S - 397 Total No. of Pages : 2

Total Marks: 100

B.E.(Mechanical) (Part 1) (Semester-VII) (Revised) Examination, May - 2015 EXPERIMENTAL MECHANICS (Elective - 1) Sub. Code : 47982

Day and Date : Saturday, 30 - 05 - 2015 Time : 10.00 a.m. to 01.00 p.m.

Instructions : 1) Attempt any THREE questions from section I and any THREE questions from section II.

- 2) Figures to the right indicates full marks.
- 3) Draw neat diagrams to supplement your answers wherever required.
- Make suitable assumptions wherever necessary and state them clearly.
- 5) Use of any type of calculator is allowed.

SECTION - I

- Q1) a) With usual notations, derive an equation for the light as it comes out of the analyzer of a circular polariscope dark field arrangement. [16]
- Q2) a) What do you understand by the terms "isoclinics" and "isochromatics"? Explain their role in stress analysis by photoelasticity.
 (8) Explain the use of white light in photoelasticity.
- Q3) a) In an experiment of separation of stresses using oblique incidence method, a fringe order of 2.48 was measured in normal incidence at a point of interest. Measurement of fringe order at the same point but in oblique incidence was carried out by rotating the model around one of the principal stresses by 45° . The fringe order at the point was recorded as 2.98. To determine the material fringe value for of the photo elastic material, calibration was conducted by subjecting a circular disc 70mm diameter of the same photoelastic material to a diametral compressive load of 560 N. When viewed through a dark field circular polariscope arrangement, the fringe order of the isochromatic fringe at the centre of the circular disc was 1.86. Determine the values of the two principal stresses at the given point. Also calculate the maximum shear stress at the same point. Take model thickness as 6 mm. [12]
 - Explain the procedure of sheet casting of a photoelastic material. How is the process of model making carried out? [6]

P.T.O.

Seat No. Q4) Write short notes on (Any Two)

[16]

[6]

- i. Oblique Incidence method of separation
- ii. Scaling Model to Prototype
- iii. Reflection photoelasticity

SECTION - II

- Q5) a) Explain the construction of an electrical resistance strain guage.Explain the difference between wire type and foil type strain guage.Why is foil gauge more commonly used? [8]
 - b) Explain the method of mounting a strain guage. How this mounting is checked? [8]
- Q6) a) What is calibration of strain gauge? How is it done?
 - b) Four strain gauges are mounted on a steel cantilever, two on top and two at the bottom. The length of the cantilever is 160 mm. Width of the cantilever is 30 mm and thickness is 6 mm. Modulus of elasticity of the cantilever material is 2.1 × 10⁵ N/mm². Gauge factor of each gauge is 2.2. Supply voltage is 8 V and output voltage is 3 m V. Calculate the load applied at the end of the cantilever. Sketch the arrangement. [12]
- Q7) a) The following readings were taken on a delta rosette attached to a Mild Steel specimen

 $\varepsilon_{A} = 500$ micro strain compressive

 $\varepsilon_n = 350$ micro strain tensile

 $\varepsilon_c = 300$ micro strain compressive

Determine the principal strains, principal stresses and their angle of orientation. Take for Mild Steel modulus of elasticity E=200 GPa and Poisson's ratio $\mu=0.30$. [16]

Q8) Write short notes on (Any Two)

[16]

- i. Torque Transducer
- ii. Stress analysis using rosette
- iii. Temperature compensation

-2-

S - 1486 Total No. of Pages : 3

B.E. (Mechanical) (Semester - VII) (Revised) Examination, May-2015 FINITE ELEMENT ANALYSIS Code : 47981

Day and Date : Thursday, 28 - 05 - 2015 Time : 10 00 c m to 01 00 c m Total Marks: 100

Time : 10.00 a.m. to 01.00 p.m.

Instructions :

Seat No.

- 1) Answer three questions from each section.
- 2) Figures to right indicate full marks.
- 3) Assume if necessary suitable data and state them clearly.
- 4) Draw neat labeled sketch wherever necessary.
- 5) Use of non-programmable calculators is permissible.

SECTION - I

- Q1) a) Explain the principle of minimization of the potential energy, Derive an expression for the stiffness matrix by using simple 1-D element.
 - b) Obtain the variational form of a differential equation.

Q2) The equation governing the torsion of a circular shaft is $T = (JG/L)\theta$, where T is the torque, J is the second moment of area of the cross section, G is the shear modulus, L is the length and θ is the angle of twist of the shaft in radians. Derive the finite element equations for the torsion elements and analyze the shaft fixed at end supports given in the figure below. (i.e., find nodal displacements and support reaction torques by discretizing the shaft into three elements). Take diameter of the shaft=20mm and G = 80 GPa. [16]



P.T.O.

[8]

S - 1486

- (Q3) a) Write examples on simplification of the model through the symmetry.[8]
 - b) Calculate the shape functions for the following triangular element. And hence find the temperature at the point(2,2) if the nodal temperatures of the element are φ=20°C, φ=100°C and φ=150°C [8]



Q4) Write short notes on:(any three)

- a) Choice of the element type
- b) Interpolation function in FEA
- c) Galerkins method
- d) Basic element shapes and behaviour
- e) Bandwidth and node numbering in the matrix

SECTION-II

- Q5) a) State the steps involved to modela mechanical element (e.g., a bracket), perform a static analysis and view results using commercial FEA software.
 [8]
 - b) What are simplex, complex and multiplex elements used in FEM? [8]
- Q6) a) Explain meaning of assembly of element equations, incorporation of boundary conditions and solutions of equations in FEA.
 [8]
 - b) Explain how size and number of elements in FE mesh are related and their effect on the solution accuracy. [8]

2

[18]

17

[18]

Q7) a) For the simply supported beam shown in figure below state the displacement and slope boundary conditions. Also, check whether the function $y = A \sin (\pi x/l)$ satisfies the boundary conditions. Next find the arbitrary constant A by collocation method by making residual Zero at x = l/2. The differential equation for beam being EId²y/dx²-M₀⁼⁼⁰, $0 \le x \le 1$ [8]



- b) What are interpolation functions?State continuity conditions at interelement nodes. [8]
- Q8) Write short notes on:(any three)
 - a) Features of a commercial FEA package
 - b) Principle of minimum potential energy
 - c) Guass quadrature numerical integration technique
 - d) Simple, complex and multiplex element
 - e) Body forces and surface traction

XXXX

Seat No.

B.E. (Mechanical) (Semester - VII) Examination, May - 2015 MECHANICAL SYSTEM DESIGN (New) Sub. Code : 47980

Day and Date : Thursday, 21 - 05 - 2015 Time : 10.00 a.m. to 1.00 p.m. Total Marks: 100

Instructions: 1) All question

- 1) All questions are compulsory
 - 2) Figures to the right indicate full marks
 - 3) Assume suitable data wherever necessary and state it clearly
 - 4) Draw neat labeled sketches wherever necessary

SECTION - I

Q1) a) Explain the relationship between man, machine and environment. [8]

b) Explain aspects of aesthetic design with suitable examples. [8]

OR

b) Derive an expression for dynamic response of lumped system

Q2) a) What is autofrettage? Discuss methods used for autofrettage of cylinders. [6]

b) A pressure vessel, subjected to a design pressure of 0.75 MPa, consists of a cylindrical shell with 2 m inside diameter and 10 mm thickness. An opening of inner diameter 300 mm and wall thickness 10 mm is provided in the shell. The corrosion allowance is 2 mm and the weld joint efficiency is taken as 0.85, the extension of opening inside the shell is 15 mm. The yield strength of the material used for the shell and the opening is 210 N/mm². A reinforcing pad made of a 10 mm thick plate is provided for the opening. Determine the inner and oute diameters of pad. [12]

 Q3) a) Derive an expression for braking torque in case of internal expanding brake.
 [8]

 An automobile vehicle weighing 13.5 kN is moving on a level road at a speed of 95 km/hr. When brakes are applied, it is subjected to a uniform

P.T.O.

S - 393

deceleration of 6m/s². There are brakes on all four wheels. The tyre diameter is 750 mm. The kinetic energy of the rotating pars is 10% of the kinetic energy of the moving vehicle. The mass of each brake drum assembly is 10 kg and the specific heat capacity is 460 J/kg°C. Calculate the braking time, braking distance, total energy absorbed by each brake, the torque capacity of each brake and temperature rise of brake drum assembly. [8]

OR

b) A plate clutch ha three discs on the driving shaft and two discs on the driven shaft, providing four pair of contact surfaces. The outside diameter of the contact surfaces is 240 mm and inside diameter 120 mm. Assuming uniform pressure and coefficient of friction 0.3, find the total spring load pressing the plates together to transmit 25 kW at 1575 rpm. If there are 6 springs each of stiffness 13 kN/m and each of the contact surfaces has worn away by 1.25 mm, find the maximum power that can be transmitted, assuming uniform wear.

SECTION - II

- Q4) a) Explain the concept of mechanical reliability and Factor of Safety. [6] OR
- a) Why geometric progression is used for estimating spindle speeds in machine tools drives? Explain.
 - b) A six speed gear box is to be designed for machine tool drive. The spindle speeds range between 150 rpm and 1000 rpm. If the gear box is driven by 5 kW, 1000 rpm motor through belt drive, draw speed diagram and gearing diagram. Determine Number of teeth on gears and Select diameter of pulleys. The standard Pulley diameters are: 80, 90, 100, 112, 125, 140, 160, 180, 200, 224, 250, 280, 290, 300, 310, 355, 375, 400, 450, and 500 mm. [12]
- Q5) a) Discuss any two Belt Take Up devices.

[8]

OR

a) Explain and discuss lagrange multiplier method in optimum design.

S - 393

[16]

b) In light weight equipment, a shaft is transmitting a torque of 900 Nm and is to have a rigidity of 90Nm/degree. Assume a factor of safety of 1.5 based on yield stress. Design the shaft for minimum weight/ Assume maximum shear stress theory of failure. Use following data for the materials [8]

Material	Mass Density (kg/m³)	Material Cost (Rs/N weight)	Yeild Strength (MPa)	Shear Modulus (GPa)
Steel	8500	16	130	80
Al-Alloy	3000	32	50	26.7
Titanium Alloy	4800	480	90	40
Magnesium Alloy	2100	32	20	16

Q6) Solve any Two

- a) Discuss the design considerations used while determining power requirement of belt conveyor.
- b) A assembly of three components A, B,C is shown in figure II-1. The dimensions of the three components are normally distributed and natural tolerance is equal to design tolerance as shown in the figure. Determine the percentage of assemblies where interference is likely to occur. Areas under the standard normal distribution curve from zero to z are as follows.





Figure - II - Q.6 (b)

- c) Discuss the need of multispeed gearbox in machine tool
- d) Explain johnson's method of optimum design.

AAA

P-516 Total No. of Pages : 4

B.E. (Mech.) (Part - I) (Semester - VII) (Revised) Examination, April - 2016 REFRIGERATION AND AIR CONDITIONING Sub. Code : 47979

Day and Date : Friday, 29-04-2016 Time : 3.00 p.m. to 6.00 p.m.

Seat No.

Total Marks : 100

Instructions : 1) Attempt any three questions from each section.

- 2) Figures to the right indicate full marks.
- 3) Use same answer books for the two sections.
- 4) Neat diagrams/charts must be drawn wherever necessary.
- <u>Use</u> of steam tables, refrigerants/psychrometric charts/tables are <u>al-</u> lowed.
- 6) Make suitable assumptions if required and state them clearly.

SECTION - 1

- Q1) a Discuss ASHRAE classification of refrigerants. Give different types, composition and applications of Azeotropes commonly used. [8]
 - (d) Give comparison of refrigerants R134a, R22 and NH, with respect to their thermodynamic properties. [8]
- - Very Describe with neat sketch the principle and operation of Li-Br₂ water vapour absorption system. [7]
 - What are pre requisites of an acceptable system for aircraft refrigeration?
 Enumerate various sources of heat addition for aeroplane. [4]

P.T.O.

P-516

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 Au or t
 Q3) a)
 Differentiate between multievaporator and multistage vapour compression refrigeration system. Represent these systems on p-h diagrams. State clearly in what circumstances these systems are used.

 Form
 eliminatory header
 [8]

condenses

What are the factors to be considered for selecting a condenser for a refrigeration system. Describe the working of an evaporative condenser with a neat sketch. [8]

- Q4) a) Explain why the coefficient of performance of a heat pump is always greater than unity. [4]
 - b) An ammonia ice plant operates between condenser temperature of 35°C and an evaporator temperature of -15°C. It produces 5 tons of ice per day from water at 25°C to ice at - 5°C. The NH₃ enters the compressor as dry saturated vapour and leaves the condenser as saturated liquid. Determine [12]
 - i) the capacity of the refrigeration plant 7.41 tons.
 - ii) Mass flow of refrigerant 0.024 Kg/s
 - iii) Discharge temperature of NH, from the compressor 388K
 - iv) Power of the compressor motor if the isentropic efficiency of the compressor is 85% and mechanical efficiency of the compressor is 90%.
 - v) Relative C.O.P. Assume Latent heat of ice = 335 kJ/kg, specific heat of ice = 1.94 kJ/kg "K. Specific heat of water = 4.2 kJ/kg "K. Sp heat of refri. vapour = 2.8 kJ/kg "K.

sat.	Enthalp	Enthalpy kJ/kg		kJ/kg *K
temp °C	liquid	vapour	liquid	vapour
-15	112.3	1426	0.457	5.549
+35	347.5	1471	1.282	4.930

Q5) Write notes on any three of the following:

- P-516
- a) Capillary tube Vs Thermostatic expansion valve.
- b) Considerations for selection of a suitable evaporator.
- c) Hermatic compressor.
- d) Alternative refrigerants.
- e) Linde cycle.
- f) Actual vapour compression cycle.

SECTION - II

- Q6) a) Sketch comfort chart showing comfort zone. Explain how design conditions can be arrived at from such chart. [8]
 - b) Discuss the classification of air conditioning systems and Distinguish between summer and winter air conditioning. [8]
- Q7) a) Why the ducts are installed in an air conditioning applications? Classify the ducts and state the general rules/principles which should be followed in the designing of ducts. [7]
 - b) Give types, locations and applications of different outlets, diffusers, registers and dampers used for the air distribution system. [9]
- Q8) a) Define enthalpy potential and derive the equation for the same. [6]
 - b) 100 m³/min of air at 32°C and 60% RH enters a cooling will leaves at 20°C and 50% RH. Find by using psychrometric tables only [10]

i)	the mass of water removed per kg of dry air.	0.00185 kg/kg of dry ais
ii)	the heat removed per kg of dry air.	13.8 KJ/kg
iii)	weight of dry air passing per min.	115
iv)	the capacity of the cooling coil in tons.	7 to 8 tons -
v)	the mass of water vapour removed per hour.	9.16 Kg (hr.

P-516

- Q9) a) What are the sources which contribute to the sensible heat and latent heat load? Explain them briefly. [6]
 - A conference hall is desired to be maintained at 27°C DBT and 18°C WBT with outside condition of 35°C DBT and 26°C WBT. Estimate the amount of air to be supplied per hour and the supply condition of air on the basis of following information. [10]

Heat gain through wall and roofs = 23kW, lighting load = 18.4 kW

Heat gain through glass areas = 1.8 kW fan motor load = 5.6 kW

Infilteration load = 1.2 kW, Occupants in the room = 85

Sensible heat gain per occupant = 0.06 kW, cooling will by pass factor = 0.15

Latent heat gain per occupant = 0.07 kW.

Assuming 60% of fresh air and 40% recirculated air is mixed through conditioner.

Q10)Write notes on any three of the following :

- a) Duct Systems for Hospitals.
- b) Thermal exchange of human body with environment.
- Energy requirements of diff. types of A/C systems.
- d) Ventilation requirements.
- e) Air washer and its applications.
- Static regain method of duct sizing & its advantages.

Find Vs, , hi hz and ha mass of infiltration air

ma = RSH+ RLH Total hert service

18

P- 517 Total No. of Pages :4

B.E.(Mechanical)(Semester -VII)(New Course) Examination, April - 2016 MECHANICAL SYSTEM DESIGN Sub. Code: 47980

42

Day and Date : Saturday, 30 - 04 - 2016 Time :03.00 p.m. to 6.00 p.m.

Total Marks :100

1) All questions are compulsory.

- 2) Figures to the right indicate full marks.
- Assume suitable data wherever necessary and state it clearly. 3)
- 4) Draw neat labeled sketches wherever necessary.

SECTION-I

Q1) a) Explain, the importance of aesthetic design considerations, in product design with the help of suitable examples. [8]

Discuss ergonomic considerations in design of displays and controls.[8]

OR

Explain modelling of masses and inertia.

the internal and the external diameters of the assembly are 120mm and 200mm and the diameter at the junction is 160mm. If after shrinking on the contact pressure at the junction is 8 N/mm2. Determine using Lame's equation, the stresses at the inner mating and outer surfaces of the assembly after the fluid has been admitted. 121

()2) a)

P.T.O.

- Discuss the stresses induced in thick cylinder. [6] A shrink fit assembly formed by shrinking on tube over another, is subjected to an internal pressure of 60N/mm2. Before the fluid is admitted,

Instructions :

Seat No.

Q3) a) Explain the energy considerations used in design of brakes. [8]

b) The brake is shown in Figure I-1 requires and actuating force of 2000N at the end of the lever. Coefficient of friction is 0.3 and maximum pressure intensity is IMPa. Determine the width of the shoe and the braking capacity. [8]



Figure I-1 Question 3 (b)

OR

An automotive single plate clutch consists of two pairs of contacting surfaces. The outer diameter of the friction disk is 270mm. The coefficient of friction of 0.3 and the maximum intensity of pressure is 0.3N/mm². The clutch is transmitting a torque of 531 N-m. Assuming uniform axial wear, calculate, the inner diameter of the friction disk and spring force required to keep the clutch engaged.

SECTION-II

Q4) a) Derive an expression for mean and standard deviation for a resultant combination when number of populations is combined. [6]

OR

Why multi-speed gearboxes are required in machine tools?

- b) A multi speed gear box is to be designed for a headstock of a turret lathe for nine spindle speeds ranging from 30 rpm to 1000 rpm. If the gear box is driven by 5kW, 720 rpm electric motor through the belt drive. Draw the speed ray diagram and gearign diagram determine number of teeth on gears. Select the diameters of pulleys for belt drive. The standard pulley diameters are: 80, 90, 100, 112, 125–140, 160, 180, 200, 224, 250, 280, 290, 300, 310, 355, 375, 400, 450, and 500 mm. [12]
- Q5) a) What is the purpose of idlers? Explain any two types of idlers. [8]

OR

Explain Johnson's method of Optimum Design.

 b) Design a tensile bar of length of 200 mm to carry a tensile load of 5kN for minimum cost out of following materials. [8]

Material	Mass Density (kg/m3)	Material Cost (Rs/N weight)	Yield Strength (MPa)
Steel	7500	16	130
Al-Alloy	3000	32	50
Titanium Alloy	4800	480	90
Magnesium Alloy	2100	32	20

[16]

Q6) Solve any two:

1 m

- a) Write a note on objectives of optimum design.
- b) Discuss significance of standard normal distribution curve in the engineering statistical analysis.
- c) State and explain basic consideration in design of multi spindle derives.
- d) Write a note on belt take-up devices.

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B.E.	(Mechanical) (Semester-VII) (Revised)
	Examination, May - 2016
	FINITE ELEMENT ANALYSIS
	Sub Code: 47981

Day and Date : Monday, 02-05 - 2016 Time : 3.00 p.m. to 6.00 p.m. Total Marks: 100

Instructions :

Seat No.

1) Answer any three questions from each section.

Figures to right indicate full marks.

3) Assume if necessary suitable data and state them clearly.

Draw neat labelled sketch wherever necessary.

5) Use of non-programmable calculators is permissible.

SECTION-I

Q1) Analyse the axially loaded stepped bar shown in figure below. Use the finite element method (element and global matrix) to predict the nodal displacements u_2 , u_3 and u_4 at the nodes 2, 3 and 4, and the support reaction R at the fixed node 1 ($u_1 = 0$). The cross sectional areas are 50 mm², 20 mm² and 10 mm², the lengths of steps are 10mm each and the modulus of elasticity is 200 GPa. [16]



P.T.O.

P-518

[18]

- Q2) a) For a one-dimensional bar elementprove that the displacement through the element (with a linear variation) is given by $U_{(x)} = N_i U_j + N_j U_j$, where the shape functions $N_i = (x_j x)/l$ and $N_j = (x x_j)/l$. Also plot N and N over the length of the element. Evaluate $(N_j + N_j)$, and $(dN_i/dx + dN_j)/dx$. [8]
 - b) State different weighted residual methods used in FEA formulation. [8]
- Q3) a) Explain the steps required to carry out the analysis of simple 1-D steady state heat conduction using ANSYS software. [8]
 b) Explain 1-D, 2-D, 3-D elements in FEA. [8]
- Q4) Write short notes on (Any Three):
 - a) Functional extremization in FEA.
 - b) Discretization/meshing of a model.
 - c) Choice of the element.
 - d) Weighted residual method.
 - Steps involved in Time History Postprocessor in ANSYS.

SECTION-II

Q5) For the truss shown in figure, determine the element and global stiffness matrices. The cross section of all members is 'A' and modulus of elasticity, 'E'. [16]



-2-

P-518

- Q6) a) Prepare an algorithm/flowchart to write a computer code for the finite element analysis of a simple plane truss having n nodes and m elements.
 [8]
 - b) Explain simplex, complex and multiplex elements in FEA. [8]
- Q7) a) Explain in detail the activities involved in postprocessor of an FEA software.
 [8]
 - Explain with suitable examples simplification of a model using symmetry.
 [8]

Q8) Write short notes on (Any Three):

[18]

- a) Preprocessing in ANSYS.
- b) Body forces and surface tractions.
- c) 1-D, 2-D, 3-D elements in FEA.
- d) Interpolation function.
- e) Bandwidth of the stiffness matrix.

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P - 520 Total No. of Pages :3

B.E. (Mechanical) (Part - IV) (Semester - VII) Examination, May - 2016 AUTOMOBILE ENGINEERING (Elective - I)

Sub. Code: 47984

Day and Date : Tuesday, 03 - 05 - 2016 Time : 3.00 p.m. to 6.00 p.m. Total Marks: 100

- Instructions: 1) Attempt any three questions from each section.
 - 2) Figure to right indicates full marks.
 - 3) Non programmable calculator is allowed.

SECTION-I

Q1) a) \	Write	the	functions	of
----------	-------	-----	-----------	----

- i) Frame
- ii) Clutch
- iii) Gear box
- iv) Propeller shaft
- v) Differential
- vi) Steering
- vii) Brake
- viii) Battery
- b) Explain the concept of semi forward and fully forward chassis. [4]
- c) Write the advantages of four wheel drive over two wheel drive. [4]
- Q2) a) Explain the terms:
 - i) Tractive effort
 - ii) Gradiability
 - iii) Drawbar pull

P.T.O.

6

[8]

Seat No.

01

- 15

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P - 520

[18]

- b) The coefficient of rolling resistance for a truck weighing 62293.5N is 0.018 and coefficient of air resistance is 0.0276 in the formula. R = KW + KaAV² N where A is M² of frontal area and V the speed in Km/hr. The transmission efficiency in top gear of 6.2:1 is 90% and that in the second gear of 15:1 is 80%. The frontal area is 5.574M². If truck has to have a maximum speed of 88 Km/hr in top gear calculate [10]
 - The engine B.P. required.
 - ii) The engine speed if the driving wheels have an effective diameter of 0.8125m.
 - iii) The maximum grade the truck can negotiate at the above engine speed in second gear.
 - iv) The maximum drawbar pull available on level at above engine speed in second gear.
- Q3) a) Draw neat sketch of multi plate clutch and compare advantages and disadvantages with single plate cutch. [8]
 - b) Explain the construction and working of differential.
 [8]

Q4) Attempt any three:

- a) Hybrid vehicle
- b) Constant mesh gear box
- c) Propeller shaft
- d) Torque tube drive

SECTION-II

- Q5) a) List steering gear boxes and explain any one of them with neat sketch.[8]
 - b) What is need of wheel alignment? Which parameters are checked in wheel alignment? [8]

	P -	520
Q6) a)	How does vacuum brake work explain with sketch.	8
b)	Explain the working of wheel cylinder in hydraulic brake system.	[8]
Q7) a)	Compare conventional suspension with independent suspension. the four vehicles where these systems are used.	List [8]
b)	Explain the principle and operation of lead - acid battery.	[8]
Q8) Wr	ite short note on any three:	[18]
a)	Voltage and current regulator.	

- b) Alternator.
- c) Active suspension.
- d) Three wheeler layout.

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S - 392 Total No. of Pages :4

Seat No.

Instructions :

B.E (Mech.) (Part - I) (Semester - VII) (Revised) Examination,

May - 2015

REFRIGERATION AND AIR CONDITIONING

Sub. Code: 47979

Day and Date : Tuesday, 19- 05- 2015

.Total Marks: 100

Time : 10.00 a.m. to 01.00 p.m.

- 1) Attempt Any Three Questions from each section.
- 2) Figures to the right indicate full marks.
- 3) Use same answer books for the two sections.
- 4) Neat diagrams/charts must be drawn wherever necessary.
- Use fo steam tables, refrigerant/psychrometric charts/tables are allowed.
- 6) Make suitable assumptions if required and state them clearly.

