MPPSC AE

Previous Year Paper
Paper - II
Mechanical Engineering
(2014 Shift 2)

State Engineering (Prelims) Exam – 2014

Second Paper – Second Shift

(Provisional Model Answer Key)

Mechanical Engineering

Q1 : A steel rod of 2 m long is heated through a temperature of 100^0C . The coefficient of linear expansion is α = 6.5 X 10^{-6} /^{0}C and E= 2 X 10^6 N/cm^2. The stress induced in the bar is	
A	1000 N/cm^2
B	1200 N/cm^2
C	1300 N/cm^2
D	1400 N/cm^2
Answer Key: **C**	

Q2 : The design calculations for members subjected to fluctuating loads with the same factor of safety yield the most conservative estimates when using	
A	Gerber relation
B	Soderberg relation
C	Goodman relation
D	None of these is correct
Answer Key: **B**	

Q3 : A leaf spring 1 m long carries a central point load of 2000 N. The spring is made up of plates each 5 cm wide and 1 cm thick. The bending stress in the plate is limited to 100 N/mm^2. The number of plates required will be	
A	3
B	5
C	6
D	8
Answer Key: **C**	

Q4 : The stress due to suddenly applied load as compared to the stress due to the same load gradually applied to the same rod is	
A	half

B	same
C	double
D	three times

Answer Key: **C**

Q5 : Choose the wrong statement

A	The shear force at any section of a beam is equal to the total sum of the forces acting on the beam on any one side of the section,
B	The magnitude of the bending moment at any section of a beam is equal to the vector sum of the moments (about the section) due to the forces acting on the beam on any one side of the section,
C	A diagram which shows the values of shear forces at various sections of structured member is called a shear force diagram,
D	A simply supported beam is one which is supported on more than two supports.

Answer Key: **D**

Q6 : Two blocks with masses 'M' and 'm' are in contact with each other and are resting on a horizontal frictionless floor. When horizantal force (F) is applied to the heavier body mass 'M', the blocks accelerate to the right i.e. towards the application force. The force between the two blocks is

A	$\frac{F(M+m)}{m}$
B	$\frac{FM}{m}$
C	$\frac{mF}{M}$
D	$\frac{mF}{M+m}$

Answer Key: **D**

Q7 : A thick walled pressure vessel is subjected to an internal pressure of 60 MPa. If the hoop stress on the outer surface is 150 MPa, then the hoop stress on the internal surface is

A	105 MPa
B	180 MPa
C	210 MPa
D	135 MPa

Answer Key: **C**

Q8 : A Mohr's circle reduces to a point when the body is subjected to

A	pure shear
B	uniaxial stress only
C	equal and opposite axial stresses on two mutually perpendicular planes, the planes being free of shear
D	equal axial stresses on two mutually perpendicular planes, the planes being free of shear.
Answer Key: **D**	

Q9 :	In a close-coiled helical spring subjected to an axial load and other quantities remaining the same, if the wire diameter is doubled, then the stiffness of the spring when compared to the original one will become
A	two times
B	four times
C	eight times
D	sixteen times
Answer Key: **D**	

Q10 :	Considering centrifugal tension, the power transmitted by belt drive is maximum at velocity V equal to Note: - T is total tension on tight side and m is mass per unit length of belt.
A	$V = \left\{\frac{T}{m}\right\}^{\frac{1}{2}}$
B	$V = \left\{\frac{T}{3m}\right\}^{\frac{1}{2}}$
C	$V = \left\{\frac{3T}{m}\right\}^{\frac{1}{2}}$
D	$V = \left\{\frac{2T}{m}\right\}^{\frac{1}{2}}$
Answer Key: **B**	

Q11 :	In a hollow circular shaft of outer and inner diameters of 20 cm and 10 cm respectively, the shear stress is not to exceed 40 N/mm^2. The maximum torque which the shaft can safely transmit is
A	58.9 KN-m
B	57.9 KN-m
C	56.9 KN-m
D	58.7 KN-m
Answer Key: **A**	

Q12 Rope brake dynamometer uses :	
A	oil as lubricant
B	water as lubricant
C	grease as lubricant
D	no lubricant
Answer Key: **D**	

