 2^2
Option D:	Not change
12.	During heat treatment of steel , the hardness of various structures in increasing order is
Option A:	martensite,fine pearlite, coarse pearlite
Option B:	fine pearlite, martensite, coarse pearlite
Option C:	martensite, coarse pearlite, fine pearlite,
Option D:	coarse pearlite, fine pearlite,martensite
13.	In Annealing cooling is done in which of the following medium?
Option A:	Air
Option B:	Furnace
Option C:	Oil
Option D:	water
14.	The fastest cooling rate is achieved when steel is quenched in
Option A:	air

Option B:	oil
Option C:	water
Option D:	brine
15.	Which of the following processes, one should use to reduce brittleness of steel after hardening.
Option A:	Annealing
Option B:	Tempering
Option C:	Normalising
Option D:	carbonitriding
16.	Identify Line defect in the following
Option A:	screw dislocation
Option B:	Tilt Boundary
Option C:	Twin Boundary
Option D:	Grain Boundary
17.	In case of edge dislocation
Option A:	Burgers vector is parallel to dislocation line
Option B:	Burgers vector is perpendicular to dislocation line
Option C:	burgers vector is at 60 degree to dislocation line
Option D:	there is no relation between burgers vector and dislocation line
18.	Which of the following is the most common slip plane for an FCC crystal?
Option A:	{110}
Option B:	{111}
Option C:	{121}
Option D:	{321}
19.	Eutectic transformation product in Fe-C system is called …….
Option A:	Pearlite
Option B:	Bainite
Option C:	Ledeburite
Option D:	Martensite
20.	TTT diagram stands for…..
Option A:	Tensile Temperature Time diagram
Option B:	Time Temperature Transformation diagram
Option C:	Temperature Time Testing diagram
Option D:	Time Transformation Testing diagram

Q2.	**Solve any Four out of Six** **5 marks each**
A	Classify crystal defects and Write a note on various types of point defects in crystal.
B	Explain Martempering process with neat sketch.
C	Explain Flame hardening heat treatment. Also state advantages & disadvantages of flame hardening method.
D	Define fracture? Differentiate between ductile fracture & brittle fracture?
E	What are composite materials? Give Classification of composites and state their applications?
F	Write a note on non destructive testing of materials.

Q3.	**Solve any Two Questions out of Three** **10 marks each**
A	Draw a neat Iron-Iron carbide Equilibrium diagram indicating all important temperature, phases, & compositions. Discuss eutectic transformation with respect to it.
B	Define creep. Draw classical creep curve. Explain each stage in detail
C	What is recrystallization annealing? Discuss various stages recovery, recrystallization and grain growth of recrystallization annealing in deatl. What are the factors affecting it?

University of Mumbai

Examination April 2021 under cluster 09 (Lead College: FAMT)

Examinations Commencing from 10th April 2021 to 17th April 2021

Program: Mechanical Engineering

Curriculum Scheme: Rev 2019 C Scheme

Examination: SE Semester: III

Course Code: MEC305 Course Name: THERMODYNAMICS

Time: 2 hours 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 extensive property of a thermodynamic system ?
Option A:	Pressure
Option B:	Volume
Option C:	Temperature
Option D:	Density
2.	A series of operations, which take place in a certain order and restore the initial condition is known as
Option A:	reversible cycle
Option B:	irreversible cycle
Option C:	thermodynamic cycle
Option D:	open system
3.	The state of an ideal gas is changed from (T1, P1) to (T2, P2) in a constant pressure process. To calculate the change in internal energy (Δu), All of the following properties are required.
Option A:	Cp, T1, T2
Option B:	Cv, T1,T2
Option C:	Cp, P1,P2
Option D:	Cv, P1,P2
4.	The gas constant (R) is equal to the _____
Option A:	sum of two specific heats
Option B:	difference of two specific heats
Option C:	product of two specific heats
Option D:	ratio of two specific heats
5.	The efficiency of an ideal Carnot engine depends
Option A:	on working substance
Option B:	on the temperature of the source only
Option C:	on the temperature of the sink only
Option D:	on the temperatures of both the source and the sink
6.	Entropy of the universe always tends to
Option A:	zero
Option B:	decrease
Option C:	increases