SECTION - I

- Q1) a) Differentiate between physical and thermodynamic properties of a refrigerant. Explain which are more important giving specific reasons.[10]
 - b) What is secondary refrigerant? State its advantages. Explain its importance with suitable application. [6]
- Q2) a) Compare and contrast between the reversed carnot cycle and Bell colemann cycle of refrigeration. What are the benefits of using air cycles for air craft cooling.
 [7]
 - b) Discuss vapour compression system and vapour absorption system with respect to merits, demerits and energy conservation. [9]
- Q3) a) What are advantages of compound compression? Discuss the merits and demerits of flash and water inter cooling employed with multiple compression.
 [8]
 - b) Give the procedure to charging and testing of refrigerants into a refrigeration system. Also give different methods of leak detection [8]

[18]

- Q4) a) Discuss the selection of refrigerant absorbent pair for vapour absorption refrigeration system. State desirable properties of apair. [6]
 - b) The following data refers to a 20 TR ice plant using ammonia as refrigerant. The temperature of water entering and leaving the condenser are 20° C and 27° C and temperature of brine in the evaporator is - 15°C, before entering the expansion valve, ammonia is cooled to 20°C and the ammonia enters the compressor dry saturated. Calculate for one tonne of refrigeration the power expended, the amount of cooling water in the condenser and the coefficients of performance of the plant. [10]

Sat.	Enthalp	y-kj/kg	Eutropy-kj/kg °K		SP. heat-kj/kg "K	
Temp ^{°C}	Liquid	vapour	liquid	vapour	liquid	vapour
- 15	112.34	1426.54	0.4572	5.5490	4.396	2.303
+ 25	298.90	1465.84	1.1242	5.0391	4.606	2.805

Use the properties given in the table below.

- Q5) Write notes on any three of the following.
 - a) Pulse tube refrigeration.
 - b) Dx type and flooded evaporators.
 - c) Thermostatic expansion valve.
 - d) Crystallization.
 - e) Protection devices used in compressor.
 - f) Cascade system.

SECTION - II

- Q6) a) Explain the importance of effective temperature in air conditioning system.
 Discuss the factors governing optimum effective temperature. [8]
 - b) Define thermal comfort of human body and explain it with the help of equation of thermodynamics of human body. [8]

S - 392

- Q7) a) Enlist the various equipments used in a central air conditioning plant. Explain the working of air washer with the help of a neat sketch. [8]
 - b) Define Aspect ratio, duct class. equivalent diameter and equivalent length in duct sizing. Give use of different charts used in duct design. [8]
- *Q8)* a) Define i) Bypass factor and contact factor
 - ii) Degree of saturation and Relative humidity. [6]
 - b) 450 cmm of air at 38° DBT and 27°C WBT is mixed with another stream of 720 cmm of air at 23°C DBT and 55% RH. The mixture is cooled to 14°C Assume coil SHF = 0.55 Determine. [10]
 - i) Final condition of the mixture
 - ii) Heat removed by cooling coil
 - iii) Moisture removed by cooling coil.
- (29) a) Distinguish clearly between summer and winter air conditioning. [4]
 - b) The following data refers to a high humidity chambers. Summer outside condition = 35°c DBT, 25°c WBT [12]

Inside design condition = 21°c DBT, 70% RH.

RSH = 46.52kw, RLH = 2.9075kw.

Ventilation = 108 cmm. Assume BF = 0.05.

Find when space humidification isnot used.

- i) Outdoor air load
- ii) Grand total heat
- iii) ESHF
- iv) ADP
- v) Dehumidification air quantity
- vi) Eutering and leaving conditions at the apparatus.

Q10) Write notes on any three of the following.

S - 392 [18]

- a) Factors forming the load on airconditioning system.
- b) Methods of Duct design.
- c) Ventilation and its requirements.
- d) Systems of air distribution.
- e) Comfort chart.
- f) Energy conservation in air conditioning.

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S - 2089 Total No. of Pages : 4

Seat No.

B.E. (Mech.) (Part - I) (Semester - VII) (Revised) Examination, December - 2015

> REFRIGERATION AND AIR CONDITIONING Sub. Code : 47979

Day and Date : Tuesday, 08 - 12 - 2015

Total Marks: 100

Time : 10.00 a.m. to 01.00 p.m.

Instructions : 1) Attempt any three questions from each Section.

- Figures to the right indicate full marks.
- Use same answer books for the two sections.
- 4) Neat diagrams/charts must be drawn wherever necessary.
- Use of steam tables, refrigerants/psychrometric charts tables are allowed.
- 6) Make suitable assumptions if required and state them clearly.

SECTION - I

Q1) a) What factors govern the selection of refrigerants for various application? Why and where, following refrigerants are commonly used

i) air ii) R 134a iii) Ammonia. Comment why each is suitable at specified place and not at all places? [10]

- b) What is O.D.P. and G.W.P with respect to refrigerants and their importance. [6]
- Q2) a) Draw a schematic diagram/layout of an air cycle refrigeration system employed for air conditioning the cockpit and cabin space for an air plane. Explain the working of it with T-S diagram. [8]
 - b) Describe with a neat diagram practical acqua ammonia vapour absorption system using heat exchangers. Give comparison with Lithium bromide water vapour absorption system.
- Q3) a) Draw the sketch of claude system for liquefication of air. Show the cycle on temp-entropy plane and explain the working of the system. State merits and demerits of the same.
 - b) Discuss the difficulties encountered in the production of law temperature with the help of single or multistage vapour compression refrigeration system.

[6]

P.T.O.

[18]

- Q4) a) Explain with the help of p-h diagrams, the effect of condensing temp, evaporating temp, vapour superheating and liquid subcooling on the performance of vapour compression refrigeration system.
 [8]
 - b) It is proposed to replace R12 by ozone friendly R 134a in a refrigeration plant of 9 tonnes - capacity with evaporator and condenser temperature of 0°C and 40°C respectively. Considering standard saturation cycle, compare the mass flow rate and cop for two refrigerants. The saturation properties and vapour specific heat are as follows :

Cp for R-12 = 0.776 kj/kg°K, Cp for R134a = 1.068 kj/kg°K, Comment on the results. [8]

		Specific enthalpy		Specific entropy	
Refrigerant	Temp	Liquid	Vapour	Liquid	Vapour
	°C	kj/kg	kj/kg	kj/kg °k	kj/kg %
R134a	0	200.81	398.78	1.0025	1.7261
	40	255.73	419.63	1.1884	1.7128
R12	0	36.1	187.5	0.1420	0.6966
	40	74.6	203.2	0.2718	0.6825

Q5) Write notes on any three of the following :

- a) Removal of flash gas and flash intercooling.
- b) Automatic Expansion valve.
- c) Vortex tube refrigeration.
- d) Insulating materials in Refrigeration systems.
- e) Cryogenic and its applications.
- f) Electrolux Refrigeration system.

SECTION - II

Q6)	a)	Explain the self regulatory system of the body against high tem	p. and
		low temp. exposure.	[4]
	b)	Discuss the factors affecting thermal balance between the body a environment.	nd the
	c)	Draw the comfort chart and explain in detail.	[7]

S - 2089

[9]

- Q7) a) Develop an expression for equivalent diameter of a rectangular duct.
 What are the assumptions made.
 [8]
 - b) What is the economics of an air transmission system & state the general rules which should be followed in the designing of ducts. [8]
- Q8) a) Define Relative humidity \$\phi\$ and degree of saturation \$\mu\$ and derive the relation between them.

$$\phi = \frac{\mu}{1 - (1 - \mu)\frac{PS}{p}}$$
[7]

- b) Atmospheric air at 1.01325 bar has DBT of 30°C and WBT of 23°C.
 Compute
 - Partial pressure of water vapour
 - ii) Specific humidity
 - iii) Dew point temperature
 - iv) Degree of saturation

Verify your results by psychrometric chart.

- Q9) a) Define and sketch on psychrometric chart RSHF, ESHF and GSHF in case of cooling and dehumidifying coils. [7]
 - b) A meeting hall of an administrative building is to be air conditioned for winter conditions. Following is the necessary data, = outdoor conditions → 10°C DBT & 75% R4 Required indoor conditions → 20°C DBT and 150°C WBT. Amount of air circulated = 0.3m³/min/person. No. of occupants = 100, The required conditions are achieved by heating and then by adiabatic humidification. Find :
 - i) Capacity of humidifier
 - ii) Capacity of heating coil in kW

Bypass factor if the surface temperature of heating coil is 36°C.
 Represent the process on psychrometric chart. [9]

S - 2089 [18]

Q10) Write notes on any three of the following :

- a) ADP and its significance.
- b) Duct materials.
- c) Air conditioning systems.
- d) Duct systems for Auditorium.
- e) Ventilation requirements.
- f) Spray type humidifiers.

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Total No. of Pages : 4

B.E. (Mechanical) (S	emester - VII) Examination, December - 2015
MECHANI	CAL SYSTEM DESIGN (New Course)
	Sub. Code : 47980

Day and Date : Friday, 11 - 12 - 2015 Time : 10.00 a.m. to 1.00 p.m.

Seat No.

Total Marks : 100

- Instructions : 1) All questions are compulsory.
 - 2) Figures to the right indicate full marks.
 - Assume suitable data wherever necessary and state it clearly.
 - Draw neat labeled sketches wherever necessary.
 - SECTION-I

QI) a) Discuss ergonomic design considerations in displays and control panels.
 [8]

 b) Explain form, Symmetry and balance, Colour, Style with reference to aesthetic design. [8]

OR

b) What is modeling? Explain different types of modeling.

- Q2) a) Explain how pressure vessels are classified as per IS 2825 : 1969. [8]
 - b) A hydraulic cylinder, made of gray cast iron FG300, is subjected to an internal pressure of 15 MPa. If the inner and outer diameters of the cylinder are 200 mm and 240 mm respectively, determine the factor of safety. If the cylinder pressure is further increased by 50%, what will be the factor of safety? [10]
- Q3) a) Compare:
 - Single plate clutch and multiplate clutch.
 - ii) Dry clutch and wet clutch.

P.T.O.

[8]

b) A cone clutch is used to transmit 30 kW at 750 rpm. Semi cone angle of the clutch is 12.5°, coefficient of friction 0.2, mean diameter of friction surface is '6b' where 'b' is the width of friction surface in mm, load factor is 1.75. Find the radii of friction surfaces and face width. Also find the spring wire diameter if disengagement factor is 1.2 and spring index is 6. Assume safe shear stress of 500 MPa. If the spring is deflected by 5 mm during disengagement, find the number of active coils and free length of spring. [8]

OR

b) An automotive type internal expanding shoe brake is shown in figure I - 1. The face width of the friction lining is 50 mm and the coefficient of friction is 0.4. The maximum intensity of pressure on the lining is 0.8 N/mm². The angle θ₁ can be assumed to be zero. Calculate the actuating force and torque capacity of the brake.



Figure I-1 Question 3(b)

-2-

[8]

SECTION-II

 Q4) a) What is significance of the normal distribution curve in the engineering statistical analysis? State its limitations.

OR

- a) What do you understand by maximum loss of economic cutting speed? Derive and expression for the same.
- b) A multispeed gear box is to be designed for a small size, general purpose machine tool for the spindle speeds varying between 63 rpm and 630 rpm. If the recommended geometric progression ratio is as per R5 series, draw the candidate structure diagram for machine tool gear box and select optimum structure diagram. If the gear box is to be driven by 720 rpm, three phase A.C. motor through a belt drive, determine the ratio of belt pulley diameters. [12]
- Q5) a) What is adequate design and Optimum design? Explain with suitable examples.
 [8]
 - b) A triple ply belt conveyor is required to transport 2 ton of iron ore per hour through a distance of 1000 m and a height of 300 m. The permissible belt speed is 90 m/min. Ef the mass density of iron ore is 2.5 ton/m³, determine the belt width, diameter of drive pulley and reduction ratio of gear reducer, if electric motor speed is 1440 rpm. Use following data.

Flowability factor k:

Belt inclination ' α '	10° - 15°	16° - 20°	21° - 25°	26° - 30°	31° - 35°
Flowability factor 'k'	2.65 X 10-4	2.5 X 10 ⁻⁴	2.35 X 10 ⁻⁴	2.20 X 10 ⁻⁴	2.05 X 10 ⁻⁴

Standard belt widths : 400, 450, 500, 600, 650, 750, 800, 900, 1000, 1200, 1400, 1600, 1800, 2000 mm

Material factor for plies for capron belt : $K_1 = 2.0$

Belt tension and arc of contact factor $k_{3} = 80$

OR

-3-

- b) A cylindrical shell of the heat exchanger is required to accommodate a total of 100 m length of standard diameter copper tubes. One meter square cross-sectional area inside the shell can 200 copper tubes. Design the heat exchanger shell with an objective of minimizing the cost of the heat exchanger, by using the following data:
 - Cost of copper tubes = Rs. 20000.
 - ii) Cost of heat exchanger shell = Rs. 60000D^{2.5}L.
 - iii) Cost of floor space occupied by the heat exchanger shell = Rs. 10000DL.

Where D = diameter of the heat exchanger shell in m

L = length of heat exchanger shell in m.

Q6) Solve any Two:

[16]

- a) Discuss lagrange's method of optimum design.
- b) Compare structure diagram with speed diagram.
- Discuss the role of reliability in modern engineering design.
- d) What are activities involved in material handling.

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-4-

S-2091 Total No. of Pages : 3

Seat	
No.	

B.E. (Mechanical) (Part - I) (Semester - VII) Examination, December - 2015 TOTAL QUALITY MANAGEMENT (New Course) Sub. Code : 47986

Day and Date : Tuesday, 15 - 12 - 2015 Time : 10.00 a.m. to 01.00 p.m. Total Marks : 100

Instructions: 1) Answer any three questions from each section.

- 2) Figures to the right indicate full marks.
- 3) Make suitable assumptions wherever necessary and state them clearly.
- 4) Use of statistical tables and scientific calculator is permitted.

SECTION - I

- Q1) a) Briefly explain prevention costs providing examples appropriate to a manufacturing environment.
 [8]
 - b) Name the famous quality gurus. State in single sentence their ideology for quality processes. [8]
- Q2) a) The following table gives the number of defects on lots observed at final inspection of an assembly. Prepare a c chart. Suppose the reasons for out of control situation for Lot no 5 are known, what is your decision regarding control limits for future use? [10]

Lot number	Number of Defects	Lot number	Number of Defects
L 1	13	L 6	6
L 2	15	L 7	7
L 3	19	L 8	17
L 4	8	L 9	9
L 5	23	L 10	3

b) Describe the process of quality planning with vendors.

[6]

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[4]

- Q3) a) List the various tools that can be utilized for problem solving and situation analysis with applications. [10]
 - b) With suitable example explain defects per million opportunities (DPMO). [6]
- Q4) a) Explain the concept of signal to noise ratio in Taguchi's quality engineering.
 [6]
 - b) What is the reliability of the system below 'where the reliabilities of the components A, B, C and D are 0.975. 0.985, 0.988 and 0.993 respectively? [8]



c) List the problems encountered in achieving reliability.

SECTION - II

Q5) a) What are the prerequisites of TQM? Discuss the barriers in implementing TQM program. [8]
b) Explain the key contributions of Feigenbaum to modern quality thinking. [8]
Q6) a) Is the main concern of most consumer the price of product or service? Explain. [8]
b) Define leadership. Describe functions of leadership. [8]
S-2091

- Q7) a) Discuss the step by step process to implement ISO 9001 : 2008 quality management systems.
 [8]
 - b) What is the service quality? Discuss the difference between quality for manufacturing and service industry. [8]

Q8) Write short notes on any three :

- a) Stages of FMEA
- b) Characteristics of QC
- c) Poka-yoke devices
- d) 5-S in TQM.
- e) Benefits of QFD.

[18]

S-2092 Total No. of Pages : 3

Seat	
No.	

B.E. (Mechanical) (Part - I) (Semester - VII) Examination, December - 2015

EXPERIMENTAL MECHANICS (Elective - I) Sub. Code : 47982

Day and Date : Tuesday, 22 - 12 - 2015 Time : 10.00 a.m. to 01.00 p.m. Total Marks : 100

Instructions : 1) Attempt any three questions from Section - I and any three questions from Section - II.

- 2) Figures to the right indicate full marks.
- 3) Draw neat diagrams to supplement your answers wherever required.
- 4) Make suitable assumptions wherever necessary and state them clearly.
- 5) Use of any type of Calculator is allowed.

SECTION - I

- Q1) a) Derive an expression for intensity of light observed through analyser when a stressed photoelastic model is kept in bright field circular polariscope. [10]
 - b) A two dimensional photoelastic model of a connecting rod was observed in dark field circular polariscope. The fringe order at the point of interest was observed to be equal to 3.80. A circular disc of same material of 80 mm diameter was loaded in diametrical compression to calculate material fringe value. At a load of 1100 N the fringe order at the centre of disc was observed to be 3. [8]

Calculate maximum in plane shear stress at the point of interest in connecting rod, if its thickness is 6 mm.

Q2) a) Illustrate casting procedure for two dimensional photoelastic sheet. [8]
 b) Explain in detail the Babinet Soleil method of compensation. What are its advantages? [8]

P.T.O.

S-2092

[16]

- Q3) a) Explain "Electrical Analogy" Method used for separation of principal stresses. [8]
 - b) Enlist the different experimental stress analysis techniques. When would you propose the use of these techniques? [8]

Q4) Write notes on any two of the following :

- a) Scaling of stresses from model to prototype.
- b) Use of white light and monochromatic light in photoelasticity.
- c) Reflection Polariscope.

SECTION - II

- Q5) a) Discuss various possible configurations of wheatstone bridge circuit used for strain gauges. Also state the expression for output voltage in each case. [10]
 - Explain the principle of working of an electrical resistance strain gauge.
 Describe the desirable properties of an ideal strain gauge.
 [8]
- Q6) a) A square steel bar of 16 × 16 mm cross section was used as a compression load cell, by mounting two single element strain gauges each with 2.2 gauge factor on it. One strain gauge sensed lateral strain and the other linear strain. Two arm sensitive bridge circuit was used when a load of 18 kN was applied on the bar. Modulus of elasticity of steel bar was 2 × 10⁵ N/mm² and Poisson ratio was 0.3.

Calculate the output voltage of the bridge when excitation voltage was 5 volts d.c. was used to excite the bridge.

- b) Describe Brittle coating technique with reference to following: [8]
 - Determination of Principle stresses.
 - ii) Different crack patterns.

-2-

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Q7) The following observations are made with reactangular rosette mounted on steel specimen. [16]

> $\epsilon_{A} = 850$ Microstrain $\epsilon_{B} = 300$ Microstrain $\epsilon_{C} = -250$ Microstrain

Determine the principal strains, the principal stresses and principal angles $\phi_1 & \phi_2$.

Assume $E = 2 \times 10^5 \text{ N/mm}^3$.

 $\mu = 0.3$

Q8) Write notes on any Two of the following :

[16]

- a) Construction and working of pressure transducer.
- b) Moisture proofing of strain gauges.
- c) Semi-conductor strain gauges.
- d) Moire Methods Advantage, limitations applications.

S-2094 Total No. of Pages : 3

B.E. (Mechanical) (Part - I) (Semester - VII) Examination, December - 2015

AUTOMOBILE ENGINEERING

Sub. Code : 47984

Day and Date : Saturday, 12 - 12 - 2015 Time : 10.00 a.m. to 01.00 p.m. Total Marks: 100

Instructions : 1) Attempt any three questions from each section.

2) Draw neat sketches whenever necessary.

3) Figures to the right indicate full marks.

Make suitable assumptions if necessary and state it clearly.

5) Use of non-programmable calculator is allowed.

SECTION - I

Q1) a) Write types of automobile bodies and explain in detail, the automobile body construction.
 (8) Write detailed classification of automobiles.

(02) a) Explain in detail hybrid vehicles.

b) The vehicle weighs 62000 N and the coefficient of rolling resistance is 0.017 and the coefficient of air resistance is 0.027 in the formula R = kW + kaAV², where A is m² of frontal area and V the speed in km/h. The transmission efficiency in top gear of 6.2:1 is 88% and that in the second gear of 15:1 is 80%. The frontal area of the vehicle is 5.6 m². If the vehicle has to have a maximum speed of 86 km/h in top gear, calculate : [8]

i) The engine BP required.

P.T.O.

Seat No.

101

[8]

[18]

- The engine speed if the driving wheels have an effective diameter of 0.8125 m.
- iii) The maximum grade the vehicle can negotiate at the above engine speed in second gear and
- iv) The maximum drawbar pull available on level at the above engine speed in second gear.
- Q3) a) Describe with neat sketch centrifugal clutch. [8]
 - b) Explain working of torque converter with the help of neat sketch, what are limitations of torque converter? [8]

Q4) Write short notes on any three of the following :

- a) Electric vehicles.
- b) Materials used in automobiles.
- c) Full floating rear axle.
- d) Multi-plate clutch.

SECTION - II

Q5) a)	Explain in detail with neat sketch, Ackerman steering g	ear mechanism. [8]
b)	Explain in detail Understeer and Oversteer.	[8]
Q6) a)	Illustrate with neat sketch Air brake system.	[8]

b) Discuss in detail with neat diagram rear wheel suspension system. [8]

S-2094

[8]

[18]

- Q7) a) What are the different types of motions considered in suspension system?
 - b) Explain with neat sketch principle and working of automobile starting system. [8]

Q8) Write short notes on any three of the following :

- a) Engine electronic control module.
- b) Hotch-kiss drive.
- c) Two wheeler and three wheeler layout.
- d) Torque tube drive.

Seat No.

B.E. (Mechanical) (Part - IV) (Semester - VII) (Revised) Examination, December - 2015 INDUSTRIAL PRODUCT DESIGN (Elective - II)

- 2-

Sub. Code : 47988

Day and Date : Tuesday, 15 - 12 - 2015

Total Marks: 100

Time :10 .00 a.m. to 01.00 p.m.

- Instructions : 1) Answer any three questions from section I and any three questions from section II.
 - 2) Figures to the right indicate full marks.
 - Draw neat sketches wherever necessary.
 - 4) Answers to the two sections must be written in the same answer book.

SECTION - I

Q1) a) Explain the challenges faced in product design and development. [8]

- b) Explain the procedure for setting target specifications in product design. [8]
- Q2) a) Explain the types of modularity in product architecture with examples.[8]
 - b) Explain the following with respect to product design. [8]
 - i) Aesthetics
 - ii) Selection of engineering materials
- Q3) a) Explain the activities of concept generation process. [8]
 - b) What is a prototype? Explain the different types of prototypes. [8]
- Q4) Write Short Notes (Any Three)
 - a) Concurrent Engineering
 - b) Robust Design
 - c) Design for manufacturing and assembly
 - d) Value Engineering
 - e) Industrial design process

P.T.O.

[18]

SECTION - II

- Q5) a) Explain the design of controls in machine tools [8]
 - b) State and explain the principles applied to the design of a workstation.[8]
- Q6) a) Explain the use of anthropometric data in the design of displays and controls
 [8]
 - b) Explain the ergonomic principles used in industrial safety and health control. [8]
- Q7) a) Explain the features of ISO 14000 Environmental Management System. [8]
 - Explain the features to be considered for designing a Visual Display Terminal.
 [8]

Q8) Write Short Notes (Any Three)

[18]

- a) Safety precautions in Process Industry
- b) Safety in Foundry
- c) Material Handling and Ergonomics
- d) Personal Protective Equipment(PPE)
- e) Design of hand operated controls

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SC-78 Total No. of Pages : 3

No.	

B.E. (Mechanical) (Part - IV) (Semester - VII) (Revised) Examination, November - 2019 REFRIGERATION & AIR CONDITIONING Sub. Code : 67501

Day and Date : Saturday, 23 - 11 - 2019 Time : 10.00 a.m. to 1.00 p.m.

Total Marks: 100

Instructions :

- 1) Attempt all questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Make suitable assumptions if necessary and state it clearly.
- Use of calculator, steam table Psychrometric table and chart is allowed.
- Q1) a) Derive an expression for performance of Reversed Carnot refrigeration cycle with the help of P-V and T-S diagrams.

OR

With neat diagram explain the working of simple air craft cooling cycle.

- b) i) Give the comparison between heat engine and refrigerator.
 - ii) A Carnot refrigerator requires 1.3KW of power per ton of refrigeration to mainitain space at -44°C. Determine the cop of refrigerator and heat rejected in kw per ton.

A.

Q2) a) Draw Cascade system on P-h diagram and TS plots with schematic diagram explain the system. [8]

OR

Explain with neat sketches,

- i) Wet versus dry compression
- ii) Throttling versus isentropic Expansion

P.T.O.

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 b) 32000kg of ice per day is produced from at 0 °C in an ammonia ice plant working on vapor compression cycle. The temperature range of the cycle is -15°C to 25 °C. The vapor at the end of compression is dry saturated. Find.

i) Cop

- ii) Refrigeration effect
- iii) Mass flow rate of refrigerant in kg/s and
- iv) Power required to drive the plant.

Take latent heat of ice = 335kj/kg

- Q3) a) Write notes on
 - Secondary refrigerants
 - ii) Ice plant
 - iii) cold storage

OR

List selection criteria for following equipments for system.