Q13 Whirling speed of a shaft coincide with the natural frequency of the :	
A	longitudinal vibration
B	transverse vibration
C	torsional vibration
D	none of these is correct
Answer Key: **A**	

Q14 In slider crank mechanism, the maximum acceleration of slider is obtained when the crank is :	
A	at the inner dead centre position
B	at the outer dead centre position
C	exactly midway position between the two dead centres
D	slightly in advance of the midway position between the two dead centres.
Answer Key: **A**	

Q15 Tresca theory of failure is applicable for which of the following type of materials ? :	
A	Elastomers
B	Plastic
C	Ductile
D	Brittle
Answer Key: **C**	

Q16 :	A solid shaft is to transmit 20 kW at 200 rpm. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. The diameter of solid shaft is
A	45 mm
B	46 mm
C	48 mm
D	50 mm
Answer Key: **C**	

Q17 :	A 1.5 m long column has a circular cross-section of 5 cm diameter. One end of the column is fixed and other end is free. Taking factor of safety as 3 and E= 120 GN/m^2, safe load according to Euler's theory is
A	13.00 kN
B	13.27 kN
C	13.47 kN
D	13.87 kN
Answer Key: **C**	

Q18 :	An internal gear having 60 teeth is meshing with an external gear having 20 teeth. Module is 6 mm. The centre distance of two gears is
A	120 mm
B	180 mm
C	240 mm
D	300 mm
Answer Key: **C**	

Q19 :	In a cam drive, it is essential to off-set the axis of follower to
A	decrease the side thrust between the follower and cam surface
B	decrease the work between the follower and cam surface
C	take care of space limitation
D	reduce the cost
Answer Key: **C**	

Q20 In equilibrium condition, fluids are not able to sustain

:	
A	shear force
B	resistance to viscosity
C	surface tension
D	geometric similitude
Answer Key: **C**	

Q21 :	The fluid forces considered in the Navier-Stoke's equation are
A	gravity, pressure and viscous
B	gravity, pressure and turbulent
C	pressure, viscous and turbulent
D	gravity, viscous and turbulent
Answer Key: **A**	

Q22 :	A Brayton cycle (Air standard) has a pressure ratio of 4 and inlet conditions of one standard atmospheric pressure and 27^0C. Estimated air flow rate for 100 kW power output (when maximum temperature in the cycle is 1000^0C, (γ =1.4, and Cp =1.0 kJ/kg.K) will be
A	0.24 kJ/kg
B	0.32 kJ/kg
C	0.36 kJ/kg
D	0.42 kJ/kg
Answer Key: **C**	

Q23 :	A turbine develops 8000 kW when running at 100 rpm. The head on the turbine is 36 m. If the head is reduced to 9 m, the power developed by the turbine will be
A	16000 kW
B	4000 kW
C	1414 kW
D	1000 kW
Answer Key: **D**	

Q24 Efficiency of steam turbine can be improved by

:

A	reheating of steam
B	regenerative feed heating
C	binary vapour plants
D	all options are correct

Answer Key: **D**

Q25 Free convection flow depends on all of the following except
:

A	density
B	coefficient of viscosity
C	gravitational force
D	velocity

Answer Key: **D**

Q26 Which of the following cycle has maximum efficiency
:

A	Rankine
B	Brayton
C	Carnot
D	Joule

Answer Key: **C**

Q27 The air standard Diesel cycle is less efficient than the Otto cycle for the
:

A	same compression ratio and heat addition
B	same pressure and heat addition
C	same rpm and cylinder dimension
D	same pressure and compression ratio

Answer Key: **A**

Q28 The knock in Diesel engine occurs due to
:

A	instantaneous and rapid burning of the first part of the charge
B	instantaneous auto ignition of last part of charge
C	delayed burning of the first part of the charge
D	reduction of delay period

Answer Key: **A**

Q29 : Compensating devices are provided in carburators

A	to charge the quantity of mixture depending upon load
B	to provide always an economy mixture
C	to modify the mixture strength depending upon requirements under various operating conditions
D	to supply extra fuel during acceleration only

Answer Key: **C**

Q30 : Which part is not common between the petrol and Diesel engine ?