Option D:	unpredictable
7.	A refrigerator and heat pump operates between same temperature limits. If the COP of the refrigerator is 5, what is the COP of heat pump?
Option A:	5
Option B:	6
Option C:	7
Option D:	8
8.	Entropy is a function of
Option A:	Pressure
Option B:	Volume
Option C:	Temperature
Option D:	Internal energy
9.	When Joule-Thompson coefficient (μ) > 0, the temperature of gas with decrease in pressure
Option A:	decreases
Option B:	increases
Option C:	remains constant
Option D:	unpredictable
10.	Gibs function is expressed as
Option A:	(h – Ts)
Option B:	(u – Ts)
Option C:	(– sdT + vdp)
Option D:	(u + pv)
11.	The available energy is
Option A:	high grade energy
Option B:	portion of energy as useful work
Option C:	theoretical maximum amount of work
Option D:	low grade energy
12.	The Joule-Thompson coefficient is the slope of _____
Option A:	Isobaric curve
Option B:	Isochoric curve
Option C:	Isenthalpic curve
Option D:	Polytropic curve
13.	In Rankine cycle the work output from the turbine is given by
Option A:	change of internal energy between inlet and outlet
Option B:	change of temperature between inlet and outlet
Option C:	change of entropy between inlet and outlet
Option D:	change of enthalpy between inlet and outlet
14.	Dryness fraction of steam is defined as
Option A:	mass of water vapour in suspension/(mass of water vapour in suspension + mass of dry steam)
Option B:	mass of dry steam/mass of water vapour in suspension

Option C:	mass of water vapour in suspension/mass of dry steam
Option D:	mass of dry steam/(mass of dry steam + mass of water vapour in suspension)
15.	Rankine cycle operating on low pressure limit of p1 and high pressure limit of p2
Option A:	has higher thermal efficiency than the Carnot cycle operating between same pressure limits
Option B:	has lower thermal efficiency than Carnot cycle operating between same pressure limits
Option C:	has same thermal efficiency as Carnot cycle operating between same pressure limits
Option D:	may be more or less depending upon the magnitudes of p1 and p2
16.	A cycle consisting of two constant pressure and two isothermal processes is known as
Option A:	Carnot cycle
Option B:	Ericsson cycle
Option C:	Atkinson cycle
Option D:	Diesel cycle
17.	For same compression ratio & heat supplied
Option A:	thermal efficiency of Diesel cycle is same as that for Otto cycle
Option B:	thermal efficiency of Diesel cycle is greater than that of Otto cycle
Option C:	thermal efficiency of Diesel cycle is less than that of Otto cycle
Option D:	thermal efficiency of Diesel cycle cannot be predicted
18.	Which Cycle consists of three reversible processes?
Option A:	Ericsson cycle
Option B:	Stirling cycle
Option C:	Lenoir cycle
Option D:	Atkinson cycle
19.	If the exit pressure from a nozzle is less than critical pressure , it is
Option A:	Convergent - Divergent
Option B:	Convergent
Option C:	Divergent
Option D:	throat
20.	Flow of fluid is called Supersonic when
Option A:	$M < 1$
Option B:	$M = 1$
Option C:	$M > 1$
Option D:	$M > 5$

Q2	
A	**Solve any Two** **5 marks each**
i.	Write four Maxwell relations
ii.	Write short note on Reheat Rankine Cycle
iii.	Air is flowing isentropically through a nozzle at 27C and 0.8 bar with a velocity of 120m/s. Calculate the Stagnation Enthalpy, Stagnation Temperature, Stagnation Pressure and Stagnation density of air.
B	**Solve any One** **10 marks each**
i.	Air at 1.02 bar, 22 °C, initially occupying a cylinder volume of 0.015 m^3, is compressed reversibly and adiabatically by a piston to a pressure of 6.8 bar. Calculate : (i) Work transfer (ii) Change in entropy
ii.	Explain a) Brayton Cycle b) Limitations of Carnot Vapour Cycle

Q3	
A	**Solve any Two** **5 marks each**
i.	Write short note on Carnot Cycle
ii.	Calculate the Specific volume, Specific Enthalpy and density of 1Kg of steam at a pressure of 19bar and having a dryness fraction 0.85
iii.	Define and Explain a) Dead state b) Useful work
B	**Solve any One** **10 marks each**
i.	A heat engine is supplied with 1130kW of heat at a constant temperature of 292 ^{0}C and it rejects heat at 5 ^{0}C. The following result were recorded: (a) 834 kw heat is rejected (b) (b) 556 kw heat is rejected (c) (c) 278 kw heat is rejected Determine whether results report a reversible cycle, irreversible or impossible Cycle.
ii.	Write short note on : a) Point & Path Function b) Mach number & Mach angle c) Atkinson Cycle