- i) Compressor
- ii) Condenser
- iii) Evaporator
- b) Suggest the proper reasons, the types of refrigerants used for following applications. [7]
 - i) Domestic refrigeration
 - ii) Ice cream plant
 - iii) cold storage
 - iv) Room air refrigeration

Q4) a) What is moist air? Derive an expression for the enthalpy of moist air.[8]

OR

Explain clearly the different stages of human body defence against variations of weather conditions during summer and winter.

b) Atmospheric air at 16°C DBT & 25% RH passes through a furnace and then through a humidifier, in such a way that the final condition is 30°C DBT & 50% RH. Find the heat and moisture added to the air. Also determine the sensible heat factor of the process. [8]

[9]

 Q5) a) Explain with the help of neat sketch ERSHF, RSHF. [6] OR 6.
 Explain with neat sketches summer and year-round air conditioning systems.
 b) The following data refers to summer A/C of a building. [12] Outside design condition = 43°C DBT, 27°C WBT

Inside design condition = 25°C DBT, 50%RH

Room sensible heat gain = 84000 kJ/h

Room latent heat gain = 21000 kJ/h

By-pass factor of the cooling coil used = 0.2

The return air from the room is mixed with the outside air before entry to cooling coil in the ratio of 4:1 by mass. Determine

- i) ADP of the cooling coil
- ii) Entering and leaving conditions of air for cooling coil.
- iii) Fresh air mass flow rate
- iv) Refrigeration load on the cooling coil.

Q6) a) Explain the following methods of duct design

Static regain method.

SUP DAY2

ii) Velocity reduction method

OR

-3-

Explian dynamic losses in ducts (Atleast four)

b) Explain the concept of Green building.

[8]

[8]

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E.

SC-81

Total No. of Pages : 4

B.E. (Mechanical) (Part - IV) (Semester - VII) (New) Examination, November - 2019 MECHANICAL SYSTEM DESIGN Sub. Code : 67502

Day and Date : Tuesday, 26 - 11 - 2019 Time : 10.00 a.m. to 1.00 p.m. Total Marks : 100

Instructions :

Seat No.

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and state it clearly.
- 3) Draw neat labeled sketches wherever necessary.
- Q1) a) Explain Aspects of aesthetic design with suitable examples. [8]
 - b) Explain ergonomic consideration in design of displays and controls. [8] OR
 - b) With suitable example explain the creativity concept in the product design.
 [8]
- Q2) a) Derive Clavarino's Equation to determine the thickness of pressure vessels [6]

OR

Explain the different types of supports used for pressure vessels. [6]

- b) A pressure vessel of 300mm inner diameter subjected to an internal Pressure of 25 Mpa. The cylinder material is plain carbon steel 15C8 having ultimate strength 440N/mm², yield strength 240 N/mm² and Poisson's ratio (μ = 0.29). Determine the thickness of cylinder wall based on:
 - Maximum principal stress theory.
 - ii) Maximum principal strain theory.
 - iii) Maximum shear stress theory.
 - iv) Distortion energy theory.

Take factor of safety based on the yield strength as 1.5

[12] P.T.O.

- Q3) a) Discuss various types of friction lining materials used in clutches. What are the desirable properties of friction material. [8]
 - b) A leather faced cone clutch transmits power at 500 rpm, the semi-cone angle α is 12.5°. The mean diameter of the clutch is 300 mm, while the face width of the contacting surface of the friction lining is 100mm. The co-efficient of friction is 0.2 and the maximum intensity of pressure is limited to 0.07N/mm². Calculate the force to engage the clutch and the power transmitting capacity. [8]

OR

- b) An automotive type internal expanding brake is as shown in figure 1. The face width of friction lining is 50mm and the coefficient of friction is 0.4. The maximum intensity of pressure on the lining is 0.8 N/mm². The angle 01 can be assumed to be zero. Calculate; [8]
 - The actuating force.
 - ii) The Braking Torque Capacity.



Fig.1

Q4) a) Explain the advantages of geometrical progression for selecting the speed steps of a multi speed machine tool gear box. [6]

OR

State the difference b/w structural and speed diagram of a Machine tool gear box. [6]

- b) A multi speed gear box is to be designed for a headstock of a turret lathe for nine spindle speeds ranging from 60 rpm to 2880 rpm. If the gear box is driven by 5KW, 1440 rpm electric motor;
 - Draw the speed ray diagram.
 - ii) Draw the gearing diagram.
 - iii) Determine the number of teeth on gears.

[12]

- Q5) a) Explain design considerations of piston barrel and piston skirt with neat sketch.
 - b) The cylinder of a four stroke diesel engine as the following specifications Brake power = 3.75 kW.

Speed = 1000 rpm.

Indicated Mean Effect Pressure = 0.35 Mpa.

Mechanical Efficiency = 80%

Determine the bore and length of the cylinder linear.

OR

b) The following data is given for a connecting rod:

Engine speed =1800 rpm.

Length of connecting rod = 350mm.

Length of stroke = 175 mm.

Density of material = 7800 kg/m3

Thickness of web or flanges = 8 mm

Assume the cross-section of the connecting rod as shown in Fig.2 for which Area of cross section



-3-

181

SC-81

[8]

(A) = 11t², I_{xx} =
$$\left(\frac{419}{12}\right)t^4$$
 and y = $\left(\frac{5t}{2}\right)$ [8]

Q6) a)

a) What is adequate design and Optimum design? Explain with suitable examples? [8]

OR

- b) Explain various parameters in design of machine Elements.
- b) A thin spherical pressure vessel is subjected to an internal pressure of 5 N/mm². The mass of the empty vessel should not exceed 150kg. If the factor safety based on yield strength is 2.0. Design the pressure vessel with the objective of maximizing the gas storage.

Sr.No.	Material	Tensile Yield Strength S _{vi} ,N/mm ²	Mass Density (ρ) Kg/m ³
01	Alloy steel-15Cr90 Mo55	450	7800
02	Aluminum Alloy-74530	150	2800
03	Titanium Alloy	800	4500
04	Magnesium Alloy	100	1800

0 0 0

SUKASIO

B.E. (Mechanical) (Part - VI) (Semester - VII) (Revised) (New) Examination, November - 2019 FINITE ELEMENT ANALYSIS Sub. Code : 67503

Day and Date : Thursday, 28- 11 - 2019 Time : 10.00 a.m. to 1.00 p.m.

Total Marks : 100

Instructions :

Seat No.

- 1) All questions are compulsory.
- 2) Assume suitable data if necessary & state it clearly.
- 3) Figures to the right indicate full marks.

Q1) Attempt any two.

- Explain Rayleigh Ritz method with practical example.
 [8]
- b) Explain how Galerkin Method used in the development of an integral form with suitable example. [8]
- c) Explain the significance of von mises stress.
- Q2) a) Determine the nodal displacements, forces and the reactions at the fixed support for the given system. [12]



Esteel = 210 GPa Asteel = $4 \times 10^{-4} M^2$ $E_{Ataminium} = 70 \text{ GPa}$ Aluminium = 2 × 10⁻⁴ M²

 b) List down and briefly explain the elements for one dimensional and two dimensional elements used in FEA. [6]

P.T.O.

[8]

[6]





- b) Derive the shape functions for constant strain triangle.
- Q4) a) For the two bar truss shown in fig. determine the nodal displacements, element stresses. A force of P = 1000 KN is applied at node 1. Assume E = 210 GPa and A = 600 mm² for each element. [10]



- b) Discuss what is Plane stress and Plane strain conditions with example.[6]
- Q5) a) A composite wall, with three layers of different material as shown in fig. has the following properties for the different layers. [10]

Layer -1 Concrete slab $K_1 = 1.2 \text{ w/m}^\circ \text{ c}, x_1 = 15 \text{ cm } \& q = 15 \text{ w/m}^2$

Layer -2 Fibre glass $K_2 = 0.0332$ w/m° c, & $x_2 = 5$ cm

Layer -3 Gypsum $K_3 = 0.05 \text{ w/m}^\circ \text{ c}$, & $x_3 = 1 \text{ cm}$

SUK-8T

h = 15 w/m² °c and $T_a = 25$ °c



Calculate the temperature T_1 , T_2 , T_3 and T_4 , assuming unit area of heat flow.

b) Discuss the shape function for one dimensional linear element. [6]

Q6) Write short notes on any three

- a) Quality checks in Pre-processing.
- b) Types of analysis.

5014-87631

c) Interpretation of results.

d) Free and Mapped Meshing.

e) Loading and boundary condition.

f) Geometrical approximation used in FEA.

0303 8080

[3×6]

544-81

5115-81631

SC - 87 Total No. of Pages : 2

B.E. (Mechanical) (Part - IV) (Semester - VII) (Revised) Examination, November - 2019 EXPERIMENTAL MECHANICS (Elective - I) Sub. Code : 67504

Day and Date : Saturday, 30 - 11 - 2019 Time : 10.00 a.m. to 1.00 p.m.

Seat

No.

- Instructions : 1) All questions are compulsory.
 - Figures to the right indicate full marks.
 - 3) Draw neat diagram to supplement your answer wherever required.
 - Make suitable assumptions wherever necessary & state them clearly.
 - 5) Use of non-programmable calculator is allowed.
- Q1) a) Explain Circular Polariscope with various configurations. Draw necessary sketches.
 [8]
 - Explain Isoclinics, Isochromatics and their significance in photoelastic stress analysis
 [8]

OR

- c) Explain Babinet soleil compensation method
- Q2) a) What are the advantages of using experimental methods of stress analysis over analytical methods? Enlist experimental stress analysis techniques used in industries. [6]
 - b) Define and derive stress optics law in terms of stress and strain. Enlist its significance [10]

Q3) Write short notes (any three)

- Calibration of photoelastic material.
- b) Role of photoelasticity in design of machine components.
- c) Plane polarized light and circular polarized light.
- d) Temporary and permanent double refraction.

P.T.O.

[18]

Total Marks : 100

[8]

[18]

- Q4) a) Explain one arm sensitive, two arm sensitive and four arm sensitive to strain arrangement Wheatstone bridge? What is the difference among them? [8]
 - b) What are the various types of strain gauges? What are the criterions for selection of strain gauges? Why electrical resistance strain gauges are preferred over other types? [8]

OR

- c) Explain in brief principle and working of reflection polariscope. [8]
- Q5) The following observations are made with delta rosette mounted on specimen $\varepsilon_A = -850$ Microstrain; $\varepsilon_B = 1200$ Microstrain; $\varepsilon_C = 700$ Microstrain Determine the principal strains, principal stress and principal angle. Assume E = 200 GPa and Poisson's Ratio = 0.285 [16]
- Q6) Write short notes (any three)
 - a) Potentiometer circuit
 - b) Cross Sensitivity

5114-8386

- c) Brittle coating method
- d) Moisture proofing of the strain gauges



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SC - 88 Total No. of Pages : 3

B.E. (Mechanical) (Part - IV) (Semester - VII) Examination, November - 2019 AUTOMOBILE ENGINEERING (Elective - I) Sub. Code : 67506

Day and Date : Saturday, 30 - 11 - 2019 Time : 10.00 a.m. to 1.00 p.m.

Total Marks: 100

Instructions :

Seat

No.

- 1) All questions are compulsory.
- Draw neat sketch wherever necessary.
- Figures to the right indicates full marks.
- Assume suitable data if necessary & state it clearly.
- 5) Use of non-programmable calculator is allowed.
- Q1) a) List the different vehicle layouts. What are the advantages and disadvantages of front engine rear wheel drive? [9]
 - b) Which are the different types of chassis? Explain all in short. [8]

OR

Which are the different types of frames used in automobile? What is mean by subframe? [8]

- Q2) a) Explain with neat sketch construction and working of single plate & clutch.
 [8]
 - b) What is a function of differential? Explain it's working principle. [8]

OR

Write a short note on fluid flywheel and torque convertor.

Q3) a) What is a function of steering system? Explain with neat sketch steering linkage of four wheeler automobile. [8]

OR

Explain with neat sketch power steering system. What are advantages of power steering system. [8]

P.T.O.

[8]

SC - 88

- b) Explain in detail with neat sketch double wishbone front wheel independent suspension system. What are the advantages of an independent suspension? [9]
- Q4) a) Describe various types of brakes used in automobiles? Explain with neat sketch working of any power brake used in automobile. [8]

OR

What are the various type of wheels used in vehicles? How to select wheel and tyre size for vehicle? Specify how tyres are specified? [8]

- Explain with layout sketch of vaccum assisted hydraulic braking system.
 [8]
- Q5) a) Explain with neat sketch working of starting motor used for engine starting? How bendix drive works.

OR

Draw a circuit diagram of battery ignition system? Explain function of each component and compare with magneto ignition system. [8]

- b) Draw a full layout diagram of an automotive air conditioning system and explain function of each component and working of system? [8]
- Q6) a) Explain how to select no. of gear ratios for transmission system of automobile and also explain how to estimate gear ratio in each gear. [6]

OR

Define following terms and explain

[6]

SUK-31622

- i) Rolling resistance
- ii) Air resistance
- iii) Gradient resistance
- iv) Practice effort
- v) Power required for propulsion
- vi) Acceteration

SUL 34622

SUK-34622

b) A vehicle is weighting 62.30 KN and having air resistance coefficient 0.018 and coefficient of air resistance is 0.0276. The transmission efficiency in top gear ratio of 6:2:1 is 90% and in second gear of 15:1 is 80%. The frontal area of vehicle is 5.514 m². The vehicle has maximum speed of 88 km/hr in top gear. [12]

Calculate

SUX-34822

SUH-34622

- i) The engine power required
- ii) Engine speed if wheel diameter is 0.8125_m.
- iii) Maximum grade vehicle can climb in second gear at above engine speed.
- iv) Maximum drawbar pull at level in 2nd gear.

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SC - 93 Total No. of Pages : 2

Seat No.

B.E. (Mechanical) (Part - IV) (Revised) (Semester - VII) Examination, December - 2019 INDUSTRIAL PRODUCT DESIGN (Elective - II)

Sub. Code : 67834

Day and Date : Tuesday, 3 - 12 - 2019 Time : 10.00 a.m. to 1.00 p.m.

Total Marks : 100

- Instructions : 1) All questions are compulsory.
 - 2) Figure to right indicate full marks.
 - 3) Draw neat sketches wherever necessary.

Q1) a	a)	Explain stepwise, how to find customer need of Product as a washing machine.	cloth [8]
E	b)	Explain different methods for gathering raw data from customers.	[8]
		OR	
ł	b)	Explain quality aspect in Product design?	[8]
Q2) a	a)	Differentiate innovation and creativity in Product Design.	[8]
b)	What is the process for Product planning? How product specifica are set?	tions [8]
		OR	
b	b)	Explain stepwise concept screening procedure.	[8]
Q3) a	1)	Explain effect of product architecture on Product change.	[8]
b)	Explain four step method for establishing product architecture.	[10]
		OP	

- OR
- b) Explain stepwise how will product architecture differ for product as table fan for economically lower segment? [10]

SC - 93

- Q4) a) Explain impact of Design for manufacturing decisions on Development time, development cost and life cycle cost. [8]
 - b) Explain stepwise the need of design for environment. [8]

OR

- b) Explain stepwise need of concurrent engineering in Product Design. [8]
- Q5) a) Explain the factors to be considered in design of controls in Machine tools.
 [8]
 - b) Explain the use of Anthropometric data in the design of controls in Automobiles. [10]

OR

- b) Explain in detail which factors effects on aesthetics of Product. [10]
- Q6) a) Which are important personal protective equipment's used for safety in industry. [8]
 b) Explain safety precautions to be taken in foundry. [8]

OR

b) Explain safety precautions to be taken in textile industry. [8]

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SE-90 Total No. of Pages : 2

Seat		1
No.		

B.E. (Mechanical) (Part - IV) (Semester -VII) (Revised) Examination, November - 2018 REFRIGERATION & AIR CONDITIONING

Sub. Code : 67501

Day and Date : Tuesday, 20 - 11 - 2018 Time : 2.30 p.m. to 5.30 p.m. Total Marks :100

Instructions : 1) Attempt all questions.

- 2) Neat diagrams must be drawn wherever necessary.
- 3) Make suitable assumptions if necessary and state it clearly.
- Use of calculator, steam table, psychrometric table and chart is allowed.
- Q1) a) Derive an expression for COP of a reversed Carnot refrigeration Cycle with the help of PV and TS diagram.
 [8]

OR

Explain air refrigeration systems? List the advantages of air refrigeration systems.

b) Solve the following

- i) Explain BEE star label rating & COP of the refrigerator. [4]
- ii) In air refrigeration plant working on Bell Coleman cycle air is compressed to 5 bar from 1 bar. Its initial temperature is 10°C. After compression the air is cooled up to 20°C in a cooler before expanding back to a pressure of 1 bar. Assume Gamma, γ = 1.4 Determine the COP of the plant. [6]
- Q2) a) Explain the actual vapour compression cycle with P-h & T-S diagrams.[8] OR

Describe liquid suction heat exchanger with schematic and p-h diagrams.

- b) A Freon 12 vapour compression system operating at a condenser temperature of 40°C and evaporator of -5°C develops 15 Tons of refrigeration. Using the P-h diagram determine [8]
 - i) Mass flow rate of the refrigerant circulated
 - ii) Heat rejected in the condenser
 - iii) COP

Q3) a) List down the selection criteria for refrigerant used for Ice plant, Cold storage, domestic refrigerator and Room air conditioner.
 [8]

OR

Describe the working of evaporative condenser with a neat sketch.

- b) How the refrigerants are classified? Explain the procedure to derive ASHRAE designation.
- Q4) a) With neat sketches explain psychrometric chart and air washer.
 [8] OR

Explain in detail Thermal exchange of body with environment

- b) 20m³ of air/minute at 30°C & 60% RH is cooled to 22°C DBT maintaining specific humidity constant. Find the following [8]
 - i) Heat removed from air
 - ii) RH of cooled air

b)

- iii) Mass of cooled air. Take air pressure = 1 bar.
- Q5) a) Explain in detail, cooling and heating load estimates.

[8]

OR

Explain with neat sketch Window and Packaged air condition.

- b) A hall is to be maintained at 20°C DBT & 60% RH when the outdoor conditions are 40°C DBT & 26°C WBT. Sensible heat load in room is 66000kJ/hr, latent heat load in room is 20000kJ/hr, infiltrated air is 30m³/min, DPT of the cooling coil is 5°C. If the 60% of the total air is recirculated from the hall & mixed with the conditioned air after the conditioner, then find the followings [10]
 - i) Condition of air leaving the conditioner and just before entering the hall
 - ii) Mass of fresh air entering the cooler
 - iii) Bypass factor of the conditioner coil
 - iv) Refrigeration load in tons of refrigeration on conditioner coil
- Q6) a) Explian with neat sketches different types of ventilation systems. [8] OR

Derive expression for rectangular section equivalent to circular section. Explain the concept of green building. [8]

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SE - 91 Total No. of Pages : 4

Seat No.

B.E. (Mechanical) (Semester - VII) (New Course)

Examination, November - 2018

MECHANICAL SYSTEM DESIGN

Sub. Code : 67502

Day and Date : Saturday, 24 - 11 - 2018

Total Marks : 100

Time : 02.30 p.m. to 05.30 p.m.

Instructions : 1) All questions are COMPULSORY.

- 2) Assume relevant data and state them clearly.
- 3) Draw neat sketches wherever necessary.
- Figure to the right indicate FULL marks.
- 5) Use of Non-programmable calculator is allowed.
- Q1) a) What is the relevance of aesthetic considerations in product design? Explain with neat sketches the aspects of aesthetic design. [8]
 - b) What is the meaning of anthropometry? How the anthropometrical data is used in ergonomic design consideration of products? Explain with examples. [8]

OR

Explain the man machine relationship applied to ergonomics. Based on that explain various design considerations of displays and control. [8]

Q2) a) Explain with sketches the distribution of tangential stresses and radial stresses in the wall of a thick cylinder subjected to internal pressure as well as external pressure. [6]

OR

What do you understand by "supports" of the pressure vessel? With neat sketches describe the various types of supports. [6]

b) A pressure vessel is subjected to a design pressure of 0.75 MPa. Inside diameter of the shell is 2 m and thickness of shell is 10 mm. a nozzle of inside diameter 300 mm and thickness 10 mm is provided in the shell. The corrosion allowance is 2 mm and weld joint efficiency can be taken as 85%. The nozzle extends 15 mm inside the shell. The yield strength of the material of the shell as well as the nozzle is 210 N/mm². Factor of safety can be assumed to be 1.5. Determine whether reinforcement maybe provided. If yes, determine the inner and outer diameter of reinforcement pad of 10 mm thickness.

P.T.O.

- Q3) a) Discuss the desirable properties of an ideal friction material for clutch. What are the most commonly used friction materials? [8]
 - A single plate clutch transmits 25 kW at 900 rpm. Maximum pressure intensity between plates is 85 kN/m². Outer diameter of the plate is 360 mm. both sides of the plates are effective. Coefficient of friction is 0.25. Calculate (i) the inner diameter of friction plate and (ii) Axial force required to engage the clutch. Assume uniform wear. [8]

OR

Figure 1 shows an internal expanding shoe brake. Face width of the friction lining is 50 mm. Coefficient of friction is 0.4. Maximum intensity of pressure is 0.8 N/mm². The angle θ_1 can be assumed to be zero. Calculate (i) The actuating force and (ii) torque \ absorbing capacity of the brake. Drum rotates clockwise. [8]



Figure 1 Question 3 b

Q4) a) Explain the general guidelines in developing kinematic or gearing diagram for the multispeed gear box. [6]

OR

Explain the following terms with reference to machine tool gear box. [6]

i) Range Ratio

ii) Number of stage or transmission group

iii) Number of spindle steps

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[6]

- b) A multispeed gear box is to be designed for a headstock of a turret lathe for nine spindle speeds ranging from 300 rpm to 1000 rpm. If the gear box is driven by 5KW.720 rpm electric motor.
 - i) Draw structure/speed/ray diagram
 - ii) Draw gearing diagram.
 - iii) Determine no. of teeth on gears for the first stage only.
 - iv) Select pulley diameter for belt drive.

The standard pulley diameters are :

80, 90, 100, 112, 125, 140, 160, 180, 200, 224, 250, 280, 290, 300, 310, 355, 375, 400, 450,500mm. Assume same module for all gears. [12]

- Q5) a) Explain briefly guidelines for the design of piston ring.
 - b) The cylinder of four stroke diesel engine has the following specification: Brake power-7.5 kw,speed-1400 rpm, Indicated mean pressure-0.35MPa, Mechanical Efficiency-80%, Maximum gas pressure-3.5MPa, Compression ratio = 15 The liner and cylinder head are made of grey cast iron FG250 (S₄ = 250 MPa) and reboring factor = 3.5. The studs are made of plain carbon steel (S₄ = 380 MPa). If the factor of safety for all parts is 6, determine [10]
 - i) the bore and length of cylinder liner
 - ii) thickness of cylinder liner
 - iii) thickness of cylinder head
 - iv) the size, number and pitch of studs

OR

- b) Following data refers to the piston of four stroke of diesel engine: Cylinder bore = 250 mm, Maximum gas pressure = 4N/mm², Allowable bearing pressure at small end of connecting rod =15N/mm², Length of piston pin in bush of small end = 0.45D, Ratio of inner to outer diameter of piston pin = 0.6, Mean diameter of piston boss = 1.4 times outer diameter of piston pin. Allowable bending stress of piston pin = 84 N/mm² Determine: [10]
 - i) Outer diameter of piston pin
 - ii) Inner diameter of piston pin
 - iii) Mean diameter of piston boss
 - iv) Check design for bending and shear stress induced.

[6]

[6]

Q6) a) Explain the Johnsons method of optimum design of mechanical elements.

OR

Explain the Lagrange's Multiplier for optimum design.

b) A shaft is required to transmit a torque of 1000 N-m and is to have a rigidity of 90 N-m/degree. Assuming factor of safety of 1.5 based on yield strength; design the shaft for minimizing weight. Assume the maximum shear stress theory of failure. Use following data for the materials. [10]

Mass Density(□)kg/m³	Yield Strength (Syt) MPa	Shear Modulus(G) GPa
8500	130	80
3000	50	26.7
4800	90	40
2100	20	16 00
	Mass Density(□)kg/m ³ 8500 3000 4800 2100	Mass Yield Density(□)kg/m³ Strength (Syt) MPa 8500 130 3000 50 4800 90 2100 20

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Total Marks: 100

No.		

B.E. (Mechanical) (Semester - VII) Examination, November - 2018

EXPERIMENTAL MECHANICS (Elective - I) (Paper - I) Sub. Code : 67504

Day and Date : Thursday, 29 - 11 - 2018

Time: 02.30 p.m. to 05.30 p.m. Instructions:

- 1) All Questions are compulsory
- 2) Figures to the right indicate full marks.
- Draw neat diagram to supplement your answer wherever required. 3)
- Make suitable assumptions wherever necessary & state them clearly. 4)
- 5) Use of non-programmable calculator is allowed.
- Explain various experimental methods of stress analysis and their relative 01) a) merits and demerits [6]
 - Explain the terms 'Temporary double refraction' and permanent double b) refraction' with reference to photo elasticity. Explain the principle of photo elasticity. [10]
- What are the desirable properties of an Ideal photoelastic material? Discuss (02) a) the merits and demerits of some common photoelastic materials [8] b) Explain the working of plane polariscope on photoelasticity [8] OR
 - Explain Tardy's Method with derivation. c) [8]

Q3) Write short notes (any three)

- [18] Isoclinics and Isochromatics. n) [6] b) Polariscope [6] Photoelastic sheet casting and model making (3 [6] d) Babinet soleil compensation method [6]
- Q4) a) Explain Brittle coating method and compare it with strain gauge technique.[8] Explain the principle of working of an electrical resistance strain gauge. b) Describe the desirable properties of ideal strain gauge. [8]
 - OR
 - Explain various types of strain gauges by comparing them with each other.[8] c)

P.T.O.