A	air cleaner
B	exhaust silencer
C	battery
D	fuel injector

Answer Key: **D**

Q31 : Which among the NC operations given below are continuous path operations ?
Arc welding (AW), Milling (M), Punching in sheet metal (P), Drilling (D), Laser cutting of sheet metal (LC), Spot welding (SW)

A	AW, LC and M
B	AW, D, LC and M
C	D, LC, P and SW
D	D, LC, and SW

Answer Key: **B**

Q32 : The loss of available energy associated with the transfer of 1000 kJ of heat from a constant temperature system at 600 K to another at 400 K, when the environmental temperature is 300 K is

A	166.67 kJ
B	250.00 kJ
C	500.00 kJ
D	750.00 kJ

Answer Key: **A**

Q33 If V_N and α are the nozzle exit velocity and nozzle angle in an impulse turbine, the optimum blade velocity is given by :

A	$V_N \cos 2\alpha$
B	$V_N \sin 2\alpha$
C	$\frac{V_N \cos \alpha}{2}$
D	$\frac{V_N^2}{2}$

Answer Key: **D**

Q34 The entropy of universe tends to :

A	become zero
B	remain constant
C	be maximum
D	attain a certain finite minimum value

Answer Key: **A**

Q35 : A counter flow shell and tube heat exchanger is used to heat water with hot exhaust gases. The water (C_p = 4180 J/kg ^{0}C) flows at a rate 2 kg/s while the exhaust gas (C_p = 1030 J/kg ^{0}C) flows at the rate of 5.25 kg/s. If the heat exchanger surface area is 32.5 m^2 and the over all heat transfer coefficient is 200 W/m^2 ^{0}C, what is the NTU for the heat exchanger ?

A	1.2
B	2.4
C	4.5
D	8.6

Answer Key: **A**

Q36:	A counter flow heat exchanger is used to heat water from 20^0C to 80^0C by using hot gas entering at 140^0C and leaving at 80^0C. The log mean temperature difference for the heat exchanger is
A	80^0C
B	60^0C
C	110^0C
D	not determinable
Answer Key: **B**	

Q37:	The axis of movement of a robot may include
A	elbow rotation
B	wrist rotation
C	X-Y coordinate motion
D	all options are correct
Answer Key: **D**	

Q38:	Automatic loading and unloading of materials can be accomplished by means of
A	power push or pull device
B	power roller, belt and chain
C	automatic couple and uncouple
D	all options are correct
Answer Key: **D**	

Q39:	Steam turbines are classified according to
A	direction of flow
B	principle of action
C	number of cylinder
D	arrangement of pressure drop
Answer Key: **D**	

Q40 In nuclear power plants there are three main sources of radioactive contamination of air. Out of three one of the source is

:

A	step-up transformer
B	liquid metal
C	fission of nuclei of nuclear fuels
D	penstock

Answer Key: **C**

Q41 Which of the following is not considered a method of input control in a CAD system ?
:

A	programmable function box
B	joystick
C	plotter
D	touch material

Answer Key: **C**

Q42 A transmission shaft subjected to bending loads must be designed on the basis of
:

A	maximum normal stress theory
B	maximum shear stress theory
C	maximum normal stress and maximum shear stress theory
D	fatigue strength

Answer Key: **A**

Q43 The flow of fluid through a pipe is laminar, when
:

A	the fluid is ideal
B	the fluid is viscous
C	the Reynold's number is less than 2000
D	the Reynold's number is more than 3000

Answer Key: **C**

Q44 The radiation heat transfer rate per unit area in (W/m^2) between two plane parallel grey surfaces (emissivity = 0.9) maintained at 400 K and 300 K (given Stefan Boltzmann's constant $\sigma = 5.67X10^{-8}$ W/m^2K) is
:

A	992
B	812
C	464
D	567
Answer Key: **B**	

Q45 For forced convection, Nusselt number is a function of **:**	
A	Prandtl and Grashoff number
B	Reynolds and Prandtl number
C	Reynolds and Grashoff number
D	Reynolds number only
Answer Key: **B**	

Q46 The essential physical components of FMS is **:**	
A	potentially independent NC machine tools
B	a conveyance network to more parts and sometimes tools between machines and fixturing stations
C	an overall control network that coordinates the machine tools, the part-moving elements and the workpieces
D	all options are correct
Answer Key: **D**	

Q47 Refrigerant used in domestic refrigerators is **:**	
A	ammonia
B	air
C	SO_2
D	freon-12
Answer Key: **D**	

Q48 The comfort conditions in air conditioning are at **:**	
A	0^0C DBT and 0% RH

B	20^0C DBT and 60% RH
C	30^0C DBT and 80% RH
D	40^0C DBT and 90% RH
Answer Key: **B**	

Q49 :	The use of refrigerant R-22 for temterature below -30^0C is not recommended due to its
A	good miscibility with lubricating oil
B	poor miscibility with lubricating oil
C	low evaporating pressure
D	high compressor discharge temperature
Answer Key: **D**	

Q50 :	Basic law of heat conduction is
A	Fourier's law
B	Newton's law
C	Stefan's law
D	First law of thermodynamics
Answer Key: **A**	

Q51 :	The size of weld in butt welded joint is equal to
A	0.5 times throat of weld
B	Throat of weld
C	$\sqrt{2}$ times throat of weld
D	Two times throat of weld
Answer Key: **B**	

Q52 :	If two pumps identical in all respects and each capable of delivering a discharge Q against a head H are connected in series, the resulting discharge is
A	2Q against a head 2H
B	2Q against a head H

C	Q against a head H
D	$\sqrt{Q}$ against a head $\sqrt{2}H$

Answer Key: **C**

Q53 In interferometric measurement method, the path difference between one bright band and the next is varied by :

A	Half wavelength
B	Two half wavelength
C	One quarter wavelength
D	Two wavelength

Answer Key: **B**

Q54 Wear allowance is provided on :

A	Go gauge
B	Not go gauge
C	Both go and not go gauge
D	None of these is correct

Answer Key: **A**

Q55 In ammonia vapour compression system, the temperature of ammonia after compression will be :

A	0^{o} to $40^{o}C$
B	40^{o} to $50^{o}C$
C	50^{o} to $70^{o}C$
D	70^{o} to $110^{o}C$

Answer Key: **D**

Q56 C.O.P. of a vapour absorption system can be increased by using :

A	Vapour compression
B	Heat exchanger
C	Both vapour compression and Heat exchanger

D	None of these is correct

Answer Key: **B**

Q57 Availability of a system at any given state is :

A	A properly of the system
B	The maximum work obtained as the system goes to dead state
C	The total energy of the system
D	The maximum useful work obtainable as the system goes to dead state.

Answer Key: **D**

Q58 In ABC analysis, the C items are those which represents :

A	Small percentage of the total annual consumption value
B	High percentage of the total annual consumption value
C	Small percentage of closing inventory value
D	High percentage of closing inventory value

Answer Key: **A**

Q59 The key features of material requirement planning system are :

A	Planned order release
B	Time-phasing of requirement
C	Provisions for rescheduling
D	All options are correct

Answer Key: **D**

Q60 The optimality of a transportation problem is determined by application of :

A	North west corner method
B	Modi method
C	Vegels application method
D	Least cost method

Answer Key: **C**

Q61 Which of the following is an advantage of using an expert system?
:

A	Imposed structure
B	Knowledge engineering resistance
C	Vapid prototyping
D	All options are correct

Answer Key: **D**

Q62 In a M/M/1 queue, with utilization factor of 0.5, the probability of only one person waiting in the queue is
:

A	0
B	1.0
C	0.125
D	1.25

Answer Key: **D**

Q63 The condition for irreversibility of a cycle is
:

A	$\oint \frac{dQ}{T} < 0$
B	$\oint \frac{dQ}{T} > 0$
C	$\oint \frac{dQ}{T} = 0$
D	None of these is correct

Answer Key: **A**

Q64 Production planning consists of
:

A	Preplanning and routing
B	Scheduling and dispatching
C	Expediting
D	All options are correct
Answer Key: **A**	

Q65 :	In electro chemical machining the material removal is due to
A	Corrosion
B	Erosion
C	Fusion
D	Ion displacement
Answer Key: **D**	

Q66 :	CAD/CAM is the inter-relationship between
A	Marketing and design
B	Manufacturing and marketing
C	Engineering and marketing
D	Engineering and manufacturing
Answer Key: **D**	

Q67 :	In a linear programming model there are four decision variables and three constraints. During an iteration, by Simplex method, the coefficient of the base variable would form
A	An identity matrix
B	Slack variables
C	Basic solution
D	None of these is correct
Answer Key: **A**	