Q5)	The	e following observations are made with rectangular rosett el specimen	e mounted on
	ϵ_A the E =	= 850 Microstrain; ε_{B} = 300 Microstrain; ε_{C} = - 250 Microstr principal strains, principal stress and principal angles. Assu = 2 × 10 ³ N/mm ² and Poisson's Ratio is 0.3	ain Determine me
Q6)	Wr	ite short notes (any three)	[18]
	a)	Moire Method of Stress Analysis	[6]
	b)	Semiconductor Strain Gauges	[6]
	c)	Birefringent Coating Technique	[6]
	d)	Strain Gauge Material	[6]

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Total No. of Pages : 2

Total Marks: 100

B.E. (Mechanical) (Semester - VII) Examination, November - 2018

AUTOMOBILE ENGINEERING (Elective - I)

Sub. Code : 67506

Day and Date : Thursday, 29 - 11 - 2018

Time : 02.30 p.m. to 05.30 p.m. Instructions:

Seat

No.

- 1) All questions are compulsory.
- 2) Draw neat sketch wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Make suitable assumptions if necessary,
- 5) Use of non-programmable calculator is allowed.
- Q1) a) How will you classify the automobiles? Explain it with suitable examples.[9]
 - b) Which are the different types of chassis? Discuss about the materials used for chassis frame. [8]
- What is a function of clutch? With neat sketch explain single plate clutch.[8] (02) a) What is necessity of gear box? Explain constant mesh gear box with b) neat sketch. [9]

OR

- Explain with neat sketch automatic transmission. c) [9]
- (03) a)
 - a) Camber
 - ii) Caster
 - iii) Scrub radius
 - iv) Cornering force

OR

Which are the main components of a steering system? Describe with simple sketch. [8]

b)

What do you mean by active suspension? Explain with figure air suspension [8]

[8]

P.T.O.

- Explain the following terms.

system used in buses.

181

[7]

171

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- 04) a) Compare internal expanding brakes with external contracting disc brakes used in automobiles on the basis of performance, efficiency, life & heat
 - b) Explain with neat sketch working of hydraulic brakes. List and justify [8] . advantages of hydraulic brake over other. [8]

OR

- You have to select type of wheel and tyre for a luxury car. Select suitable c) wheel construction and type of tyre and justify your selection. [8]
- Explain construction and working of lead acid battery. Explain how to (05) a) measure better performance.
 - Draw a layout sketch of electronic controlled management system used [9] b) in vehicles. List sensors used?

OR

- c) Prepare a layout of automotive air conditioning system, name the components and explain working. 181
- (06) a) A typical motor vehicle road resistance is 23 N per 1000 N wt. of vehicle and air resistance is 0.0827 V2, transmission efficiency 88% in top gear and wt. of the vehicle is 19934 N. [10]

Calculate

544.80

- the power required for top seed of 144 km/hr i)
- the acceleration in m/sec2 at 48 km/hr to reach up to 144 km/hr ii) assuming torque at 48 km/hr is 25% more than 144 km/hr.
- the brake power required at gradient of | 14 5 at 48 km/hr with 80% iii) efficiency in bottom gear. Assume accn due to gravity is 9.81 m/sec2.
- List and explain various resistances to vehicle motion. b)

OR

Explain how to select no. of gear ratio and gear ratio in automobile c) transmission. What is mean by geometric progression.

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Seat	
No.	

B.E. (Mechanical Engineering) (Semester - VII) Examination, December- 2018

TOTAL QUALITY MANAGEMENT (Elective - II)

Sub. Code : 67833

Day and Date : Saturday, 01 - 12 - 2018

Time : 02.30 p.m. to 05.30 p.m.

Total Marks : 100

- Instructions : 1) All questions are compulsory.
 - 2) Figures to the right indicate full marks.
 - 3) Make suitable assumptions wherever necessary and state them clearly.
 - 4) Use of statistical tables and scientific calculator is permitted.

Q1) Solve any two:

- a) How cost of Quality is arrived at? What is the normal ratio of individual category costs to cost of Quality? Give examples of prevention expenses.
- b) Which symbols are commonly used while preparing flow process chart? Draw a process chart of any process that you know or have seen in an organization.
- c) "Satisfied internal customers are creators of culture of commitment". How?

Q2) Solve any Three:

- a) What are the fundamentals of product quality planning? Prepare product quality planning chart.
 [6]
- b) How production trial runs help in product and process validation? [6]
- c) Explain process capability indices. How these lead to defect prevention? [6]
- An organization wishes to go for six sigma initiative. Draw the step wise blue print. [6]

Q3) Solve any two:

- a) What all losses are included in Quality loss function? How these can be addressed through six steps of Taguchi Process? [8]
- b) How to evaluate parallel, series and combined system reliability? [8]
- A system has three parallel components, X, Y, & Z with reliabilities 0.95, 0.92 & 0.90. How much system reliability will change if component X is out of order?

Q4) Solve any two:

- a) One key principle of TQM is continual improvement. What steps you suggest to achieve and monitor sustenance of this? [8]
- b) Elaborate steps suggested by Schonberger to achieve manufacturing excellence.
 [8]
- c) Explain with examples role of TEI, JIT & TQC in the context of TQM.
 [8]

Q5) Solve any three:

- a) "Getting new customer is difficult than retaining existing customers." Why? Suggest strategies for customer retention. [6]
- b) Management support and commitment is vital in success of TQM implementation. How the leadership can demonstrate this? [6]
- c) Differentiate between Quality Circles and CFT on the basis ofparticipation, focus, objectives and benefits to the organization. [6]
- d) Which human errors are generally addressed by Poka-Yoke technique?[6]

Q6) Slove any two:

- a) How service quality differs from manufacturing quality? Suggest steps to be taken to enhance service performance with minimum wastes in service.
 [8]
- b) ISO/TS: 16949:2009 is automobile sector specific standard. What are its benefits to an organization? Draw road map to achieve ISO/TS. [8]
- c) Can you describe Baldrige criteria for performance excellence as outlined in Malcom Baldrige Quality Award?

 $) \bigcirc \bigcirc$

-2-

Seat No.	Total No.	SE - 96 of Pages : 2
B.E. (I INDUS	Mechanical) (Semester - VII) Examination, Decemb STRIAL PRODUCT DESIGN (Elective - II) (Revised) (Sub. Code : 67834	er - 2018 Paper-I)
Time : 0 Instructi	 D2.30 p.m. to 05.30 p.m. D1 All questions are compulsory. 2) Figures to the right indicate full marks. 3) Draw neat sketches wherever necessary. 	arks : 100
<i>Q1)</i> a)	Explain the characteristics of successful product development	it. [8]
b)	Explain the challenges of product development	[8]
	OR	
	Explain the steps for identifying customer needs.	[8]
<i>Q2)</i> a)	Explain the process of establishing the target specifications.	[8]
b) C	Explain the steps in the concept generation OR	[8]
	Explain the following with respect to concept selection	[8]
	i) Concept screening	
	ii) Concept scoring	
<i>Q3)</i> a)	What is product architecture? Differentiate between Modular an Architecture.	d integral [8]
b)	Explain the implications of product architecture.	[10]
	OR	6
	Explain the concept of product data management.	[10]

Q4)) a)	Explain the use of prototyping in product design.	SE - 96
	b)	What are the principles to be followed in Design for Manufactur	ring (DFM) [8]
		OR	
		Explain the role of material selection in product design	[8]
Q5)	n)	Explain various Aesthetic considerations in product design.	[8]
	b)	Explain various Ergonomics considerations in product design	[10]
		OR	_
		Explain the application of anthropometric data in ergonomic de	sign. [10]
Q6)	a)	Explain the different types of personal protective equipment.	[8]
	b)	Explain the safety precautions to be followed in processing inc	iustry. [8]
		OR	
		Explain the ISO 14000 -environmental management system.	[8]

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SE - 807

Total No. of Pages : 3

Seat No.

B.E. (Mechanical) (Semester - VII) Examination, November - 2018 FINITE ELEMENT ANALYSIS (Revised)

Sub. Code : 67503

Total Marks : 100 Day and Date : Tuesday, 27 - 11 - 2018 Time : 02.30 p.m. to 05.30 p.m. All questions are compulsory. 1) Instructions: Assume suitable data if necessary & state it clearly. 2) Figures to the right indicate full marks. 3) [8] Discuss past, present and future of FEA. 01) a) [8] Discuss Rayleigh-Ritz method. b) OR Explain in detail the steps used in FEA. [8] c)

- Q2) a) What are the important properties of shape function. Show & explain the variation of shape function for linear element.
 - b) Explain simplex, multiplex & higher order elements.
 - c) Calculate nodal displacements, stresses and strains for the structural member shown in Fig. 2 c. subjected under axial load on 20kN.



Fig. 2.c

Cross sectional areas for the stepped bar $A_1 = 2cm^2$, $A_2 = 5cm^2 \& A_3 = 8cm^2$ respectively.

Youngs Modulus for materials are:

 $E_1 = 2 \times 10^5 \text{N/mm}^2$, $E_2 = 2.2 \times 10^5 \text{N/mm}^2$, $E_3 = 1 \times 10^5 \text{N/mm}^2$

[16]

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[8]

Discuss Constant Strain Triangle (CST) Q3) a)

OR

- ISO-Parametric Elements. b)
- For the two member plane truss shown in Figure 3.c, determine glob: c) matrix, nodal displacement, stresses & reactions. 114



Figure 3.c

E for all elements = 70 Gpa. &

Cross sect. area for each element = 200 mm2.

- Q4) Attempt any two.
 - Axisymmetric element and its applications. a) 181
 - Discuss displacement functions and strain displacement relation for b) axisymmetric element. [8]
 - Discuss what is plane stress & plane strain conditions with examples.[8] c)
 - d) Selection of elements in FEA.
- Q5) a) A composite wall shown in Fig. 5.a consists of three materials. The outer temperature is To = 20°C, convection heat transfer takes place on the inner surface of the wall with $T_{-} = 800^{\circ}C$ & h = 25 W/m², °C, Calculate temperature distribution in the wall. [12]



 b) Discuss the analysis of Finproblem by conduction & convection by writing the terms involved in stiffness matrix and force vector. [4]

OR

c) Aspect ratio and distortion.

Q6) Write short notes on any three.

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- a) Free and mapped meshing.
- b) Different types of analysis done by FEA.
- c) Interpretation of results & validation.
- d) Simplification through different symmetry.
- e) Geometrical approximation used in FEA.

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[4]

 $[3 \times 6 = 18]$

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SF - 103 Total No. of Pages :2

B.E. (Mechanical Engineering) (Semester - VII) Examination, November - 2017 TOTAL QUALITY MANAGEMENT (Elective - II) Sub. Code: 67833

Day and Date : Thursday, 23 - 11 - 2017 Time : 2.30 p.m. to 5.30 p.m.

Total Marks: 100

- Instructions: 1) All Questions are compulsory.
 - Figures to the right indicate full marks.
 - 3) Make suitable assumptions wherever necessary and state them clearly.
 - Use of statistical tables and scientific calculator is permitted.

Q1) Solve any Two.

- a) Track the journey-Inspection, Quality Control, Quality Assurance and Quality Management.
 [8]
- Enumerate customer compliant redressal mechanism being followed in an organization known to you.
- c) What are the needs, wants and expectations of Internal Customers? [8]

Q2) Solve any Three.

- a) How Quality of design and quality of conformance decided? [6]
 b) How control over vendor quality is established? [6]
 c) Describe seven QC tools used in problem solving process. [6]
- d) What is Six Sigma? What are the steps involved in implementing it in an organization? [6]

Q3) Solve any Two

 a) What do you mean by parallel, series and combined system reliability? Give suitable examples.
 [8]

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Seat No.

SF - 103

[8]

[8]

[8]

[8]

- What are the applications of reliability tests? b)
- Three subsystems are reliability wise in series and make up a system. c) Subsystem 1 has a reliability of 94.6%, subsystem 2 has a reliability of 99.7% and subsystem 3 has a reliability of 92.8% for a mission of 100 hours. What is the overall reliability of the system for a 100 hour Mission?

Q4) Solve any Two.

- How TQM differs from tradional management approach? a) [8]
- What are the focus areas of Theory of Constraints? Prepare a brief write b) up on Feignbaum's theory of TQC. [8]
- Explain any one approach to TQM followed by an organization known c) to you. [8]

Q5) Solve any Three.

- Quality Policy deployment and quality function deployment lead to a) increase in customer satisfaction. How? [6]
- An organization wishes to develop quality culture. How TQM can help b) the organization? [6]
- c) Quality objectives should be SMART. Give a list of quality objectives set by an organization based on SMART philosophy. 6
- Share details of any TQM technique implemented by an organization. d) Has it been successful? If yes, why? If no, why? [6]

Q6) Solve any Two:

- Elaborate SERVQUAL model in details. a)
- What are the steps involved in implementation of ISO : 9001:2008. [8] b)
- What are the criteria used to decide winner of CII Exim Quality Award? c) SUKSOG SUX-SOG

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SV - 864

Total No. of Pages : 3

Seat No.

B.E. (Mechanical) (Semester - VII) (Revised) Examination, April - 2018

FINITE ELEMENT ANALYSIS

Sub. Code : 67503

Day and Date : Thursday, 26 - 04 - 2018 Time : 02.30 p.m. to 05.30 p.m.

Total Marks: 100

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[8]

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- Instructions : 1) Draw neat labeled sketch wherever necessary.
 - Assume suitable data if necessary and state it clearly.
 - 3) Figures to the right indicate full marks.
- Q1) a) Write a note on past, present and future of FEA.
 [8]
 - b) If a displacement field is described by

$$u = 10^{-4}(-x^2 + 2y^2 + 4xy); v = 10^{-4}(2x + 4y - y^2),$$

Determine $\in x$, $\in y$, γ_{xy} at x = 1; y = 0

OR

b) Explain Rayleigh Ritz method with the help of an example.

Q2) a) Define shape function. Explain properties of shape function. Also draw the variation of each shape function for a one dimensional linear element.

OR

Derive the element stiffness matrix and force vector of one dimensional element using potential energy approach. [8]

 b) For the bar shown below determine nodal displacements and stress in each material [8]



- Q3) a) Write a short note on isoparametric element.
 - b) Find the shape function for the triangular element shown below and show that the sum of all shape function is one at any point within the element.



- Q4) a) A long cylinder of 100 mm internal diameter and 130mm external diameter is subjected to hot fluid at 200°C from inside and ambient conditions on outside. Draw the sketch showing actual problem and also model the problem for a sample length of 10mm using axisymmetic element with proper boundary conditions.
 - b) The stiffness matrices and force vectors of three truss elements shown in figure is as follows:



Element No.	Nodes		
	i	j	
1	1	3	
2	1	2	
3 6	3	2	

Element stiffness matrix and force vector is,



Obtain the global stiffness matrix and global force vector.

-2-

[10]

[6]

[12]

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[10]

- Q5) a) Derive the relation between B matrix and Jacobian. J matrix for a linear triangular element for a heat transfer problem. [6]
 - b) A bar of rectangular cross-section having thermal conductivity of 1.5 W/m °C is subjected to boundary conditions as shown in figure. [10]

$$\frac{180^{\circ}C}{h = 50 \text{ W/m}^{2} \text{ C}} = \frac{180^{\circ}C}{180^{\circ}C} = \frac{180^{\circ}C}{180^{\circ}C}$$

Mesh the domain with three triangular elements and obtain the conductivity matrix of each one.

Q6) a) Write short notes on any two

6350

- i) Free and mapped meshing
- ii) Aspect ratio and distortion
- iii) Results validation and data interpretation
- Explain in detail the steps to be carried out in commercial FEA software for a simple structure made up of two truss elements. [8]

SF-9/ Total No. of Pages : 3

B.E. (Mech) (Part - IV) (Semester - VII) (Revised) Examination, November - 2017 REFRIGERATION AND AIR CONDITIONING Sub. Code : 67501

Day and Date : Friday, 10 - 11 - 2017 Time : 2.30 p.m. to 5.30 p.m.

Total Marks: 100

Instructions: 1)

Seat

No.

- Attempt ali questions.
- Figures to the right indicates full Marks.
- Used same answer book.
- Neat diagram must be drawn.
- Use of steam table, Refrigerant property tables/charts and psychrometric charts are allowed.
- Make suitable assumptions if required.

Q1) Attempt any two.

- a) Derive an expression for performance of a reversed carnot refrigeration cycle with vapour refrigerant and mention the limitations. [8]
- b) Explain reversed Brayton cycle for Air refrigeration, derive, an expression for COP and represent on T-s plot.
- e) i) Explain the following terms in brief. Energy ratios (EER) and Ton of Refrigeration.
 - A carnot refrigerator requires 1.4KW of power per Ton of refrigeration to maintain a space at -45°C. Determine; COP of a refrigerator and heat rejected in KJ per Ton.

Q2) Attempt any two.

- a) Explain in detail the methods of improving performance of a vapour compression refrigeration with help of P -H diagram. [9]
- b) Draw cascade system on P-H and T-S plots with schematic diagram. Explain the System and write the expression for COP.
- c) A vapour compression system of 12TR capacity maintains an evaporator temperature of -8°c and condenser temperature + 30°c. Vapour is dry and saturated at entry to the compressor and compression is isentropic,

[8]

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Assuming actual COP 60% of the theoretical. Calculate;

- i) Power input.
- ii) Actual COP.

If Vapour is super heated by 5°c at suction to compressor, Calculate Power input and actual COP. (Assume saturated liquid at end of condenser in both cases.) [9]

Saturation	Spec	cific Enthalpy	Specific Entropy		
Temperature	Liquid(h _p)	Vapour (hg)	Liquid (Se)	Vapour (S.)	
8°c	28.72KJ	184.07KJ	0.149KJ/kg-k	0.7 KJ/Kg-K	
+30°c	64.59KJ	199.62KJ	0.240KJ/kg-K	0.685KJ/kg-k	

Take, Cp of vapour is 0.733 KJ/Kg -K. Properties of Refrigerant.

Q3) Attempt any two.

- Enumerate the desirable properties of a good refrigerant and suggest the refrigerants used in.
 - i) Reciprocating compressor
 - ii) Centrifugal Compressor.
 - iii) Axial compressor and justify your answer
- b) Write a note on
 - i) Ice plant.
 - ii) Dairy plant.

c) Describe the working of evaporative condenser with neat sketch. [8]

Q4) Solve any two.

 a) i) Derive relation between relative humidity and degree of saturation (μ) with usual notations.

ii) Explain Enthalpy deviation and show it on Psychrometric chart.[4]

-2-

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- The moist air is at 25°c DBT and 30% degree of saturation. The total b) pressure is 1.01325 bar, calculate Enthalpy and volume of air per Kg of dry air. [8]
- c) Explain adiabatic mixing of moist air with injected water spray with the help of Psychrometric chart. Write the governing equations for the enthalpy and specific humidity. Draw the condition line with help of SHF scale given on the chart. [8]

Q5) Solve any two.

- Explain briefly with sketch A.D.P, B.F, capacity of cooling coil and a) i) factors affecting them. [5]
 - Write only the equation for air quantity over a cooling and ii) dehumidifying coil using ESHF, ADP and B.F. [4]
- Draw only the neat sketch of comfort chart giving numerical values. b) Explain human body regulatory process against heat and cold. [9]
- The air at 30.5°c DBT and 55% R.H enters cooling coil at the rate of 300 c) cmm. The coil ADP is 13°c and BF is 0.1667. Calculate water vapour condensed and S.H.F using S.H.F Scale given on the chart. 191

Q6) Solve any two.

- Enumerate the sources of heat load for central Air conditioning system a) used for large building. [8]
- Explain methods used for duet sizing in brief for supply air and return b) air. [8]

-3-

Write short notes on. c)

[8]

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- Air distribution requirements. i)
- (ii Types of outlets.
- Grilles. (iii)

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Diffusors. iv)

SF-98 Total No. of Pages : 4

B.E. (Mechanical) (Semester - VII) (New Course) Examination, November - 2017 MECHANICAL SYSTEM DESIGN Sub. Code : 67502

Day and Date : Monday, 13-11-2017 Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

Seat No.

Instructions : 1) All questions are compulsory.

- Assume suitable data wherever necessary and state it clearly. 2)
- Draw neat labeled sketches wherever necessary. 3)
- With suitable example, explain effect of appearance, shape, colour and Q1) a) proportion in Aesthetic Design. [8]
 - Explain ergonomic consideration in design of Pressure Cooker. b) [8]

OR

- What is creativity and explain the role of creativity in the design of a b) product. [8]
- Explain the concept of pre-stressing in thick pressure vessels with suitable O2) a) examples. [6]

OR

- Classify unfired pressure vessels as per IS 2825-1969 code. a)
- A cylindrical pressure vessel shell of inside diameter 1500mm is subjected b) to an internal pressure of 2 MPa . The shell as well as heads are made of low alloy steel with an ultimate tensile strength of 450N/mm2. The double welded butt joints which are spot radiographed ($\eta = 0.85$), are used to fabricate the vessel. The corrosion allowance is 3mm. Determine the thickness of the cylindrical shell and the thickness of the head if the heads are: [12]
 - Flat Head i)
 - ii) Plain Formed
 - Hemispherical iii)
 - Torispherical with crown radius of 1125mm iv)

[6]

SF-98

- Explain with neat sketches self-energizing, self locking and uncontrolled Q3) a) braking conditions in short shoe block brake. [8]
 - A multi-disk plate clutch consists of five steel plates and four bronze b) plates. The inner and outer diameters of the friction disks are 75 and 150mm respectively. The coefficient of friction is 0.1 and the intensity of pressure on friction lining is limited to 0.3 N/mm². Assuming uniform wear theory, calculate: [8]
 - Required force to engage the clutch and i)
 - Power transmitting capacity at 750 rpm. ii)

OR

An internal expanding brake with four identical shoes is shown in figure b) below. Each hinge pin supports a pair of shoes . The actuating mechanism is designed in such a way that it produces the same force P on each of the four shoes . The face width of the friction lining is 50 mm and the maximum intensity of normal pressure is limited to 1N/mm2. The coefficient of friction is 0.30 [8] 1KSDG

Calculate :

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The actuating force P. i)

The torque absorbing capacity of the brake. ii).



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6

[8]

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Q4) a) Basic considerations in design of multi speed gear box.

OR

- Explain the procedure for selecting optimum structure diagram. a) [6]
- A three-stage, twelve speed gear box is to be designed for multi spindle b) speeds varying between 60 r.p.m and 2880 r.p.m. The second stage 1 consists three speed steps if the gear box is driven by 5kW, 1440 r.p.m. electric motor: Assume same module for all gears. [12]
 - Draw the speed ray diagram. i)
 - Draw the gearing diagram. ii)
 - iii) Determine the number of teeth on gears.
- Explain briefly guidelines for design of piston ring. Q5) a)
 - The cylinder of a four stroke diesel engine as the following specifications b) Brake power = 3.00 kW. [8]

Speed = 800 rpm.

Indicated Mean Effect Pressure = 0.30 MPa.

Mechanical Efficiency = 70%

Determine the bore and length of the cylinder liner.

OR

b) The following data is given for a connecting rod:

Engine speed =2000rpm.

Length of connecting rod =300mm.

Length of stroke = 160mm.

Density of material =7800 kg/m3

Thickness of web or flanges = 6 mm

Assume the cross-section of the connecting rod as shown in figure for which Area of cross section, calculate the whipping stress in the connecting rod. SUKSOG SUKSDG

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(A)=11t², I_{xx} =
$$\left(\frac{419}{12}\right)t^4$$
 and $y = \left(\frac{5t}{2}\right)$ [8]

What is adequate design and Optimum design? Explain with suitable Q6) a) Examples? [8]

OR

- Explain relation between functional requirement parameters group, a) geometrical parameters group and material parameters group in the optimum design of machine Elements. 11 [8]
- A tensile bar of length 500mm is subjected to the constant tensile force of b) 3000N. If the factor of safety is 2, design the bar with the objective of minimizing the material cost, out of the following materials [8]

Material	Mass Density (ρ)Kg/m ³	Material Cost Per Unit Mass (c) Rs/Kg	Tensile Yield Strength (S _{yt}) N/mm ²
Plain carbon steel	7800	28	400
Alloy steel	7850	150	900
Aluminium Alloy	2800	132	150
Titanium Alloy	4500	2200	800
	Plain carbon steel Alloy steel Aluminium Alloy Titanium Alloy	Plain carbon steel 7800 Alloy steel 7850 Aluminium Alloy 2800 Titanium Alloy 4500	MaterialMass DensityMaterial Cost Per Unit Mass (c)(p)Kg/m³Unit Mass (c)Rs/KgPlain carbon steel7800Alloy steel7850Aluminium Alloy2800Titanium Alloy45002200

SF-99 Total No. of Pages : 3

Seat No.