Q68 :	Crater wear occurs mainly due to
A	Abrasion

B	Diffusion
C	Oxidation
D	Adhesion
Answer Key: **B**	

Q69 Control charts for variables are the examples of :	
A	P, np, C, u charts
B	$\bar{X}$, R, σ charts
C	A, B, C, charts
D	None of these is correct
Answer Key: **B**	

Q70 PERT and CPM are :	
A	Techniques to determine project status
B	Decision making techniques
C	Aids to determine the cost implication of project
D	None of these is correct
Answer Key: **B**	

Q71 In Carnot cycle, the algebraic sum of the entropy change for the cycle is :	
A	Positive
B	Negative
C	Zero
D	None of these is correct
Answer Key: **C**	

Q72 A perfect gas flows through a nozzle where it expands in a reversible adiabatic manner. The inlet conditions are 22 bar, 500^{o}C, 38 m/s. At exit the pressure is 2 bar. Given R=190 J/Kg K and γ =1.35. The exit velocity will be :	
A	700 m/s
B	726 m/s

C	801 m/s
D	701 m/s
Answer Key: **B**	

Q73 :	The turbulent flow has
A	Streak line motion
B	Parabolic velocity distribution
C	Random orientation of fluid particles
D	Small slope of velocity profile at the wall
Answer Key: **C**	

Q74 :	In a drilling operation, the tool life was found to decrease from 20 min to 5 min due to increase in drill speed from 200 rpm to 400 rpm. What will be the tool life of that drill under same condition if the drill speed is 300 rpm
A	7.9 min
B	8.9 min
C	6.4 min
D	9.8 min
Answer Key: **B**	

Q75 :	In the tolerance specification 25D6, the letter 'D' represents
A	Grade of tolerance
B	Upper deviation
C	Lower deviation
D	Type of fit
Answer Key: **D**	

Q76 :	3-2-1 method of location in a jig or fixture would collectively restrict the work-piece in 'n' degree of freedom, where the value of 'n' is
A	6
B	8
C	9

D	12

Answer Key: **C**

Q77 Forecasting which assumes a static environment in the future is :

A	Passive forecasting
B	Active forecasting
C	Long term forecasting
D	Short term forecasting

Answer Key: **A**

Q78 What is computer numerical control (CNC)? :

A	CNC is a self contained NC system for a single machine tool using a computer controlled by a part program to perform basic NC functions.
B	CNC is a self contained system for a single operated manual controlled machine.
C	CNC is a self contained NC system for a multi machine tool operated by a conventional technique.
D	None of these is correct

Answer Key: **A**

Q79 The area – velocity relationship for compressible fluid flow is :
Note : M is the Mach number and C is the sonic speed.

A	$\frac{dA}{A} = \frac{dV}{V}(M^2 - 1)$
B	$\frac{dA}{A} = \frac{dV}{V}(C^2 - 1)$
C	$\frac{dA}{A} = \frac{dV}{V}(1 - M^2)$
D	$\frac{dA}{A} = \frac{dV}{V}(1 - V^2)$

Answer Key: **A**

Q80 : For a linear distribution of velocity in the boundary layer on a flat plate, the ratio of displacement thickness to nominal thickness is	
A	1/2
B	1/3
C	1/4
D	2/3
Answer Key: **A**	

Q81 : In economics of machining, which one of the following costs remains constant?	
A	Machining cost per piece
B	Tool changing cost per piece
C	Tool handling cost per piece
D	Tool cost per piece
Answer Key: **C**	

Q82 : The heat production from a normal healthy man when asleep is about	
A	20 Watts
B	40 Watts
C	60 Watts
D	80 Watts
Answer Key: **C**	

Q83 : Deep hole drilling of small diameter (say 200 μm) is done with EDM by selecting the tool material as	
A	Copper wire
B	Tungsten wire
C	Brass wire
D	Tungsten carbide wire
Answer Key: **C**	

Q84 In ultra machining process, the material removal rate will be higher for material with :	
A	Higher toughness
B	Higher ductility
C	Lower toughness
D	Higher fracture strain
Answer Key: **C**	

Q85 Specific speed of an impulse turbine (Pelton wheel) ranges from :	
A	10-40
B	50-100
C	60-250
D	300-800
Answer Key: **A**	