B.E. (Mechanical) (Semester-VII) (Revised) Examination, November - 2017 FINITE ELEMENT ANALYSIS Sub. Code : 67503

Day and Date : Wednesday, 15-11-2017 Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

- Instructions : 1) All questions are compulsory.
 - Assume suitable data if necessary and state it clearly.
 - 3) Figures to the right indicate full marks.
- Q1) a) Explain in detail the general steps of finite element analysis. [7]
 b) Explain the principle of minimum potential energy with the help of an example. [7]

- b) If a displacement field is described by $u = (-x^2 + 2y^2 + 6xy)^* 10^{-4}$ and $v = (3x + 6y y^2)^* 10^{-4}$ determine ε_x , ε_y , γ_{xy} at the point x = 1, y = 0.[7]
- Q2) a) Calculate the displacements, stress, strain and reactions for a stepped bar as shown in figure. Given: $A_{steel} = 400 \text{ mm}^2$; $A_{brass} = 300 \text{ mm}^2$; $L_{steel} = 500 \text{ mm}$; $L_{brass} = 300 \text{ mm}$; $E_{steel} = 200 \text{ GPa}$; $E_{brass} = 70 \text{ GPa}$; [10]



- b) Derive the shape functions for a one dimensional quadratic element and sketch the variation of each shape function along the entire element. [8]
 OR
- b) Explain the elimination and penalty method with the help of an example.[8]
- Q3) a) Classify the elements by virtue of their interpolation function and state their merits and demerits.
 [6]

OR

SF-99

b) Calculate the shape functions for the elements shown in figure [12]



- Q4) a) A long cylinder of inside diameter 80mm and outside diameter 120mm snugly fits in a hole over its full length. The cylinder is then subjected to an internal pressure of 2 MPa. Draw the sketch showing actual problem and also model the problem for a sample length of 10mm using two axisymmetric triangular elements with proper forces and boundary conditions. Also show the element connectivity table and coordinates of all nodes.
 - b) Calculate the displacements in global coordinate and local coordinate systems for a truss shown in figure. [10]



- Q5) a) Explain with a neat sketch the boundary conditions for a two dimensional steady state heat conduction problem. [6]
 - b) A composite wall consisting of three materials as shown in figure. The outer temperature is 40°C. Convection heat transfer takes place on the inner surface of the wall with T_x = 500°C and h = 25 W/m²°C. Determine the temperature distribution in the wall. [8]

$$k_{1} = 20 \text{ W/m }^{\circ}\text{C}$$

$$k_{2} = 30 \text{ W/m }^{\circ}\text{C}$$

$$k_{3} = 50 \text{ W/m }^{\circ}\text{C}$$

$$T_{o} = 40 \,^{\circ}\text{C}$$

$$L_{1} = 0.3 \text{ m}$$

$$T_{o} \quad h_{1}$$

$$\int h_{1} \quad h_{1} \quad h_{2} \quad h_{3}$$

$$L_{3} = 0.1 \text{ m}$$

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- Q6) a) Explain in detail the steps to be carried out in commercial FEA software for obtaining the displacement in a stepped bar each of length L/2, fixed at one end and subjected to axial force P at the other end.
 - b) Explain the measures of element distortion in a finite element analysis package. [6]

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SF - 100 Total No. of Pages :2

Seat No.

B.E. (Mechanical) (Part - IV) (Semester - VII) (Revised) Examination, November - 2017 **EXPERIMENTAL MECHANICS (Elective - I)** Sub. Code: 67504

Day and Date : Tuesday, 21 - 11 - 2017 Time :2.30 p.m. to 5.30 p.m.

Total Marks: 100

Instruction	s: 1)	All Questions are compulsory.
	2)	Figures to the right indicate full marks.
	3)	Draw neat diagram to supplement your answer wherever required.
	4)	Make suitable assumptions wherever necessary & state them clearly.
	5)	Use of non - programmable calculator is allowed.
Q1) a)	Explain a	advantages and scope of Experimental Mechanics. [6]
b)	Explain t	he term polariscope, its scope in photoelasticity. Enlist various

ious configurations of polariscope. [10]

What is meant by Tardy's Method, explain it with derivation. Q2) a) [8]

Explain the working of circular polariscope for photoelasticity. b) [8]

OR

Explain Ideal photoelastic material with their desirable properties? Discuss c) the merits and demerits of some common photoelastic materials. [8]

Q3) Write short notes (any three) :

- Photoelastic sheet casting and model making. a)
- Use of white light and monochromatic light in photoelasticity. b)
- Different experimental stress analysis methods. c)
- Isoclinics and Isochromatics. (b)

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[18]

- Q4) a) Explain the principle of Brittle coating method of stress analysis. Sketch the crack patterns under various conditions of stress. [8]
 - Explain various types of strain gauges by comparing them with each other.
 [8]

OR

- c) Explain Moire Method with its advantages, limitations and applications.[8]
- Q5) The following observations are made with rectangular rosette mounted on aluminum specimen.

 $\varepsilon_{A} = 280$ Microstrain; $\varepsilon_{B} = 60$ Microstrain; $\varepsilon_{C} = 100$ Microstrain

Determine the principal strains, principal stress and principal angles. Assume E = 70 GPa and Poisson's Ratio is 0.32 [16]

Q6) Write short notes (any three):

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- a) Semiconductor Strain Gauges.
- b) Commercial Strain Indicators.
- c) Transducer Applications of Strain Gauges.
- d) Temperature Compensation.

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SF-101 Total No. of Pages : 2

B.E. (Mechanical) (Part - IV) (Semester-VII) Examination, November - 2017 AUTOMOBILE ENGINEERING (Elective - 1) Sub. Code : 67506

Day and Date : Tuesday, 21 - 11 - 2017 Time : 2.30 p.m. to 5.30 p.m.

Seat No.

Total Marks: 100

Instructions: 1) All questions are compulsory.	
--	--

- 2) Draw neat sketch wherever necessary.
- Figures to the right indicate full marks.
- Make suitable assumption if necessary.
- 5) Use of non-programmable calculator is allowed
- Q1) a) Compare the front engine front wheel drive and front engine rear wheel drive with its advantages and disadvantages. [8]
 - b) Which are the different types of vehicle body? List the body parts. [8]

Q2) a) Describe briefly parts of the clutch. With its function.

OR

How are the clutches are classified? Explain with neat sketch diagram spring type. Clutch.

- b) What is a need of differential. Explain its operation with neat sketch. [9]
- Q3) a) Explain steering geometry.

OR

What is mean by slip angle, understeer and oversteer.

b) Which are the different types of springs used in suspension system. [8]

[8]

[9]

F-101

04) a)	D	C C 11 .					SF-101
(24) a)	De	tine following	and expla	ain it rel	evanc	e.	[8]
	1)	Brake effici	ency		ii)	Stopping distance	[0]
	ш)	Braking for	ce		iv)	Power brakes.	0
	(V)	Servo brake	S		vi)	Anti lock braking	54
1.1	VII)	 Brake bleedi 	ng		viii)	Brake fadding	
D)	Wh	at are the varie	ous tyre n	omencla	ature,	show with a figure?	List factors
	ante	cting tyre peri	formance.				[8]
(2)	En			OF	5		101
0)	can	be improved	effect of A with the h	BS in a elp of /	utomo ABS,	otive brakes. Explain	how safety [8]
Q5) a)	Exp	lain with neat	sketch w	outeta			
	batte	ery performan	ce param	eters an	of lead	d acid battery. List a	and explain
b)	Exp	lain with neat s	sketch Ele	etronic	contr	ollod	[8]
	in au	itomobile show	ving all n	ecessar	V com	ponents	ystem used
				OR		ponents.	[9]
c)	Expl	ain with neat sl	cetch alim	etiser a	utomo	tive air conditioning	system.[9]
Q0) a)	Follo Kr=0 ratio	wing are the $0.018 \text{ Ka} = 0.0 = 6.2$, second	vehicle s 276, Tran gear rati	pecific smission = 15	ations on efts	, wt. of vehicle = 6 , in top gear = 90%	52.29 KN, , Top gear
	gear	= 80%, frontal	area = 5.	574 m ²	whee	el dia = 0.81	in second
	Calcu	ilate.				a = 0.81 mis,	[12]
	i) 1	Engine power	required.				
	ii) 1	Engine speed r	equired.				
	iii) 1	Maximum pos	sible grad	le in sea	cond o	lear at above 1	
	iv) N	Maximum drah	oar pull in	second	toear	et above speed.	
b)	Write	a note on varie	ous resist	ances to) vehi	cle motion	
			(DR	· · · · · · · ·	ere motion.	[5]
c)	What	B effect of w	t. Distrib	ution o	n veh	vicle performance	
3	selecti	on.				note periornance a	nd drive
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SF - 103 Total No. of Pages :2

Seat No.

B.E. (Mechanical Engineering) (Semester - VII) Examination, November - 2017 TOTAL QUALITY MANAGEMENT (Elective - II) Sub. Code: 67833

Day and Date : Thursday, 23 - 11 - 2017 Time : 2.30 p.m. to 5.30 p.m.

Total Marks: 100

Instructions :

- All Questions are compulsory.
- Figures to the right indicate full marks.
- 3) Make suitable assumptions wherever necessary and state them clearly.
- 4) Use of statistical tables and scientific calculator is permitted.

Q1) Solve any Two.

- a) Track the journey-Inspection, Quality Control, Quality Assurance and Quality Management.
 [8]
- Enumerate customer compliant redressal mechanism being followed in an organization known to you. [8]
- c) What are the needs, wants and expectations of Internal Customers? [8]

Q2) Solve any Three.

a)	How Quality of design and quality of conformance decided?	[6]
b)	How control over vendor quality is established?	[6]
c)	Describe seven QC tools used in problem solving process.	[6]

d) What is Six Sigma? What are the steps involved in implementing it in an organization? [6]

Q3) Solve any Two

 a) What do you mean by parallel, series and combined system reliability? Give suitable examples.
 [8]

- b) What are the applications of reliability tests?
- Three subsystems are reliability wise in series and make up a system. c) Subsystem I has a reliability of 94.6%, subsystem 2 has a reliability of 99.7% and subsystem 3 has a reliability of 92.8% for a mission of 100 hours. What is the overall reliability of the system for a 100 hour Mission?

Q4) Solve any Two.

- How TQM differs from tradional management approach? a) [8]
- What are the focus areas of Theory of Constraints? Prepare a brief write b) up on Feignbaum's theory of TQC. [8]
- Explain any one approach to TQM followed by an organization known c) to you. [8]

Q5) Solve any Three.

- Quality Policy deployment and quality function deployment lead to a) increase in customer satisfaction. How? [6]
- An organization wishes to develop quality culture. How TQM can help b) the organization? [6]
- c) Quality objectives should be SMART. Give a list of quality objectives set by an organization based on SMART philosophy. [6]
- Share details of any TQM technique implemented by an organization. d) Has it been successful? If yes, why? If no, why? [6]

Q6) Solve any Two:

- Elaborate SERVQUAL model in details. a) [8]
- What are the steps involved in implementation of ISO : 9001:2008. [8] b)
- What are the criteria used to decide winner of CII Exim Quality Award? c) SUKSOG SUK-SOG

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SF - 103

SF - 104 Total No. of Pages :2

Seat No.

B.E. (Mechanical) (Part - IV) (Semester - VII) (Revised) (Paper - II) Examination, November - 2017 INDUSTRIAL PRODUCT DESIGN (Elective - II) Sub. Code: 67834

Day and Date : Thursday, 23 - 11 - 2017 Time : 2.30 p.m. to 5.30 p.m.

Total Marks: 100

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[8]

Instruction	s: 1)	All questions are compulsory.
	2)	Figures to the right indicate full marks.
	3)	Draw neat sketches wherever necessary.
Q1) a)	Explain	the concept of Market research and market survey.
b)	Explain	quality aspect of product design.

OR

Explain the characteristics of successful product development. [8]

Q2) a) Explain the process of refining/setting final specifications. [8]
 b) Explain the steps in the concept testing. [8]

OR

Explain innovation and creativity in product design. [8]

- Q3) a) Explain the steps in establishing the product Architecture. [8]
 b) Evolution is a stabilishing the product Architecture.
 - b) Explain the implications of product architecture. [10]

OR

Explain the functional elements of DeskJet Printer with a neat diagram.[10]

Q4) a)	Explain the concept of concurrent engineering	SF - 104
b)	What are the principles to be followed in Design for Ass OR Explain the role of tolerance in product design.	[8] sembly (DF A). [8] [8]
Q5) a)	Explain design of displays in machine tools.	[8]
	 i) Ergonomics ii) Aesthetics 	[10]
	OR	
	Explain the Man-Machine relationship system.	[10]
Q6) a)	Explain the different personal protective equipment used	in a foundary.
b) (Explain the safety precautions to be followed in manufacturi	ng industry.[8]

OR

Explain the ISO 14000 system.

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[8]

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SJ-342 Total No. of Pages : 3

Seat No.

B.E. (Mechanical) (Part-I) (Semester-VII) (Revised) Examination, November - 2016, REFRIGERATION AND AIR CONDITIONING

Sub. Code :47979

Day and Date : Tuesday, 15 - 11 - 2016 Time : 2.30 p.m. to 5.30 p.m. Total Marks: 100

- Instructions: 1) Attempt any three questions from each section.
 - 2) Figures to the right indicate full marks.
 - 3) Use same answer books for the two sections.
 - 4) Neat diagrams / charts must be drawn wherever necessary.
 - Use of steam tables, refrigerants /psychrometric charts and tables are allowed.
 - 6) Make suitable assumptions if required and state them clearly.

SECTION-I

- Q1) a) What are the desirable properties of good-refrigerant ? Discuss with suitable examples. [8]
 - b) How the refrigerants are classified ? Explain the Ashrae designation of refrigerants. [8]
- Q2) a) Discuss vapour compression and vapour absorption refrigeration system in context of energy conservation. [6]
 - b) Sketch and explain the working of water lithium bromide vapour absorption refrigeration systems. What are its applications and limitations? [10]
- Q3) a) Explain the working of a multievaporator system having two evaporators at different temperatures and single compression with suitable example. Draw neat sketch of the system with p-h diagram. [7]
 - b) Draw the sketch of claude system for liquefication of air. Show the cycle on temp - entropy plane and explain the working of the system. State merits and demerits of the same.
 [9]

SJ-342

- Q4) a) Explain Boot strap air retrigeration system with a neat sketch and T-S diagrams. [6]
 - b) An ice plant operates on the ideal vapour compression cycle using refrigerant R134 a. The refrigerant enters the compressor as saturated vapour at 0.15 Mpa and leaves the condenser as saturated liquid at 0.7 Mpa. Water enters the ice making machine at 30°C. And as ice at -5°C.For an ice production rate of 10 kg per hour. Determine the power input to the ice plant. The specific heat of ice and water are 2.1 and 4.18 kJ/kg °K respectively. And the latent heat of fusion of ice is 334 kJ/kg.[10]

Also calculate the coefficient of performance of the system.

Q5) Write notes on any three of the following.

[18]

- a) Actual vapour compression cycle.
- b) Ozone depletion & global warming
- c) Methods of charging and testing.
- d) Vortex tube refrigeration system.
- e) Expansion devices used in refrigeration system.

SECTION-II

Q6) a) Define and explain GSHF, ESHF, ADP and bypass factor. [8]
b) When the DBT is 35°C, WBT is 23 °C and barometer reads 750 mm of Hg. Calculate for atmospheric air.

i)	Relative humidity.	ii)	Humidity ratio.	
iii)	Density.	iv)	Enthalpy of air.	[8]

- Q7) a) Sketch and explain the comfort chart. Define effective temperature scale used in comfort chart. [8]
 - b) Discuss the factors affecting thermal balance between human body and the environment. Explain self regulatory system of body against high temperature and low temp. Exposure. [8]

Q8) a) Prove that rectangular equivalent of circular duct is given by D= 1.265

$$\frac{(ab)^{as}}{(a+b)^{a2}}$$
 what are assumptions mode? [7]

- Explain with sketches the different types of air distribution systems with outlets. [9]
- Q9) a) Explain systematic approach to load estimation on air conditioning plant.[6]
 - b) A summer air conditioning system for a small office building is to be designed. The design is to be based on the following information. [10]

Outside design condition \rightarrow DBT = 35° C , WBT = 28°C

Inside design condition \rightarrow DBT = 26°C, RH = 50%

Room sensible heat gain $\rightarrow 45 \text{kW}$

Room latent heat \rightarrow 9 kW

Ventilation air _____ 0.95 m³/sec

A four-row direct expansion refrigerant 134 a coil with bypass factor of 0.2 will be used. Analyze the problem on psychrometric chart and determine the following.

- i) The room apparatus dew point (ADP).
- ii) The temperature of the air leaving the coil,
- iii) The total quantity of air required (m³/see).
- iv) The temperature of mixed air entering the coil.
- v) The coil apparatus dew point (ADP) temperatures.

Q10) Write notes on any three of the following.

[18]

- a) Air washer.
- b) Air conditioning system for theatre.
- c) Spray type dehumidifiers.
- d) Methods of duct designing.
- e) Energy conservation in air conditioning.

* * *

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SJ-343 Total No. of Pages :3

Seat No.

B.E.(Mechanical) (Part - I) (Semester - VII) (Pre - Revised) (Old) Examination, November - 2016 MECHANICAL SYSTEM DESIGN

Sub. Code: 47980

Day and Date : Thursday, 17-11-2016 Time : 2.30 p.m. to 5.30 p.m. Total Marks: 100

[8]

- Instructions : 1) All questions are compulsory.
 - 2) Figures to the right indicate full marks.
 - 3) Draw neat diagrams wherever required to support your answer.
 - 4) Make suitable assumptions wherever necessary and state them clearly.

SECTION - 1

- Q1) a) Discuss energy considerations in design of brakes.
 - b) A multi-plate clutch has three driving plates and two driven plates. The outer and inner diameters of the friction lining are 240 mm and 120 mm respectively. The coefficient of friction is 0.27. Assuming uniform pressure condition, find the total spring force pressing the plates together to transmit 28 kW at 1440rpm. If there are six springs each having a stiffness of 15 N/mm, find the power that can be transmitted, if each pair of contacting surface has worn oway by 1.5 mm. Assume uniform wear condition. [10]

OR

c) Figure I-1 shows internal expanding shoe brake. It has a drum diameter 250 mm. R = 100 mm and face width of shoe is 28 mm. Calculate the actuating force, torque capacity and the hinge pin reactions if maximum intensity of pressure is 600 kPa and coefficient of friction is 0.32. [10]



Figure I-1 Question 2 - c

Q2) a) Classify pressure vessels as per IS 2825.

- b) Explain the types of end closure for cylindrical pressure vessels. [6]
- c) An air receiver consists of a cylindrical shell of an internal diameter 1 m and length 2m, closed by hemispherical heads. The air pressure inside the vessel is limited to 15 bar. The shell, as well as, ends is made of plain carbon steel with and ultimate tensile strength of 390 N/mm². The efficiency of circumferential and longitudinal welded joints in the vessel shell is 80%. Determine and 85% respectively. The efficiency of the welded joints in the hemispherical heads is 80%. Determine the thickness of vessel shell and hemispherical head and storage capacity of the vessel.

Q3) Solve any Two

- Explain ergonomic design considerations in the design of displays.
- b) Describe the importance of aesthetic consideration in the product design.
- c) What is modeling? Explain various types of modeling.

SECTION - II

Q4) a) Explain deviation diagram w.r.t. design of multispeed gearbox. [6]

OR

- b) What are advantages of using geometric progression in multispeed gearbox? [6]
- c) A six speed gear box is to be designed for a machine tool drive. The spindle speeds range between 150 rpm and 1000 rpm, driven by an electric motor of 5 kW with 1000 rpm through belt drive. Draw speed diagram, gearing diagram, number of stages and dimensions of pulleys. [12]

-2-

[16]

SJ-343

Q5) a) What is adequate design and optimum design? Explain the same with suitable example. [6]

OR

- b) Discuss Lagrange's method of optimum design using suitable example.[6]
- c) A simple tensile bar is subjected to specified constant force 'F'. Design the bar with the objective of minimizing cost of material using factor of safety 'N_f' for following specified limitations in the optimum design. L_{min} ≤ L ≤ L_{mm}. [10]

Q6) Solve any Two

- a) Write a note on design of chain conveyors.
- b) Explain gravity type tension take-up units in Belt conveyors.
- Explain difference between design tolerance and natural tolerance, and explain how it helps in reduction of rejection.

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[16]
SJ-345 Total No. of Pages :3

B.E. (Mechanical) (Part - IV) (Semester - VII) (Old) Examination, November - 2016 EXPERIMENTAL MECHANICS (ELECTIVE - I) Sub, Code : 47982

Day and Date : Wednesday, 23 - 11 - 2016 Time : 2.30 p.m. to 5.30 p.m.

Seat No.

Total Marks: 100

Instructions: 1) Attempt THREE questions from section I and THREE questions from section II.

- 2) Figures to the right indicate full marks.
- 3) Draw neat diagrams to supplement your answers wherever required.
- Make suitable assumptions wherever necessary and state them clearly.
- 5) Use of any type of calculator is allowed.

SECTION - I

- Q1) a) With neat sketches explain the construction and working of wire type and foil type electrical resistance strain gauge. What are the advantages of the foil type strain gauges over the wire type? [9]
 - b) What is the role of Wheatstone bridge in strain gauge applications? Write and derive the condition for bridge balance. [8]

OR

- Explain in a step wise manner how will you determine a uniaxial stress at a point using the electrical resistance strain gauge.
- Q2) The following readings were taken on a rectangular rosette attached to Steel specimen

 $\varepsilon_{s} = 500$ micro strain tensile

 $\varepsilon_n = 400$ micro strain tensile

 $\varepsilon_c = 200$ micro strain compressive

Determine the principal strains, principal stresses and their orientation. Take for Steel E = 2×10^5 MPa and Poisson's ratio $\mu = 0.30$ [16]

P.T.O.

[8]

[8]

- Q3) a) Write a note on "semiconductor strain gauge" with neat sketch. What are their advantages over the electrical resistance strain gauge? [9]
 - b) Write a note on "strain gauge type pressure transducer" with neat sketch.

OR

b) Write note on Balancing of bridge

SECTION - II

- Q4) a) What are the advantages of using the experimental methods of stress analysis over the analytical methods? List some experimental methods of stress analysis and state their relative merits and demerits. [8]
 - Explain the method of calibration of photoelastic material using a circular disc under diametral compression. What is the advantage of using a circular disc for calibration? [8]

OR

- b) Write note on Electrical analogy method of separation of stresses. [8]
- Q5) a) In an experiment of separation of stresses using oblique incidence method, a fringe order of 2.84 was measured in normal incidence at a point of interest. Measurement of fringe order at the same point but in oblique incidence was carried out by rotating the model around one of the principal stresses by 45°. The fringe order at that point was recorded as 3.56. To determine the material fringe value fo of the photo elastic material, calibration was conducted by subjecting a circular disc 70 mm diameter and made from the same photoelastic material to a diametral compressive load of 520 N. When viewed through a dark field circular polariscope arrangement, the fring order of the isochromatic fringe at the centre of the circular disc was 1.64. Determine the values of the two principal stresses at the given point. Also calculate the maximum shear stress at the same point. Take model thickness as 6 mm.
 - b) Write the various methods for fractional fringe measurement. Explain in detail Tardy's method. State its advantages over other methods. [9]

OR

b) Write Short Notes on Babinet Soleil compensation method

[9]

- Q6) a) Explain the principle of brittle coating method. What do you understand by calibration of brittle coating? Describe briefly the methods employed for calibration. [8]
 - b) Why is it necessary to use only white light in plane polariscope arrangement? Also explain the meaning of 'isoclinic parameter'. How will you determine direction of principal stress using a plane polariscope arrangement? [8]

OR

b) Write note on fractional Fringe Measurement.

[8]

SJ-350 Total No. of Pages :2

Scat No.

B.E. (Mechanical) (Part I) (Semester - VII) (Pre-Revised) Examination, November - 2016 INDUSTRIAL PRODUCT DESIGN (Elective - II) Sub. Code: 47988

Day and Date : Friday, 25 - 11 - 2016 Time :2.30 p.m. to 5.30 p.m. Total Marks: 100

P.T.O.

Instructions : 1) Answer any three questions from section I and any three questions from section. II

- 2) Figures to the right indicate full marks.
- 3) Draw neat sketches wherever necessary.
- 4) Answer to the two sections must be written in the same answer book.

SECTION - I

Q1)	a)	Explain the procedure for identifying customer needs.	[8]
	b)	Explain the challenges faced in product design and development.	[8]
Q2)	a)	Explain and compare the different types of prototypes in product de	sign. [10]
	b)	Explain the concept of value engineering.	[6]
Q3)	a)	Explain the procedure for setting target specifications in product de	sign. [8]
	b)	Explain the procedure for estimating the manufacturing cost in prodesign.	oduct [8]
Q4)	Wri	ite short notes (Any Three):	[18]
	a)	Concept generation process.	
	b)	Design for environment.	
	c)	Design for manufacturing (DFM).	
	d)	Concurrent Engineering.	
	e)	Market Research.	

SECTION - II

Q5) a)	Explain the ergonomics principles used in industrial safety and health control. [6]
b)	Explain the following with respect to controls. [10]
	i) Shape coding of controls
	ii) Design of hand wheels
Q6) a)	Explain the key factors to be considered in the design of a work station.[8]
b)	Explain the benefits and features of ISO 14000 Environmental Management System. [8]
Q7) a)	Explain the different personal protective equipment to be used as safety devices. [8]
b)	Explain the general causes of occupational health hazards in modern industries. [8]
Q8) Wri	ite short notes on (Any Three): [18]
a)	Safety in Foundry.
b)	Aesthetics in product design.
c)	Necessity of anthropometric data in product design.
d)	Visual display unit.

e) Product data management.

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SJ-351 Total No. of Pages : 3

Seat No.

B.E. (Mechanical) (Part-IV) (Semester-VII) (Revised) (New) Examination, November - 2016 REFRIGERATION AND AIR CONDITIONING

Sub. Code :67501

Day and Date : Tuesday, 15-11 - 2016 Time : 2.30 p.m. to 5.30 p.m. Total Marks: 100

Instructions : 1) Attempt all questions.

- 2) Figures to the right indicate full marks.
- 3) Use same answer book.
- 4) Neat diagram must be drawn.
- Use of steam table, refrigerant property table/ chart & psychrometric charts are allowed.
- 6) Make Suitable assumptions if required.

Q1) Attempt any two.

- a) Explain Bell-Coleman Air cycle with help of block diagram. Derive the expression for COP and represent the cycle on T-S plot.
 [8]
- b) Discuss the main differences between Reversed Carnot cycle operating on perfect gas and wet vapour with help of T-S plot. [8]
- c) i) A Carnot refrigerator requires 1.25kW per ton of refrigeration to maintain a region at low temperature of -40°C. Determine C.O.P. and heat rejected in kJ/min. [4]

ii) Give the comparison between Heat Engine, Heat pump and Refrigerator. [4]

Q2) Attempt any two.

- a) Discuss the effects of operating conditions on the performance of vapour compression refrigeration system. [8]
- b) Write a note on
 - Applications of cryogenics. [4]
 - ii) Actual vapour compression refrigeration. [4]

P.T.O.

- c) An ammonia refrigerating machine works between condenser temperature of 40°C and evaporator temperature of -10°C. Determine theoretical piston displacement per ton of refrigeration and C.O.P for following cases.
 - i) Dry and saturated refrigerant vapour at the beginning of the compression
 - ii) Super heated vapour by 5°C at the beginning of the compression. Assume isentropic compression and no subcooling for both cases. C_p of NH₁ vapour = 2.8 kJ/kg-°C. [8]

Q3) Attempt any two.

- a) ASHRAE classification of refrigerants. Suggest alternative refrigerants for environmental protection and justify your suggestion. [9]
- b) Explain in detail safety devices used in refrigeration system and sketch any one of them. [9]
- c) Explain how following equipment are selected for a system.
 [9]
 - i) Compressor
 - ii) Condenser
 - iii) Evaporator

Q4) Solve any two.

- a) i) With standard notation derive the relation between specific humidity and partial pressures of dry air and water vapour. [5]
 - ii) Show Enthalpy deviation curves on psychrometric chart. [3]
- b) Moist air at 1.013 bar has DBT =25°C, WBT = 20°C, P = 2.01 kN/m². Use equations and calculate specific humidity, Relative humidity, specific enthalpy of moist air and dew point temperature from steam table. Use psychrometric table only.
- With neat sketch, briefly explain adiabatic mixing of two air streams. Write only governing equations for enthalpy, mass of air, mass of water vapour.

Q5) Solve any two.

 a) Write only governing equations and represent on hand drawn psychrometric chart for B.F, contact factor, A.D.P and coil capacity. Also draw RSHF, GSHF and ESHF lines. [9]

-2-

- b) Air at 15.9°C DBT and 95% RH is heated and humidified to 30.5°C DBT and 55% RH. The processes are sensible heating, air washer with recirculated water spray till R.H rises to 95% and then sensible heating. Find makeup water quantity, heating required and humidifying efficiency of air washer. [9]
- Draw only neat sketch of comfort chart giving numerical values. Show all year round zone. Write the factors affecting effective temperature.

Q6) Solve any two.

- a) Write a note on sources of heat load for air conditioning unit briefly, suitable for all seasons. [8]
- b) Write a note on duct sizing using friction loss chart, Conversion chart for circular to rectangular ducts and aspect ratio. [8]
- c) Write short notes on- types and use of grilles and diffusors. Also give their locations and factors governing selection. [8]

* * *

B.E.(Mechanical) (Semester - VII) (New Course) Examination, November - 2016 MECHANICAL SYSTEM DESIGN Sub. Code : 67502

Day and Date : Thursday, 17-11-2016 Time : 2.30 p.m. to 5.30 p.m. Total Marks: 100

Instructions :

Sent No.

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and state it clearly.
- 3) Draw neat labelled sketches wherever necessary.
- Q1) a) With suitable example, explain the importance of aesthetic design of product. [8]
 - b) Explain the relationship between man, machine and environment. [8]

OR

With the help of neat sketch explain the ergonomic design consideration involved in the design of executive chair.

Q2) a) What are the objectives of pre-stressing the high pressure cylinders? Describe the various methods of pre-stressing such cylinders. [8]

OR

Explain briefly the considerations of openings in Pressure Vessels.

- b) A pressure vessel consists of a cylindrical shell with an inside diameter of 1650mm, which is closed by Torispherical heads with a crown radius of 1300 mm. The operating pressure inside the vessel is 1.5 Mpa. The Yield strength of the material used for the shell and head is 255N/mm² and the weld joint efficiency may be assumed to be 0.8. The corrosion allowance is 2mm. Determine the thickness of the cylindrical shell and the Torispherical head. [10]
- Q3) a) Explain with neat sketch the working of centrifugal clutch, stating its advantages and applications. [8]

P.T.O.

b) An automotive type internal expanding brake is as shown in figurel. The face width of friction lining is 50 mm and the coefficient of friction is 0.4. The maximum intensity of pressure on the lining is 0.8 N/mm². The angle θ1 can be assumed to be zero. [8]

Calculate

- i) The actuating force
- ii) The Braking Torque Capacity



OR

A centrifugal clutch, transmitting 20 kW at 720 rpm, consists of four shoes. The clutch is to be engaged at 75% of the running speed. The inner radius of the drum is 170 mm, while the radius of center of gravity of each shoe, during engaged position is 140mm. The coefficient of friction is 0.25. Calculate the mass of the each shoe.

Q4) a) Explain briefly Compound ray diagram of a multi speed machine tool gear box. [6]

OR

Explain general guidelines in developing kinematic or gearing diagram for multi speed gear box.

-2-

A multi speed gear box is to be designed for a headstock of a turret lathe b) for nine spindle speeds ranging from 30 rpm to 1000 rpm. If the gear box is driven by 5KW, 720 rpm electric motor; [12] Draw the speed ray diagram. i) ii) Draw the gearing diagram. Determine the number of teeth on gears. iii) Assume same module for all gears. Explain briefly Guidelines for design of piston Rings. 5) a) [8] Determine the small and the big end bearings of the connecting rod for a b) diesel engine with the following data: 181 Cylinder Bore = 100 mm i): Maximum gas pressure = 4 Mpa ii) (Vd) ratio for piston pin bearings = 2 (I/d) ratio for crank pin bearing = 1.3 Allowable bearing pressure for piston pin bearing = 12 Mpa Allowable bearing pressure for crank pin bearing = 7.5 Mpa. OR The following data is given for a connecting rod: Engine speed = 1800rpm. Length of connecting rod = 350mm. Length of stroke = 175mm. Density of material = 7800kg/m3 Thickness of web or flanges = 8 mm Assume the cross-section of the connecting rod as shown in Fig. 2 for which Area of cross section.



-3-

(A) = 11
$$t^2$$
, $I_{yy} = \left(\frac{419}{12}\right)t^4$ and $y = \left(\frac{5t}{2}\right)$

Q6) a) Explain Lagrange's Multiplier for optimum design.

OR

Explain the following terms in Johnson method of optimization.

- i) Primary Design Equation (PDE)
- ii) Subsidiary Design Equation (SDE)
- iii) Limit Equation (LE)
- A torsional shaft is required to transmit a torque of 1000 N-m and is to have a rigidity of 90 N-m/degree. Assuming factor of safety of 1.5 based on yield strength, design the shaft for minimum weight. Assume maximum shear stress theory of failure. [8]

Material	Mass Density (ρ) Kg/m ³	Yield Strength (S _{yt}) MPa	Shear Modulus(G) GPa
Steel Allogy	8500	130	80
Aluminium Alloy	3000	50	26.7
Titanium Alloy	4800	90	40
Magnesium Alloy	2100	20	16

Use following data for the materials.

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SJ-353 Total No. of Pages :2

B.E. (Mechanical) (Part - I) (Semester - VII) (New) Examination, November - 2016 EXPERIMENTAL MECHANICS (Elective - I) (Paper-I) Sub. Code: 67504

Day and Date : Wednesday, 23 - 11 - 2016 Time : 2.30 p.m. to 5.30 p.m.

Total Marks: 100

Instructions :	1)	All questions are compulsory.
	2)	Figures to the right indicate full marks.
	3)	Draw neat diagram to supplement your answer wherever required
	4)	Make suitable assumptions wherever necessary & state them clearly
	5)	Use of non-programmable calculator is allowed.

	e procedure for two dimensional photoelastic sneet.	8
b) Exp	lain the electrical analogy method.	[8]

OR

Explain the oblique incidence method c) [8]

Enlist the different experimental stress analysis techniques. When would Q2) a) you propose the use of these techniques? 161

Explain the method of photoelastic stress analysis. Explain a stepwise b) manner how two dimensional stress analysis of machine is carried out using theory of photoelasticity. [10]

Q3) Write short notes (any three).

a)	Circular Polari	scope
----	-----------------	-------

- Advantages and scope of Experimental Mechanics b)
- Significance of material fringe value c)
- Shear difference methods d)

P.T.O.

[18]

Seat

No.

011

17.

1. 2

- Q4) a) What do you understand by a strain rosette? What are the different type of strain rosette configurations explain in brief. [8]
 - b) Explain Wheatstone Bridge Circuit.

OR

- c) Explain Brittle coating technique and interpretation of crack pattern data.
- Q5) The following observations are made with delta rosette mounted on specimen $\varepsilon_A \approx -845$ Microstrain; $\varepsilon_B = 1220$ Microstrain; $\varepsilon_c = 710$ Microstrain Determine the principal strains, principal stress and principal angles. Assume E = 200 GPa and Poisson's Ratio = 0.285

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- Q6) Write short notes (any three)
 - a) Gauge factor
 - b) Reflection Polariscope
 - c) Crack detectiontechniques
 - d) Balancing of Bridges

[18]

[16]

[8]

[8]

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SJ-354 Total No. of Pages :3

Seat No.

> B.E. (Mechanical) (Part - IV) (Semester - VII) (Revised) (New) Examination, November - 2016 AUTOMOBILE ENGINEERING (Elective - I) Sub. Code : 67506

Day and Date : Wednesday, 23 - 11 - 2016 Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

Instructions : 1) All questions are compulsory.

2) Draw neat sketches wherever necessary.

- Figures to the right indicate full marks.
- Make suitable assumption if necessary.
- 5) Use of non-programmable calculator is allowed.
- Q1) a) Explain with neat diagram, front engine rear wheel drive layout and write its advantages and disadvantages. [8]
 - b) Which are the different types of chassis? What are the materials used for chassis frames? [8]
- Q2) a) With the help of suitable diagram, describe the constructional features of a diaphragm spring type clutch. Discuss its advantages and disadvantages relative to the clutch employing helical springs (coil spring). [9]
 - b) What is an overdrive? Explain its construction and discuss it working with sketch.

OR

Discuss with neat sketch of principle and working of differential.

P.T.O.

- Q3) a) Which are two types of steering mechanism? Explain any one of them with neat sketch. [8]
 - b) What is mean by active suspension? With neat sketch explain air suspension. [9]

OR

Which are the different types of independent suspensions? Explain any one of them with neat sketch.

Q4) Solve any three questions:

- a) What are various types of brakes? Compare drum brakes with disc brakes. [6]
- b) Explain with neat sketch working of air brakes. List advantages. [6]
- c) Explain with layout sketch working of ABS list advantages [6]
- d) Define tyre size and catogeries of tyres. What are various tyre specifizations. List causes of tyre wear. [6]

Q5) Solve any two questions:

- a) Explain with sketch battery construction. How battery produces electricity and how charging can be done? Explain. [8]
- b) Explain with neat sketch working of magneto ignition system. Compare with battery ignition system. [8]
- c) Explain with neat sketch electronic controlled engine & vehicle management system. [8]

-2-

[8]

Q6) Solve any two questions:

- a) Explain various resistances to vehicle motion? How to estimate total resistance to vehicle motion and power required to propell vehicle. [8]
- Explain various factors affecting air resistance to vehicle motion? How to reduce each of them.
 [8]
- c) A vehicle specifications are as follows

Vehicle weight - 7975.5 N

Power - 14.7 KW @ 2500 rpm

Speed of 2500 rpm - 64.37 kmph in top gear

Gear box bottom ratio - 3.5 : 1

Transmission effi. - 88% in top gear

Transmission effi. - 80% in bottom gear

Wheel diameter - 0.762 mts.

Frontal area of vehicle - 1.116 m2

Coest. of air resi. ka - 0.0314

Coent of polling resi. kr = 0.023

Estimate

i) Speed of vehicle in bottom gear

ii) Tractive effort available at wheels in top and bottom gear

-3-

iii) Gradient can climb in bottom gear

Total No. of Pages : 2

B.E. (Mechanical Engineering) (Semester-VII) (New) Examination, November - 2016 TOTAL QUALITY MANAGEMENT (Elective-II) Sub. Code : 67833

Day and Date : Friday, 25 - 11 - 2016 Time : 2.30 p.m.to 5.30 p.m. Total Marks : 100

- Instructions : 1) All questions are compulsory.
 - 2) Figures to the right indicate full marks.
 - 3) Make suitable assumptions wherever necessary and state them clearly.
 - 4) Use of statistical tables and scientific calculator is permitted.

Q1) Solve any Two

Seat No.

- "Absence of customer complaints does not necessarily mean that a) customers are satisfied". Comment. [8] Why internal customer consideration is important for any organization? b) What do they expect? [8] c) What can address defects-correction corrective action or preventive action? How? [8] O2) Solve any Three a) Explain three universal processes of quality improvement as propagated by juran. [6] What are the inputs and outputs of product design and development as b) per APQP? [6] c) Design new vendor selection format for an organization. [6]
 - d) Six sigma status leads to organizational excellence. How to achieve it?[6]

Q3) Solve any Two

- a) Explain accelerated life testing for reliability. What are its limitations?[8]
- b) What are the important stages of Design FMEA? Devise a format. [8]
- c) A system has three parallel components-A,B, & C with reliabilities 0.95, 0.92 & 0.90 respectively. Find the reliability of the system. [8]

P.T.O.

Q4) Solve any Two

- a) An organization wishes to implement TQM. How they should go about it?[8]
- b) Philip Crosby has developed 14 step program for effective quality. What are the salient features of this program? [8]
- Develop TQM model for a medium scale organization using feign baum's theory of TQC.

Q5) Solve any Three

- a) Distinguish between customer wants, needs and expectations with suitable examples. How TQM organization meets these? [6]
- b) What role HR plays in institutionalizing TQM in the Organization? [6]
- Describe what steps have taken by an organization that you visited/known to you to implement 5S philosophy? What tangible and intangible benefits that organization has reaped?
- d) What is the difference between Kaizen and innovation? How kaizen satisfies human needs? [6]

Q6) Solve any Two

- a) Which processes and systems you know or have witnessed in a service industry? [8]
- b) Discuss main clauses of ISO: 9001:2008 and explain the clause on "Measurement, Analysis and improvement". [8]
- Discuss the impact of quality Award on TQM. How quality award helps an organization. [8]

SJ-359 Total No. of Pages : 2

Total Marks : 100

Seat No.

Day and Date : Friday, 25 - 11 - 2016

B.E. (Mechanical) (Part-I) (Semester-VII) (New) (Revised) Examination, November - 2016 INDUSTRIAL PRODUCT DESIGN (Elective - II) Sub. Code : 67834

Time: 2	30 p.m.to 5.30 p.m.		
Instructio	ns: 1) All questions are compulsory. 2) Figures to the right indicate fu 3) Draw neat sketches wherever	ll marks, necessary.	
Q1) a)	Explain the challenges to product dev	velopment and design.	[8]
b)	Explain the steps for identifying cust OR	omer needs.	[8]
b)	Explain quality aspect in product des	ign .	[8]
Q2) a)	Explain the following with respect to i) Metrics	target specifications.	[8]
	ii) Competitive benchmarking		
b)	Explain the following with respect to i) Search Externally	concept generation	[8]
	uy Search Internatiy		
b)	Explain concept selection process in	product design.	[8]
Q3) a)	What is product architecture? Explain architecture.	the types of modularity in prod	uet
b)	Explain the implications of product a manufacturability.	rchitecture on product change a	ind [0]
	OR		
b)	Explain the functional elements of wr	ist watch with a neat diagram. [1	[0]
		P.T.	0.

04)	a)	Explain the concept of value engineering	[8]
2.1	b)	What are the principles to be followed in Design for Assembl	y (DFA) [8]
		OR	
	b)	Design for Environment is a necessity -Explain	[8]
05)	a)	Explain design of controls in machine tools	[8]
1	b)	Explain the following with respect to product design	[10]
		i) Ergonomics	
		ii) Aesthetics	
		OR	
	b)	Explain the following:	[10]
		i) Anthropometric data	
		ii) Man-Machine System	
Q6) a)	Explain the different types of personal protective equipt safety devices.	nent used as [8]
	b)	Explain the safety precautions to be followed in chemical i	ndustry. [8]
		OR	

b) Explain the different factors which effect industrial safety. [8]

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SJ-961 Total No. of Pages : 3

B.E. (Mechanical) (Semester-VII) (Revised) (New) Examination, November - 2016 FINITE ELEMENTANALYSIS Sub. Code :67503

Day and Date : Monday, 21- 11 - 2016 Time : 2.30 p.m. to 5.30 p.m.

> Answer any three questions from each section. 1)

Figure to the right indicate full marks. 2)

Assume if necessary suitable data and state clearly. 31

Draw neat labelled sketch wherever necessary. 4)

Use of non-programmable calculators is permissible. 5)

SECTION-I

Q1) Consider the temperature distribution through the composite wall shown in figure below which is composed of a layer of insulation sandwiched between two brick walls. Use the finite element method (element and global stiffness matrix) to predict the temperatures T2 and T2 at the interfaces and heat flux through the composite slabs (Q1 and Q4).



A-steel **B**-insulation K_=80×10-3 W/mmºC K_a=4× 10-3 W/mm°C Nodes: 1.2,3,4 Elements: 1-2, 2-3, 3-4 Q, and Q, are heat flux. entering and leaving

- What are higher order (quadratic, cubic, etc.) elements? sketch their Q2) a) shape functions (interpolation polynomials). [8]
 - b) For the plane truss shown in figure below determine the unknown P.T.O.

Seat No.

Instructions :

Total Marks: 100

[16]

displacements, reaction forces, strains and stresses in the members of the truss. $P_1=1000$ KN and $P_2=1500$ KN, Modulus of elasticity E=210GPa, length of the two members is 1m each and cross-sectional area is 5×10^{-4} m². [8]



- Q3) a) Derive stiffness matrix for one dimensional bar element subjected to axial tension using the principle of minimum potential energy.
 [8]
 - b) Write down the shape functions for 4-noded linear quadrilateral element using natural coordinate system.
 [8]

Q4) Write short notes on : (Any three)

- a) Gauss elimination method
- b) Node and element numbering
- c) Von-Mises stress
- d) Rayleigh Ritz methods
- e) Natural coordinate system

SECTION-II

- Q5) a) Explain the importance of element shape and distortion in relation to quality of the finite element mesh.
 [8]
 - b) State the steps involved to model a mechanical element (e.g., a bracket, perform a static analysis and view results using commercial FEA software.[8]

[18]

[18]

Q6) a) A displacement field $u = 1 + 3x + 4x^3 - 6xy^2$ and $v = xy - 7x^2$ is imposed on a square element shown in figure below, [8]



- Write down expressions for E, E, and Y,
- ii) Find where ɛ is maximum within the square
- b) Prepare an algorithm/flowchart to write a computer code for the finite element analysis of a simple plane truss having n nodes and m elements.
 [8]
- Q7) a) What are simplex, complex and multiplex elements used in FEM? [8]
 - b) Explain with an example how node/element numbering affects the bandwidth of a stiffness matrix. [8]

Q8) Write Short notes on : (Any three)

a) Simplification of FE model through symmetry

- b) Constant strain triangle (CST)
- c) Interpolation functions used in FE formulation
- d) Numerical integration
- e) Convergence requirements of interpolation functions.

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SL-323 Total No. of Pages :3

B.E. (Mechanical) (Part-IV) (Semester-VII) (New) (Revised) Examination, May - 2017 REFRIGERATION AND AIR CONDITIONING Sub. Code : 67501

Day and Date : Monday, 15-05-2017 Time : 2.00 p.m. to 5.00 p.m. Total Marks : 100

Instructions: 1) Attempt all question.

- 2) Figures to the right indicate full marks.
- Use same answer book.
- 4) Neat diagrams must be drawn.
- 5) Use of steam table, refrigerant/Psychrometric charts, tables are allowed.
- 6) Make suitable assumptions if required.

Q1) Attempt any two.

i)

Seat No.

- a) The c.o.p of air refrigerations cycle is low, but still air refrigeration system is most common in Air crafts discuss the statement. [8]
- b) Justify the following statements briefly.

COP of carnot refrigerator will be higher in winter than summer.[4]

- Carnot COP of domestic refrigerator is less than carnot COP of domestic air conditioner. [4]
- c) A reversed carnot cycle has a COP of 5.5. Determine the absolute temperature ratio high temperature to low temperature.

If power consumption of the cycle is 8kW. What is the refrigerating capacity of the machine in TR?

If the cycle is used as a heat pump with same ratio of high to low temperatures. Determine its C.O.P for heating and quantity of heat pumped. [8]

Q2) Attempt any two.

- Discuss the following cases,
 - Wet Versus Dry compression.
 - ii) | Throttling Versus Isentropic Expansion.

P.T.O.

[8]

- b) What do you mean by multistaging and why it is necessary? Explain with line diagram multistage compression with flash gas intercooler to operate a low temperature evaporator and represent on p.h diagram. [8]
- c) A simply vapour compression refrigeration system uses methyl chloride (R - 40) and operates between temperatures of -10°C and 45°C. At entry to the compressor, the refrigerant is dry saturated and after adiabatic compression it attains 60°C. Find C.O.P of the refrigeration system.

The properties of methyl chloride are as follows.

[8]

Saturation	Enthalpy in kJ/kg		Entropy in kJ/kg	
temperature in °C	Liquid	Vapour	Liquid	Vapour
-10	45.4	460.7	0.183	1.637
45	133.0	483.6	0.485	1.587

- Q3) Attempt any two.
 - a) Suggest with proper reasons type of refrigerant used for following applications. [9]
 - i) Domestic refrigerator. ii) Cold storage of 100 JR.
 - iii) Ice Cream plant. iv)
- iv) Room air conditioner.

[9]

[8]

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- i) Azeotropes, ii) Secondary refrigerants.
- Discuss in detail refrigerator controls and draw neat sketch of thermostat.
 [9]

Q4) Solve any two.

b)

a) Define Relative humidity and Degree of saturation.
 Derive the expression;

$$\phi = \frac{\mu}{1 - (1 - \mu)\frac{P_s}{P}}$$

Write note on.

Where P.: Partial pressure of water vapour at saturation condition.

P: Total pressure.

o: Relative humidity.

- µ: Degree of saturation.

-2-

[8]

14-50

- b) With help of psychrometric chart explain the process of sensible and latent heat transfer between air and wetted surface at temperature t and t. The specific humidity and enthalpy values w, w, h, h.
 [8]
- Moist air has DBT = 25°C, degree of saturation 30% total pressure 1.01325 bar. Use psychrometric equations and steam table to calculate enthalpy and volume per kg of air. [8]

Q5) Solve any two.

- a) Briefly explain ADP, Thermodynamic WBT, cooling coil capacity and By pass factor. List factors affecting By pass factor. [9]
- b) With help of comfort chart explain factors conductive to comfort. Write note on body regulatory process against heat and cold. [9]
- c) Sensible heat gain and latent heat gain are 65 kw and 8 kw. respectively. The desired room condition is DBT 24°C and RH 50%. The out door air at DBT 35°C and WBT 25°C is mixed with recirculated air in the ratio 1:4. The mixture enters cooling coil and leaves the coil at DBT 12.5°C. The bypassed air gets mixed with air leaving the coil and is supplied to room at 14°C DBT. Find S.H.F, enthalpy of air entering room and cooling capacity of the coil. [9]

Q6) Solve any two.

SUK-SUG

- a) Write a brief note with equations if any for the sources of heat load for large air conditioning installation. [8]
- b) Write a note on friction loss chart, Equivalent length, methods of duct sizing, and conversion from circular to rectangular shape in duct sizing.
- c) With neat sketch discuss the various duct layouts. Also write the requirements of air distribution. [8]

-3-

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Total No. of Pages : 4

Seat No.

B.E. (Mechanical) (Semester - VII) (New Course) Examination, May - 2017 MECHANICAL SYSTEM DESIGN Sub. Code : 67502

Day and Date : Tuesday, 16 - 05 - 2017 Time : 2.00 p.m. to 5.00 p.m.

Total Marks : 100

Instructions : 1) All questions are compulsory.

- Assume suitable data wherever necessary and state it clearly.
- 3) Draw neat labeled sketches wherever necessary.
- Q1) a) What is aesthetics? Explain with suitable example the role of various features in the aesthetic design considerations.
 [8]
 - Explain with neat sketches ergonomic design consideration in design of ladies bicycle.
 [8]

OR

Explain the design considerations in controls and displays.