Q86 Hydrogen can play an important role as an alternative fuel to conventional fuel as :	
A	An energy carrier
B	An energy device
C	An energy system
D	None of these is correct
Answer Key: **A**	

Q87 When the ordering cost is increased to four times, the EOQ will be increased to :	
A	Two times
B	Three times
C	Eight times
D	Ten times
Answer Key: **A**	

Q88 In a reaction turbine

:	
A	Flow can be regulated without loss
B	There is only partial conversion of available head to velocity head before entry to runner
C	The outlet must be above the tail race
D	Water may be allowed to enter a part or whole of wheel circumference
Answer Key: **B**	

Q89 :	The constant volume cycle is also called
A	Carnot cycle
B	Joule cycle
C	Diesel cycle
D	Otto cycle
Answer Key: **D**	

Q90 :	The ratio of mass heat flow rate by convection to the flow rate by conduction under a unit temperature gradient and through a characteristic length L is known as
A	Prandtl number
B	Nusselt number
C	Stanton number
D	Peclet number
Answer Key: **D**	

Q91 :	A fixed gear having 10 teeth meshes with another gear having 25 teeth, the centre lines of both the gears being joint by an arm so as to form an epicyclic gear train. The number of rotations made by the smaller gear for one rotation of the arm is
A	Three
B	Four
C	Five
D	Six
Answer Key: **C**	

Q92 A cam is to be designed for a knife edge follower with following data; cam lift 40 mm during 90^{o} of cam rotation with SHM, dwell for the next 30^{o}, during the next 60^{o} of can rotation the follower returns to its original position with SHM,

:	dwell during the remaining 180^o. The acceleration of the follower during its accent and descent are
A	20.6, 11.8 m/s^2
B	20.6, 118 m/s^2
C	50.6, 11.8 m/s^2
D	50.6, 113 m/s^2
Answer Key: **D**	

Q93 :	For a band brake, the width of the band for a drum diameter greater than 1m, should not exceed
A	150 mm
B	200 mm
C	250 mm
D	300 mm
Answer Key: **A**	

Q94 :	Effect of hummer blow in a locomotive can be reduced by
A	Decreasing the speed
B	Using two or three pairs of wheels coupled together
C	Balancing whole of the reciprocating parts
D	Either by decreasing the speed or using two or three pairs of wheels coupled together
Answer Key: **D**	

Q95 :	A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10000 N-m. The shaft is made of 45 C8 steel having ultimate tensile stress of 700 MPa and an ultimate shear stress of 500 MPa. Assume a factor of safety as 6. The diameter of the shaft according to the maximum shear stress theory is
A	84 mm
B	85 mm
C	86 mm
D	87 mm
Answer Key: **C**	

Q96	A hydraulic press exerts a total load of 3.5 MN. This load is carried by two steel rods, supporting the upper head of the

:	press. The safe stress is 85 MPa and E=210 kN/mm^2. The diameter of the rod will be
A	160 mm
B	161 mm
C	162 mm
D	165 mm
Answer Key: **C**	

Q97 :	If the ratio of the diameter of rivet hole to the pitch of rivet is 0.25, then the tearing efficiency of the joint is
A	0.50
B	0.75
C	0.25
D	0.87
Answer Key: **B**	

Q98 :	The diameter of the air cylinder of an air press is 200 mm and the cylinder assembly is held together by six bolts which are of the length of cylinder. The maximum operating air pressure in the cylinder is 0.9 N/mm^2. The fitted gasket must be preloaded with 20kN forces to prevent air leakage. The external load on the bolt is
A	275.6 kN
B	285.2 kN
C	28.52 kN
D	28.82 kN
Answer Key: **C**	

Q99 :	A 50 mm diameter solid shaft is welded to a flat plate by 10 mm fillet weld. The maximum torque that the welded joint can sustain if the maximum shear stress intensity in the weld material is not to exceed 80 MPa is
A	2 kN-m
B	2.1 kN-m
C	2.22 kN-m
D	2.35 kN-m
Answer Key: **C**	

Q100	Oldham coupling is used to connect two shafts

:	
A	Which are perfectly aligned
B	Which are at 90^{o}
C	Which have lateral misalignment
D	Whose axes intersect at a small angle
Answer Key: **C**	