- [8]
- Q2) a) Derive Birnie's equation to determine the thickness of thick pressure vessel.
 [8]

OR

Explain with neat sketches the supports used in pressure vessels. [8]

b) A high pressure cylinder consists of an inner cylinder of inner and outer diameter of 200mm and 300mm respectively. It is jacketed by an outer cylinder with an outside diameter of 400 mm. The difference between the outer diameter of the inner cylinder and the inner diameter of the jacket before assembly is 0.25mm (E = 207 kN/mm²). Calculate the shrinkage pressure and the maximum tensile stress induced in any of the cylinders. [10]

[6]

- Q3) a) Derive the torque transmitting capacity of single plate clutch using uniform pressure theory, [8]
 - A four wheeled automobile car has a total mass of 1000kg. The moment b) of inertia of each wheel about a transverse axis through its center of gravity is 0.5 kg-m2. The rolling radius of the wheel is 0.35m. The rotating and reciprocating parts of the engine and the transmission system are equivalent to a moment of inertia of 2.5 kg-m2, which rotates at five times the road-wheel speed. The car is travelling at a speed of 100km/h on a plane road. When the brakes are applied the car decelerates at 0.5g. There are brakes on all four wheels. Calculate: [8]
 - The energy absorbed by each brake. i)
 - The torque capacity of each brake. ii)

OR

A centrifugal clutch consists of four shoes, each having a mass of 1.5 kg. In the engaged position, the radius to the center of gravity of each shoe is 110 mm, while the inner radius the drum is 140mm. The coefficient of friction is 0.3. The pre-load in the spring is adjusted in such a way that the spring force at the beginning of engagement is 700 N. The running speed is 1440 rpm. [8]

Calculate:

The speed at which the engagement begins; i)

The power transmitted by the clutch at 1440 rpm. ii)

Difference between structural diagram and Speed diagram. Q4) a)

OR

Explain briefly need of speed deviation diagram in the design of multi speed machine tool gear box. 6

[8]

- b) A multi speed gear box, determine the speed steps arranged in geometric progression for the following conditions: n_{min} = 100 r.p.m, n_{max} = 1800 r.p.m. and z = 9. If the gear box is driven by 5kW, 1440 r.p.m. electric motor: [12]
 - Draw the speed ray diagram.
 - ii) Draw the gearing diagram.
 - iii) Determine the number of teeth on gears.

Assume same module for all gears.

- Q5) a) Explain design of studs for cylinder head.
 - b) Determine the small and the big end bearings of the connecting rod for a diesel engine with the following data: [8]
 - i) Cylinder Bore = 80mm
 - ii) Maximum gas pressure = 3Mpa

(1/d) ratio for piston pin bearings = 2

(l/d) ratio for crank pin bearing = 1.2

Allowable bearing pressure for piston pin bearing = 10 Mpa

Allowable bearing pressure for crank pin bearing = 06 MPa.

OR

The following data is given for a connecting rod:

Engine speed = 1500 rpm

Length of connecting rod = 250 mm.

Length of stroke = 150 mm.

Density of material = 7800 kg/m³.

Thickness of web or flanges = 6 mm

Assume the cross-section of the connecting rod as shown in figure for which Area of cross section, calculate the whipping stress in the connecting rod.

A) = 11t²,
$$I_{xx} = \left(\frac{419}{12}\right)t^4$$
 and $y = \left(\frac{5t}{2}\right)$.

Q6) a)

Explain Johnson method of optimum design.

OR

Explain briefly following terms,

Functional parameters group. i)

Material parameters group. ii)

iii) Geometrical parameters group.

in the design of mechanical elements.

A shaft is to be used to transmit a torque of 1500 N-m. The required b) torsional stiffness of the shaft is 100N-m/degree, while the factor of safety based on yield strength in shear is 2.0. Using the maximum shear stress theory, design the shaft with the objective of minimizing the weight, out of the following materials.

Use following data for the materials

Material	Weight Density (w) N/m ³	Yield Strength (S _{y1}), MPa	Modulus of rigidity (G), N/mm ²
Chromium steel	77×10^{3}	420	84×10^{3}
Plain carbon steel	76.5×10^{3}	230	84 × 10 ³
Titanium Alloy	44×10^{3}	900	42×10^{3}
Magnesium Alloy	17.5×10^{3}	225	15×10^3

[8]

[8]

[8]

[8]

SL-325 Total No. of Pages : 2

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No.	

B.E. (Mechanical) (Part - I) (Semester - VII) Examination, May - 2017 EXPERIMENTAL MECHANICS (Elective - I) Sub. Code :67504

Day and Date : Thursday, 18 - 05 - 2017 Time : 2.00 p.m. to 5.00 p.m.

Total Marks: 100

Instructions : 1) All Questions are compulsory.

Figures to the right indicate full marks.

Draw neat diagram to supplement your answer wherever required.

Make suitable assumptions wherever necessary & state them clearly.

5) Use of non-programmable calculator is allowed.

- Q1) a) Explain advantages and scope of Experimental Mechanics in design.[6]
 b) With usual notations derive the stress optics law. What is its significance? [10]
- Q2) a) Why the compensation techniques are necessary in photoelasticity?
 Explain any one method of compensation.
 - b) What are Quarter wave plates? Why are they called so? Explain with sketches all the four configurations of circular polariscope indicating the relative orientation of axis of polarizer, analyzer and two quarter wave plates. [8]

OR

Explain Role of Polariscope in photoelasticity.

Q3) Write short notes (any three)

- a) Use of white light and monochromatic light in photoelasticity.
- b) Various configurations of polariscope.
- c) Experimental stress analysis methods.
- d) Calibration of photoelasticmaterial.

[18]

[8]

- Q4) a) Explain the principle of Brittle coating method of stress analysis. Sketch the crack patterns under various conditions of stress.
 [8]
 - b) Explain the procedure bonding of the gauge on metallic surfaces. What checks are usually made on gauge installations? [8]

OR

- c) Explain Moire Method with its advantages, limitations and applications.
 - [8]
- Q5) The following observations are made with rectangular rosette mounted on aluminum specimen. [16]

 $\epsilon_A = 285$ Microstrain ; $\epsilon_B = 65$ Microstrain ; $\epsilon_c = 102$ Microstrain.

Determine the principal strains. principal stress, principal strain directions and maximum shear stress. Assume E= 70 GPa and Poisson's Ratio = 0.32.

Q6) Write short notes (any three).

[18]

- a) Explain Two, Three and four element rosettes.
- b) Temperature Compensation.
- c) Transducer Applications of Strain Gauges.
- d) Commercial Strain Indicators.

SL-328 Total No. of Pages : 2

Seat No.

B.E. (Mechanical Engineering) (Semester - VII) Examination, May - 2017 TOTAL QUALITY MANAGEMENT (Elective - II) Sub. Code : 67833

Day and Date : Friday, 19 - 05 - 2017 Time : 2.00 p.m. to 5.00 p.m. Total Marks : 100

Instructions : 1) All questions are compulsory.

- Figures to the right indicate full marks.
- 3) Make suitable assumptions wherever necessary and state them clearly.
- 4) Use of statistical tables and scientific calculator is permitted.

Q1) Solve any Two.

- a) "Quality means satisfied customer". Elaborate with suitable examples.
- b) A good process does not produce a bad product. Why? [8]
- c) How Q.A. differs from Q.C. What are the roles and objectives of Q.A?[8]

Q2) Solve any Three.

- a) How Quality Plan is prepared? What all is included in Quality Plan? [6]
- b) APQP has five steps. Elaborate each briefly. [6]
- c) Describe a disciplined problem solving process, step by step. [6]
- d) What is process capability? On which factors does it depend? [6]

Q3) Solve any Two.

- a) On which factors product and system reliability depends? Why robust and reliability approach is considered important for Quality? [8]
- b) Taguchi's approach emphasizes upon-concept design, parameter design and tolerance design. How this leads to robust design so that product is of high quality and is defect free. [8]
- c) A computer system is composed of four identical terminals in series. If the required system reliability is 0.999, calculate reliability of each component. [8]

P.T.O.

Q4) Solve any Two.

- a) What benefits an organization reaps if it works on TQM principles? [8]
- b) Compare Deming's approach with Philip Crosby's approach. Where do they differ? [8]
- c) How Juran links Quality Planning with Quality Control and Quality Improvement? [8]

Q5) Solve any Three.

- a) Customer focus is the key parameter of Quality Management System. What steps an organization needs to take to ensure customer focus throughout organization? [6]
- b) How Quality Policy and Quality Objectives are linked? What purpose they serve? [6]
- c) 5S is not merely cleanliness, but it is cultural change. Explain. [6]
- d) TEI is most important for the success if TQM. Why? How to achieve this? [6]

Q6) Solve any Two.

34-20

- a) Service quality is an ever changing concept. Design measurement system for service quality. [8]
- b) ISO:9001:2008 is based on Process Approach. Draw and explain the salient features. [8]
- c) What are the criteria used to decide winner of Rajiv Gandhi National Quality Award? [8]

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SL - 1002 Total No. of Pages : 3

Seat		
No.		

B.E. (Mechanical) (Semester - VII) (Revised) Examination, May - 2017 FINITE ELEMENT ANALYSIS Sub. Code : 67503

Day and Date : Wednesday, 17 - 05 - 2017

Time : 02.00 p.m. to 05.00 p.m.

Instructions :

Total Marks : 100

1) Answer any three questions from each section.

- Figures to right indicate full marks.
- Assume if necessary suitable data and state them clearly.
- 4) Draw neat labelled sketch wherever necessary.
- 5) Use of non-programmable calculators is permissible.

SECTION - I

Q1) Analyse the axially loaded stepped bar shown in figure below. Use the finite element method (element and global matrix) to predict the nodal displacements u_2 , u_3 and u_4 at the nodes 2, 3 and 4, and the support reaction R at the fixed node 1 ($u_1 = 0$). The cross sectional areas are 50 mm², 20mm² and 10mm², the lengths of steps are 15mm each and the modulus of elasticity is 210GPa.[16]



Q2) a) Define bandwidth of a stiffness matrix. Explain with an example how node numbering affects the bandwidth and hence computer memory, computational efforts and time. [8]
SL - 1002

- b) What are higher order (quadratic, cubic, etc.) elements? Sketch their shape functions (interpolation polynomials). [8]
- Q3) a) Explain general steps of FEM using a simple 1-D element for thermal analysis of heat conduction through a composite wall.
 [8]
 - b) State different weighted residual methods used in FEA formulation. [8]
- Q4) Write short notes on: (any three):
 - a) Higher order elements
 - b) Isoparametric elements
 - c) Galerkin's Method
 - d) Mesh refinement and convergence
 - e) Axisymmetric elements

 $3 \text{ is } 6 \times \sqrt{2} \times 10^{-4} \text{ m}^2$.

SECTION - II

Q5) a) For the plane truss shown in figure below determine the unknown displacements, reaction forces, strains and stresses in the members of the truss. P = 1000kN (horizontal force at node 2), Modulus of elasticity E= 210 GPa, length of the two members (element 1 and 2) is 1 m each and cross-sectional area is 6×10⁻⁴ m². The cross-sectional area of element

P El#2 E1#1 El#3 450 X

[18]

[8]

SL - 1002

- b) Explain the importance of element shape and distortion in relation to quality of the finite element mesh. [8]
- Q6) a) Explain plane stress and plane strain conditions with example and stressstrain relationship matrix? [8]
 - b) Explain higher order 1D, 2D and 3D elements.
- Q7) a) Explain with suitable examples simplification of a model using symmetry.[8]
 - b) State the steps involved to model a mechanical element (e.g., a bracket), perform a static analysis and view results using commercial FEA software.[8]

Q8) Write short notes on: (any three):

a) Triangular element

b) FE model of 2-D steady state heat conduction

c) Features of a commercial FEA package

d) What are natural coordinates? What are their benefits?

e) Numerical integration

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-3-

[8]

[8]

SV - 864

Total No. of Pages : 3

Total Marks : 100

[8]

[8]

[8]

Seat No.

> B.E. (Mechanical) (Semester - VII) (Revised) Examination, April - 2018

> > FINITE ELEMENT ANALYSIS

Sub. Code : 67503

Day and Date : Thursday, 26 - 04 - 2018

Time : 02.30 p.m. to 05.30 p.m.

Instructions: 1) Draw neat labeled sketch wherever necessary.

- 2) Assume suitable data if necessary and state it clearly.
- 3) Figures to the right indicate full marks.
- Q1) a) Write a note on past, present and future of FEA.
 [8]
 - b) If a displacement field is described by

 $u = 10^{-4} (-x_{2}^{2} + 2y^{2} + 4xy); v = 10^{-4} (2x + 4y - y^{2}),$

Determine εx , εy , γ_{xy} at x = 1; y = 0

OR

) Explain Rayleigh Ritz method with the help of an example.

Q2) a) Define shape function. Explain properties of shape function. Also draw the variation of each shape function for a one dimensional linear element.

OR

Derive the element stiffness matrix and force vector of one dimensional element using potential energy approach. [8]

 b) For the bar shown below determine nodal displacements and stress in each material [8]



P.T.O.

- Q3) a) Write a short note on isoparametric element.
 - b) Find the shape function for the triangular element shown below and show that the sum of all shape function is one at any point within the element.



- Q4) a) A long cylinder of 100 mm internal diameter and 130mm external diameter is subjected to hot fluid at 200°C from inside and ambient conditions on outside. Draw the sketch showing actual problem and also model the problem for a sample length of 10mm using axisymmetic element with proper boundary conditions.
 - b) The stiffness matrices and force vectors of three truss elements shown in figure is as follows:



Element No.	Nodes	
	i	j-
1	1	3
2	1	2
3	3	2

Element stiffness matrix and force vector is,



Obtain the global stiffness matrix and global force vector. -2-

[10]

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[6]

[12]

SV - 864

[10]

- Q5) a) Derive the relation between B matrix and Jacobian. J matrix for a linear triangular element for a heat transfer problem.
 [6]
 - b) A bar of rectangular cross-section having thermal conductivity of 1.5 W/m °C is subjected to boundary conditions as shown in figure. [10]

$$\frac{180^{\circ}C}{h = 50 \text{ W/m}^{2} \text{ C}} = \frac{180^{\circ}C}{180^{\circ}C} + \frac{180^{\circ}C}{180^{\circ}C}$$

Mesh the domain with three triangular elements and obtain the conductivity matrix of each one.

Q6) a) Write short notes on any two

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- Free and mapped meshing
- ii) Aspect ratio and distortion
- iii) Results validation and data interpretation
- Explain in detail the steps to be carried out in commercial FEA software for a simple structure made up of two truss elements. [8]

SV-97 Total No. of Pages : 3

B.E. (Mechanical) (Part - IV) (Semester - VII) (Revised) Examination, April -2019 REFRIGERATION & AIR CONDITIONING Sub. Code : 67501

Day and Date : Friday, 26 - 04 - 2019 Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

Instructions: 1)

Seat No.

- 1) Attempt all questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Make suitable assumptions if necessary and state it clearly.
- Use of calculator, steam table Psychrometric table and chart is allowed.
- Q1) a) Explain reversed Carnot cycle with gas as a refrigerant and discuss its limitations. [10]

OR

Explain necessity of air craft refrigeration and explain any one air craft refrigeration system.

- b) A cold storage is to be maintained at -6°C while the surroundings are at 38°C. The heat leakage from the surroundings in to the cold storage is estimated to be 30kW. The actual COP of the refrigeration plant is one third of an ideal plant working between the same temperatures. Find the power required to drive the plant. [8]
- Q2) a) What do you understand by cryogenics? Sketch and explain Linde system.
 [8]

OR

Describe multistage refrigeration with flash gas removal and intercooling.

P.T.O.

- A 8 tones Freon-12 refrigeration plant has saturated suction temperature b) of - 15°C. The condensation takes place at 30°C. Assuming simple saturated vapor compression, find the following using P-h chart [8]
 - COP of the plant i)
 - ii) Mass flow rate of the refrigerant.
 - iii) Power required to run the compressor in kW.
- With neat sketch explain thermostatic expansion valve Q3) a)

[8]

500,08 [8]

OR

How you will suggest compressors for

- i) Domestic refrigerator
- ii) Ice plant
- iii) Package air-conditioners
- iv) Dairy plant
- b) Write notes on
 - i) Ice plant
 - ii) Cold storage

Q4) a)

What is fog air? Explain it with the help of psychrometric chart.

With a neat sketch explain adiabatic saturation temperature. ii) [8]

OR

What is effective temperature? Explain it with the help of comfort chart.

- An A/C plant is to be designed for small office room for winter conditions. b) Outdoor conditions=10°C DBT & 8°C WBT, Required indoor conditions =20°C DBT & 60% RH. Amount of free air circulation= 0.3m3/min/ person. Seating capacity of the office = 50. The required condition is achieved first by heating and then by adiabatic humidifying. Find the following
 - Heating capacity of the coil in kW and the surface temperature i) required if the bypass factor of the coil is 0.32. SUKSO
 - Capacity of the humidifier. ii)

[8]

Q5) a) Explain with the help of neat sketch RSHF, GSHF

OR

Explain with neat sketches summer and winter air conditioning systems.

- b) The following data refers to a high humidity chamber. Summer outside condition = 40°C DBT, 27°C WBT, Inside design condition = 25°C DBT, 50%RH,RSH = 58.15kW, RLH=14.55kW, 70m³/min fresh (ventilation) air is supplied to the shop, B.F.=0.15. Find [12]
 - i) The ventilation load
 - ii) Total load to be taken by the plant
 - iii) ESHF
 - iv) ADP

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- v) Dehumidified air quantity
- vi) Entering and leaving conditions at the apparatus
- Q6) a) Explain the following methods of duct design
 - i) Equal friction method
 - ii) Velocity reduction method

OR

Explain friction loss in ducts with the help of friction chart.

b) Explain with neat sketches single and dual duct systems.

SV-97 [6]

St. SCACIO [8]

[8]

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Total No. of Pages : 4

Seat No.

B.E. (Mechanical) (Semester - VII) (New) Examination, May - 2019 MECHANICAL SYSTEM DESIGN

Sub. Code : 67502

Day and Date : Thursday, 02 - 05 - 2019. Time : 02.30 p.m. to 5.30 p.m.

Total Marks : 100

Instructions :

- All questions are compulsory.
 Assume suitable data wherever
 -) Assume suitable data wherever necessary.
- 3) Use of Non-Programmable calculator is allowed.
- Figure to the right indicate full marks.
- Q1) a) Explain the various aesthetic considerations in the product design of motor cycle clearly indicating how the present design has evolved over the years. [8]
 - b) What is creativity? What is its significance in design process? Explain with examples.
 [8]

OR

Explain various displays and controls of a CNC lathe. Describe how they should be placed in ergonomic manner.

Q2) a) Explain in a step wise manner the procedure to determine the tangential and radial stresses in a compound cylinder subjected to internal pressure.

[8]

OR

Explain clearly with neat sketches the various types of end closures used in pressure vessels. Write their relative merits and demerits. Write the design equations for Torispherical end closure and hemispherical end closure.

- b) A cylindrical pressure vessel having inside diameter 1800 mm is subjected to an internal working pressure of 2.5N/mm² Both the shell as well as the end closures is made from IS 2041- 1962 having yield strength of 290N/ mm². Weld joint efficiency may be taken as 90% Factor of safety is 1.5 Corrosion allowance is 2 mm. Determine the thickness of the shell and the thickness of the head if the heads are. [10]
 - i) Semi elliptical
 - ii) hemispherical
 - iii) Torispherical with a crown radius of 1750 mm.

- Explain with neat sketches self-engineering, self-locking and uncontrolled (03) a) breaking (grabbing) conditions in external block brake with short shoe. [8]
 - A multiplate clutch has three discs on the driving shaft and two discs on b) the driven shaft. The outside diameter of the contact surface is 240 mm and inside diameter is 120 mm. Assuming uniform pressure and coefficient of friction $\mu = 0.3$, find the total spring load pressing the plates together to transmit 25 kW at 1575 rpm. If there are 6 springs each having a stiffness 13 kN/m and each of the contacting surfaces has worn away by 1.25 mm, find the maximum power that can be transmitted. Assume uniform wear. 8

OR

Refer to the simple band brake shown in figure 1 and calculate

- i) Band tension tight and loose sides,
- ii) Actuating force and
- ii) Torque capacity of the brake . Assume that a=250 mm, 1=750mm, θ =225°, R=250mm, width of the friction lining = 60 mm, maximum intensity of pressure = 0.25N/mm² and coefficient of friction μ = 0.4. [8]





Explain briefly compound ray diagram of a multi speed machine tool Q4) a) gear box. [6]

OR

What do you understand by maximum loss of economic cutting speed. Derive the expression for the same. SUN SA

- b) Three stages, 12 speed gear box is to be designed for spindle speeds varying between 60 to 2880rpm. the gear box is driven by 5 kw, 1440rpm motor. The second stage is 3 speed steps.
 - Draw structure/speed/ray diagram. Ð.
 - ii) Draw gearing diagram
 - iii) Determine no. of teeth on gears for the first stage only.

iv) Select pulley diameter for belt drive.

The standard pulley diameters are: 80, 90, 100, 112, 125, 140, 160, 180, 200, 224, 250, 280, 290, 300, 310, 355, 375, 400, 450, 500 mm. Assume same module for all gears. [12]

Discuses the criterions for the calculations of thickness of piston head.[6] (05) a) Determine the cross section of I-section fo connecting rod for a single b) cylinder I.C. Engine. [10]

Use the following data for engine :

Piston diameter = 100mm.

Length of connecting rod = 300mm, Stroke length = 125 mm, speed = 1500rpm.

Maximum explosion pressure = 3.5N/mm², Factor of safety = 7.

Yield stress in compression =330Mpa

Assume width of section as 4t and depth 5t, where t is the web thickness of I-section.

OR

following data refers to connecting rod of diesel engine :

Engine speed = 1800 rpm. Length of connecting rod = 350 mm, Mass of reciprocating parts= 2.5kg, Length of crank pin=76mm, obliguity ratio =5.

Diameter of crank pin=58mm, Thickness of bearing bush = 3 mm, Distance between bolt centers of bearing cap = 1.8 times Diameter of crank pin,

Permissible tensile stress for bolts = 60 N/mm², permissible bending stress for cap = 80 N/mm2. Determine :

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The nominal diameter of bolt. i)

The thickness of bearing cap for the big end. ii) SUK-59295

-3-

(26) a) Ex

Explain with the example what do you mean by adequate and optimum design. [6]

OR

Discuss various parameters involve in the optimum design of mechanical elements.

 b) Design a tensile bar of length of 200mm to carry a tensile load of 5kN for minimum cost out of following materials. [10]

Material	Mass Density (kg/m ³)	Material Cost (Rs/,N weight)	Yield Strength (Mpa)
Steel	7500	. 16	130
A1-Alloy Titanium	3000	32	50
Alloy Magnesium	4800	280	90
Alloy	2100	32	20 .0

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SV-99 Total No. of Pages : 3

B.E. (Mechanical) (Semester - VII) (Revised) Examination, May -2019 FINITE ELEMENT ANALYSIS Sub. Code : 67503

Day and Date : Saturday, 4 - 05 - 2019 Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

[8]

Instructions :

Seat

No.

- All questions are compulsory.
- 2) Assume suitable data if necessary and state it clearly.
- Figures to the right indicate full marks.

Q1) Attempt any two.

- a) Evolution of FEA & its importance in present industrial practices. [8]
- b) Explain the principle of minimum potential energy with an example. [8]
- c) Explain the different steps involved in FEA.
 [8]
- d) Discuss about Von-Mises stress.

Q2) a) For the spring system shown in fig-2a, K₁ = 300 N/mm, K₂ = 600 N/mm & K₃ = 300N mm force applied at node 3, P = 400N. Calculate.[10]

- i) Nodal displacement
- ii) Global stiffness matrix
- iii) Reaction forces
- iv) Force in spring2.

KI= 300N/mm K2=600N/mm K3= 300N/mm Fig.2a

P.T.O.

[4]

[4]

 b) What are the important properties of shape function. Show and explain the variations of shape function for quadratic element. [6]

OR

- c) Compare Analytical, Numerical & Experimental method used for solveing the engineering problems. [6]
- Q3) a) A four bar plane truss is shown in fig 3-a. cross section area for each member is 400 mm² & E = 200 GPa. Prepare the global matrix by applying boundary conditions & load.



Value of E for each member = 200 GPa.

Cross set. area for each member = 400 mm² [14]

b) Write a short note on isoparametric element.

OR

c) Nodes & Element numbering.

Q4) Solve any two:

a)	Axisymetric element and its application.	[8]
b)	Differnet types of elements used in FEA.	(1) [8]

c) What is the effect of size and number of elements on accuracy of the problem explain with suitable example. [8]

[6]

[6]

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Q5) a) A composite wall consists of three materials is shown in figure 5 - a. The outer temp is T₀ = 35°C. Convection heat transfer takes place on the inner surface of the wall with T_m = 500°C & h = 40 w/m²°C Determine temp. Distribution in the wall. [10]



A composite wall with three materials.

b) Discuss the types of problems solved by FEA.

OR

c) Discuss element shape & distortion.

Q6) Solve any three.

- a) Simplex and higher oder elements.
- b) Elimination & penalty method.
- c) Simplification through different symetry.
- d) Geometrical approximations used in FEA.
- e) Interpretation of results & Validation.
- f) Meshing techniques.

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SV-100 Total No. of Pages : 3

B.E. (Mechanical) (Part - IV) (Semester - VII) Examination, May -2019 EXPERIMENTAL MECHANICS (Elective - I) Sub. Code : 67504

Day and Date : Tuesday, 07 - 05 - 2019 Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

[8]

Instructions :

Seat

No.

- Attempt any Three questions from section I and any Three questions from section II.
 - Figures to the right indicate full marks.
 - 3) Draw neat diagrams to supplement your answers wherever required.
 - Make suitable assumptions wherever necessary and state them clearly.
- 5) Use of any type of calculator is allowed.

SECTION - I

Q1) a) Discuss the properties of an ideal material for

Strain sensitive element.

ii) Carrier

iii) Lead wires

iv) Bonding cement of an electrical resistance strain gauge What are the commonly used materials for these components?

- b) Write a short note on "semiconductor strain gauge" with neat sketch.[8]
- Q2) a) Explain the term "strain rosette". Explain with sketches the different types of strain rosettes. [4]
 - b) The following readings were taken on a rectangular rosette attached to an Aluminum specimen.

 $\varepsilon_{A} = 700$ micro strain tensile

 $\varepsilon_{\rm B}$ = 500 micro strain compressive

 $\varepsilon_c = 400$ micro strain tensile

Determine the principal strains, principal stresses and their angle of orientation.

Take for Aluminum E = 70 GPa and Poisson's ratio $\mu = 0.33$. [14] P.T.O.

- Q3) a) Explain the principle of moire fringe method of stress analysis. Explain with neat sketches the mechanism of fringe production. State the advantages and disadvantages of moire method. [8]
 - b) What is gauge factor? Explain its significance. Derive an expression for the gauge factor of an electrical resistance strain gauge.
 [8]
- Q4) a) Explain the term "bridge balancing". Why is it done? Explain various balancing methods stating the relative merits and demerits of each. [8]
 - b) What do you mean by transducer application of strain gauges? What are the advantages of using strain gauges for transducer applications? Explain with sketch use of strain gauge in measurement of force. [8]

SECTION - II

- Q5) a) Explain briefly the role played by a polariscope in photoelasicity. Describe the construction of a circular polariscope and explain the function of each component in it. Sketch all four configurations of a circular polariscope. [8]
 - b) What are the advantages of using the experimental methods of stress analysis over the analytical methods? List some experimental methods of stress analysis and state their relative merits and demerits. [8]
- Q6) a) Explain the following terms related to photoelasticity (Any four). [8]
 - i) White light & Monochromatic light
 - ii) Plane polarized light & Circularly polarized light
 - iii) Temporary and permanent double refraction
 - iv) Isoclinics
 - v) Isochromatics
 - b) With usual notation derive the stress optics law. What is its significance?[8]

[18]

5 Stress

- Q7) a) In a calibration experiment a rectangular beam made of photoelastic material was loaded under condition of uniform bending moment. When viewed through a circular polariscope dark field arrangement it was observed that the third order isochromatic fringe just appeared on the top edge of the beam. If the width of the beam was 28 mm, its thickness 6 mm and it was subjected to a uniform bending moment of 5000 N.mm, calculate the material fringe value of the beam material. [8]
 - Explain the principle of brittle coating method of stress analysis. Sketch the crack patterns under various conditions of stress. [8]
- Q8) Write short notes on (any Two).
 - a) Use of monochromatic and white light in photoelasticity.
 - b) Oblique incidence method.
 - c) Calibration of photoelastic materials.



Figure 1 Q. 7 a

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SV-101 Total No. of Pages : 2

Seat No.

B.E (Mechanical) (Part - IV) (Semester - VII) (Revised) Examination, May -2019 AUTOMOBILE ENGINEERING (Elective - I) Sub. Code : 67506

Day and Date : Tuesday, 07 - 05 - 2019 Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

Instructions :	1)	All questions are compulsory.
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- Draw neat sketches wherever necessary.
- Figures to the right indicate full marks.
- Make suitable assumptions if necessary.
- 5) Use of non-programmable calculator is allowed.

a)	Explain with neat sketch front engine rear wheel drive layout and wri advantages and disadvantages.	ite its
b)	Explain in detail the automobile body construction and write different materials used for automobiles.	erent [8]
a)	Write various requirements of an automobile clutch. Explain with sketch multiplate clutch.	neat [9]
b)	Discuss with neat sketch construction and working of differential. OR	[8]
	Explain with sketch operation of synchromesh unit.	[8]
a)	What are advantages of power steering. Explain with sketch integral po	ower
	steering system.	[9]
	a) b) a) b) a)	 a) Explain with neat sketch front engine rear wheel drive layout and write advantages and disadvantages. b) Explain in detail the automobile body construction and write differentials used for automobiles. a) Write various requirements of an automobile clutch. Explain with sketch multiplate clutch. b) Discuss with neat sketch construction and working of differential. OR Explain with sketch operation of synchromesh unit. a) What are advantages of power steering. Explain with sketch integral postering system.

 b) Write requirements of automobile suspension system. Explain the working principle of hydraulic shock absorber. [8]

OR

Which are the different types of independent suspension system? Explain any one of them with neat sketch. [8]

P.T.O.

- Q4) a) Compare Disc type and Drum type brakes on the basis of performance, efficiency, life and heat dissipation.
 [8]
 - Explain with neat sketch working of Tandem Master Cylinder. Also explain Split braking system for medium duty vehicles. [8]

OR

Compare with neat sketch Tubed tyre and Tubeless tyre. List desirable tyre properties. [8]

- Q5) a) Explain the construction and working of lead acid battery. What are the different tests carried out to check the performance of battery? [8]
 - b) Draw refrigeration system for car air conditioning and explain working.[8]
 OR

Draw a layout sketch of electronic controlled management system used in vehicles. List the sensors used. [8]

- Q6) a) The coefficient of rolling resistance for a truck weighing 62293.5 Newton is 0.018 and coefficient of air resistance is 0.0276 in the formula R = K.W + Ka.A.V². The transmission efficiency in top gear of 6.2:1 is 90% and that in the IInd gear of 15:1 is 80%. The frontal area is 5.574 m². If the truck has to have a maximum speed of 88 Km/hr in top gear, Calculate:
 - the engine b.p. required.
 - the engine speed if the driving wheels have an effective diameter of 0.8125 m.
 - iii) the maximum grade the truck can negotiate at the above engine speed in IInd gear.
 - iv) the maximum draw bar pull available on the level road at the above engine speed in IInd gear.

b) Explain the following terms:

- Traction and Tractive effort
- ii) Gradiability
- iii) Draw bar pull

OR

-2-

List and explain the various resistances to vehicle motion.

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[6]

[12]

Seat No.

B.E. (Mechanical Engineering) (Semester - VII) Examination, May -2019 TOTAL QUALITY MANAGEMENT (Elective - II) Sub. Code : 67833

Day and Date : Thursday, 09 - 05 - 2019 Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

 All questions are compuls 	on	١.
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- Figures to the right indicate full marks.
- Make suitable assumptions wherever necessary and state them clearly.
- Use of statistical tables and scientific calculator is permitted.

Q1) Solve any two.

Instructions

a)	Explain process approach. How it forms basis of IS	Q Quality
	Management System?	[8]
b)	Design customer feedback form for a Restaurant.	[8]
c)	Defects result in customer dissatisfaction. How we can plan free products?	for defect [8]
	22	

Q2) Solve any three.

a)	What are the stages of quality plan	nning while developing new product?
		[6]

b) Suggest parameters and their weightage for vendor rating. [6]

- Measurement of process capability leads to a no. of conclusions. Elaborate few.
- DPMO in Six Sigma represents opportunities for improvements. How?[6]

Q3) Solve any two.

- a) Explain FEMA technique in details with concept and its applications.[8]
- b) Orthogonal arrays are applied in which technique? What inferences one can draw from them? [8]

P.T.O.

c) What is the effect of component reliability in parallel configuration? How system reliability will very for combinations of components' reliability? Consider a system Consisting of three subsystems arranged reliability-wise in parallel. Subsystem 1 has a reliability of 91.5%, Subsystem 2 has a reliability of 97.7% and Subsystem 3 has a reliability of 94.6% for a mission of 100 hours. What is the overall reliability of the system for a 100-hour mission?

Q4) Solve any two.

Deming devised a cycle for continual improvement. Highlight it's working.

b) Juran came up with trilogy leading to effective Quality. What are the salient features of this trilogy? [8]

c) How to achieve manufacturing excellence using Schonberger's action agenda? [8]

Q5) Solve any three.

- a) What is the basis of customer perception about product / service quality?
 [6]
- b) Retention of existing customers is easier than getting new customers. Comment.
 [6]
- Design one day training program for "TQM Awareness" for top management. Decide course contents, medium of instructions and methodology.
- d) What is the difference between continuous and continual improvements? Explain with suitable examples. [6]

Q6) Solve any two.

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- a) What problems are encountered while defining service quality? What are its common attributes? [8]
- b) Discuss eight quality management principles on which ISO: 9001:2008 is based.
 [8]

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c) Discuss the benefits of ISO/TS standard for an organization. [8]

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SV-104 Total No. of Pages : 2

Seat No.

B.E. (Mechanical) (Part - I) (Semester - VII) (Revised) Examination, May -2019 INDUSTRIAL PRODUCT DESIGN (Elective - II) Sub. Code : 67834

Day and Date : Thursday, 09 - 05 - 2019 Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

Instructions: 1) All questions are compulsory	ry.
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- 2) Figures to the right indicate full marks.
- 3) Draw neat sketches wherever necessary.

Q1) a)	Product design and development is an interdisciplinary activity - Explain	i,
	[8	1
b)	Explain the characteristics of successful product development. [8	1
	OR OR	1
b)	Explain the challenges faced in product design and development. [8]
Q2) a)	Explain the following with respect to concept generation. [8	1
	i) Classification tree	
	ii) Combination tree	
b)	Explain the five step process for setting final specifications in produc design.	t
	OR	ł
b)	Explain the different ways to communicate the concept in concept testing [8]	
Q3) a)	What is product architecture? Explain modular and integral architecture	
b)	Explain the implications of product architecture on product change and	i
	product variety. [10]	ľ
	OR	
b)	Draw and explain the functional elements of a ball point pen. [10]	Ĺ

P.T.O.

-			SV-104
Q4)	a)	Explain the Design for Manufacturing method (DFM).	[8]
	b)	Explain the concept of concurrent engineering.	[8]
		OR	3
	b)	Explain the different types of prototypes.	[8]
Q5)	a)	Explain aesthetics and its importance in product design.	[8]
	b)	Explain the use of anthropometric data in the design of a wor	kstation.[10]
		OR	
	b)	Explain the elements of a man - machine system.	[10]
Q6)	a)	Explain the different types of personal protective equipn safety devices.	ent used as
1	b)	Explain the different types of health hazards which affect indu	Istrial safety. [8]
		OR	52
1	b)	Explain the safety precautions to be followed in foundry.	[8]

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SV-93 Total No. of Pages : 3

B.E. (Mechanical) (Part-IV) (Semester - VII) (Revised) (New) Examination, April - 2018 REFRIGERATION AND AIR CONDITIONING Sub. Code : 67501

Day and Date : Tuesday, 24 - 4 - 2018 Time : 2.30 p.m. to 5.30 p.m.

Total Marks: 100

Instructions :

Seat

No.

- 1) Attempt all questions.
- Figures to the right indicate full marks.
- Use same answer book.
- Neat diagram must be drawn.
- Use of steam table, refrigerant property table/chart & psychrometric charts are allowed.
- 6) Make suitable assumptions if required.
- Q1) Attempt any two:
 - a) i) How do you interprete second law of Thermodynamics with Refrigeration? [4]
 - Discuss the limitations of Reversed Carnot cycle with gas a refrigerant. [4]
 - b) Necessity of cooling the Aeroplane. Discuss the internal and external heat sources contributing heat in Aeroplane compartment. [8]
 - c) The Carnot refrigerator requires 1.1 kw per tonne of refrigeration to maintain a region at a low temperature of -30°C. Determine; [8]
 - i) C.O.P.
 - ii) Higher temperature of the cycle.
 - iii) The heat rejected in kJ per ton of refrigeration.

Also calculate heat delivered and C.O.P when this device is used as heat pump.

P.T.O.

[8]

Q2) Attempt any two:

- a) Describe with help of a block diagram and P-h polt a vapour compression refrigeration system using a heat exchanger for both superheating and subcooling of a refrigerator. [9]
- b) What do you mean by Cryogenic Engineering? Explain applications of cryogenics in various fields.
 [9]
- c) A vapour compression refrigeration plant works between pressure limits of 5.3 bar and 2.1 bar. The vapour is super heated by 5°C before entering the compress the temperature at the end of isentropic compression is 37°C. Assume C_p of vapour refrigerant as 0.63 kJ/kg-k. Determine C.O.P. of the plant condition of refrigerant at end of condentation is saturated liquid properties of Refrigerant as follows: [9]

Pressure (Bars)	Temperature (ts°C)	Enthalpy of fluid (h & kJ/kg)	Latent heat h & g. kJ/kg
5.3	15.5	56.15	144.9
2.1	-14.0	25.12	158.7

Q3) Attempt any two:

- a) Discuss why CFC refrigerants needs to be phased out. Explain the ozone depletion and global warming issues. [8]
- Describe properties of a good refrigerants.
- c) Explain the working of evaporative type condenser with a neat sketch.[8]

Q4) Attempt any two:

- a) Define relative humidity (φ), degree of saturation (μ), dew point temperature and adiabatic saturation temperature. Derive the relation between φ and μ.
- b) The moist air is at 30°C,. The dew point, temperature is 15°C. The total pressure is 1 bar, Use steam table and calculate φ and μ. [8]
- c) With help of psychrometric chart explain adiabatic mixing of moist air with infected water spray. Write only the governing equations for enthalpy

and specific humidity. Draw the condition line with the help of $\left(\frac{\Delta h}{\Delta w}\right)$ protector given on the chart. [8]

Q5) Attempt any two:

- Explain the factors affecting By-Pass factor. Apparatus due point and coil rating with the help of psychrometric chart. Also write only the equations for air quantity over a coil using ESHF, ADP and B. F. [9]
- b) Explain only the body regulatory process against heat and cold. Draw neat sketch of comfort chart giving the numerical values. [9]
- c) Air conditioning system is used for a Bank with following details: [9]

No. of persons = 100.

Ventilation requirement 0.0047 m2/sec per person.

Out door design condition, $DBT = 37^{\circ}C$, $WBT = 27^{\circ}C$.

Indoor condition desired R. $H = 60\% \& DBT = 22^{\circ}C$

Room sensible heat load = 4,00,000 kJ/h.

Room latent heat load = 2,00,000 kJ/h.

By-pass factor = 0.15. Calculate:

Grand total heat, ESHF, A.D.P. amd quantity of detrumidified air supplied to the Bank.

Q6) Attempt any two:

a)	Explain sources of heat load for air conditioning system. Write essential equations.	only [8]
b)	Explain duct sizing methods by using suitable charts.	[8]
c)	Explain room air distribution requirements. Write a note on type	s of

outlets used for supply and distribution. [8]



SUN-22560

SV-94 Total No. of Pages : 4

Seat No.

B.E. (Mechanical) (Semester - VII) (New) Examination, April - 2018 MECHANICAL SYSTEM DESIGN Sub. Code : 67502

Day and Date : Wednesday, 25 - 04 - 2018 Time : 2.30 p.m. to 5.30 p.m. Total Marks : 100

Instructions: 1) All ques

-) All questions are compulsory.
- Assume suitable data wherever necessary and state it clearly.
- Draw neat labeled sketches wherever necessary.
- Q1) a) With suitable example, explain effect of symmetry and balance, surface finish, colour and harmony in aesthetic design. [8]
 - Explain importance of ergonomic considerations in the design of displays and controls in the dashboard of a car. [8]

OR

With suitable example explain the creativity concept in the product design.[8]

Q2) a) Explain with neat sketch various types of stresses acting in thin pressure vessels subjected to internal pressure. [6]

OR

Explain the different types of end closures used in pressure vessels as per IS 2825 - 1969. [6]

- b) A cylindrical pressure vessel shell of inside diameter 1500 mm is subjected to an internal pressure of 2 MPa. The shell as well as heads are made of low alloy steel with an ultimate tensile strength of 450 N/mm². The double welded butt joints which are spot radiographed ($\eta = 0.85$), are used to fabricate the vessel. The corrosion allowance is 3 mm. Determine the thickness of the cylindrical shell and the thickness of the head if the heads are: [12]
 - i) Flat Head;
 - ii) Plain Formed;

iii) Hemispherical;

iv) Toro spherical with crown radius of 1125 mm;

P.T.O.

- Q3) a) What is braking torque? Discuss various energy equations used in the design of Brakes.
 [8]
 - b) A multi-disk plate clutch consists of five steel plates and four bronze plates. The inner and outer diameters of the friction disks are 75 and 150 mm respectively. The coefficient of friction is 0.1 and the intensity of pressure on friction lining is limited to 0.3 N/mm². Assuming uniform wear theory, calculate: [8]
 - Required force to engage the clutch and
 - ii) Power transmitting capacity at 750 rpm.

OR

A four wheeled automobile car has a total mass of 1000 kg. The moment of inertia of each wheel about a transverse axis through its center of gravity is 0.5 kg-m². The rolling radius of the wheel is 0.35 m. The rotating and reciprocating parts of the engine and the transmission system are equivalent to a moment of inertia of 2.5 kg-m², which rotates at five times the road - wheel speed. The car is travelling at a speed of 100 km/h on a plane road. When the brakes are applied the car decelerates at 0.5g. There are brakes on all four wheels. Calculate: [8]

- The energy absorbed by each brake.
- ii) The torque capacity of each brake.
- Q4) a) Explain the optimization of structural diagram in the design of a multi speed machine tool gear box. [6]

OR

Explain the advantages of geometrical progression for selecting the speed steps of a multi speed machine tool gear box. [6]

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- b) A three-stage, twelve speed gear box is to be designed for multi spindle speeds varying between 60 r.p.m. and 2880 r.p.m. The second stage consists three speed steps, if the gear box is driven by 5 kW, 1440 r.p.m. electric motor. Assume same module for all gears. [12]
 - Draw the speed ray diagram.
 - ii) Draw the gearing diagram.
 - iii) Determine the number of teeth on gears.

- Q5) a) Explain step by step procedure for finding out the dimensions of the I-sections of the connecting rod.
 [8]
 - b) Determine the small and the big end bearings of the connecting rod for a diesel engine with the following data; [8]
 - i) Cylinder Bore = 80 mm
 - ii) Maximum gas pressure = 3 MPa

(1/d) ratio for piston pin bearings = 2

(l/d) ratio for crank pin bearing = 1.2

Allowable bearing pressure for piston pin bearing = 10 MPa

Allowable bearing pressure for crank pin bearing = 06 MPa

OR

The following data is given for a connecting rod:

Engine speed = 1500 rpm.

Length of connecting rod = 250 mm.

Length of stroke = 150 mm.

Density of material = 7800 kg/m3

Thickness of web or flanges = 6 mm

Assume the cross-section of the connecting rod as shown in figure for which Area of cross section. Calculate the whipping stress in the connecting rod.



(A) = 11t², I_x =
$$\left(\frac{419}{12}\right)t^{z}$$
 and $y = \left(\frac{5t}{2}\right)$.

X-AR

[8]

Q6) a) Explain Lagrange's Multiplier method for optimum design.

SV-94 [8]

OR

Explain the following terms in Johnson method of optimization. [8]

- i) Primary Design Equation (PDE)
- ii) Subsidiary Design Equation (SDE)
- iii) Limit Equation (LE)
- b) A shaft is to be used to transmit a torque of 1500 N-m. The required torsional stiffness of the shaft is 100 N-m/degree, while the factor of safety based on yield strength in shear is 2.0. Using the maximum shear stress theory, design the shaft with the objective of minimizing the weight, out of the following materials: [8]

Material	Weight Density (w) N/m ³	Yield Strength (S _{yt}) MPa	Modulus of rigidity (G) N/mm ²
Chromium steel	77×103	420	84×10 ³
Plain carbon steel	76.5×10 ³	230	84×10 ³
Titanium Alloy	44×10 ³	900	42×103
Magnesium Alloy	17.5×10 ³	225	15×103

Use following data for the materials.

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SV-96 Total No. of Pages : 3

B.E. (Mechanical) (Part - IV) (Semester - VII) Examination, April -2018 AUTOMOBILE ENGINEERING (Elective - I) Sub. Code : 67506

Day and Date :Friday, 27 - 04 - 2018 Time : 2.30 p.m to 5.30 p.m.

Seat

No.

Total Marks : 100

621

[8]

[8]

[8]

Instructions : 1) All questions are compulsory.

- 2) Draw neat sketch wherever necessary.
- Figures to the right indicate full marks.
- Make suitable assumptions if necessary.
- 5) Use of non- programmable calculator is allowed.
- Q1) a) Explain in details the automobile body construction, write different materials used for automobile body.
 [9]
 - b) Explain with neat sketch front engine front wheel drive. [8]
- Q2) a) What are the good requirements of the clutch?

OR

Explain with neat sketch the constructional details of single plate clutch.

- b) What is a need of gear box in automobile? Explain the final drive gears.
- Q3) a) What do you understand from
 - i) Caster
 - ii) Camber
 - iii) King pin inclination
 - iv) Scrub radius.

SUK-24SV P.T.O.

[4]

504-245

b) Which are the different types of springs used in the suspension system? 4518[9] Explain any one of them with neat sketch.

OR

Explain interconnected and self-leveling suspension system

- Explain with neat sketch Anti lock braking system used in modern cars. Q4) a) List benefits of ABS over conventional brakes. [8]
 - Draw a layout sketch of hydraulic braking system used in 4 wheeler b) vehicle? Explain working and how differential braking is achieved with this system? [9]

OR

List types of power and power assisted brakes used in automobiles? Explain air brake system with neat sketch?

- Draw a neat circut diagram of automobile starting, battery charging and Q5) a) ignition circuit and explain working of all. [9]
 - Draw a layout sketch of automobile air conditioning system showing all b) necessary components and explain working? [8]

OR

Explain with neat sketch Electronic Controlled Management (ECM) system used in automobile? List benefits?

- Define and explain how to estimate. Q6) a)
 - Air Resistance. i)
 - Gradient Resistance. ii)
 - iii) Rolling Resistance.
 - Tractive effort. iv)

OR

-2-

314-245

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- Explain what is relation between engine speed and road wheel speed? How to select gear box and final drive ratio?
- b) A motor vehicle weights 7975.5N and engine develops 14.7 kW at 2500 rpm. At this engine speed road speed of the car on the top gear is 64.37 km/hr. Bottom gear reduction is 3.5:1 and efficiency of transmission is 88% on top and 80% is bottom gear. The diameter of tyre is 0.762 m and the projected frontal area is 1.116 m². The coefficient of air resistance is 0.0314 N-hr²/km²-m² and road resistance is 0.023.W. Estimate. [12]
 - i) Speed of the car in bottom gear.

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SUK-24518

- ii) Tractive effort available at wheels in top and bottom gear.
- iii) Gradicut vehicle can climbin bottom gear.
- iv) Tractive effort required to start car in level and to attain speed of 48.28 km/hr in 10 seconds.

SV-98 Total No. of Pages : 2

B.E. (Mechanical Engg.) (Semester - VII) Examination, April - 2018 TOTAL QUALITY MANAGEMENT (Elective - II) Sub. Code: 67833

Day and Date : Saturday, 28 - 04 - 2018

Total Marks : 100

Time : 2.30 p.m. to 5.30 p.m.

Seat No.

Instructions : 1) All questions are compulsory.

2) Figures to the Right indicate full marks.

3) Make suitable assumptions wherever necessary and state them clearly.

4) Use of statistical tables and scientific calculator is permitted.

Q1) Solve any two

- a) Cost of quality affects both productivity and profit of an organization. Elaborate, [8]
- b) How process approach leads to QA and Quality Management? [8]
- c) Devise Internal Customer Satisfaction survey format. [8]

Q2) Solve any three :

- a) Why product quality planning is necessary these days? What are its benefits? [6]
- b) Highlight specifications for quality dimensions. [6]
- c) A capable process can achieve zero defect situation. Do you agree? [6]
- d) Why six sigma attempts are not successful? How to overcome such failures? [6]

Q3) Solve any two :

- a) How system design differs from parameter design and tolerance design?
 - [8]
- b) Which system is reliable parallel, series or combined? Why? [8]
- c) A system has three parallel components, X, Y & Z with reliabilities 0.85, 0.99, 0.87? How much system reliability will change if component Y is out of order? [8]

P.T.O.

[6]

[8]

5014-4088

Q4) Solve any two :

- a) How continual improvement can be achieved and sustained in an organization? [8]
- b) Assess Juran's triology in the context of TQM success. [8]
- c) Without Total Employee Involvement TQM cannot succeed. How to achieve it? [8]

Q5) Solve any three :

- a) Discuss challenges posed by customers, competition and technology before business. [6]
- b) What is easy Quality Policy Deployment or Quality Function Deployment? [6]
- c) TQM failure is generally attributed to lack of commitment and accountability of leadership. Comment. [6]
- d) How Poka Yoke technique leads to mistake proofing?

Q6) Solve any two :

SUK-A088

a) Elaborate SERVQUAL model and its applications.

 b) Which additional techniques are mandatory in ISO/TS 16949 Standard? Explain any one. [8]

 c) How TQM leads to Quality Award? Describe CII-EXIM National Quality Award.
 [8]
at o. B.E. (Mechanical) (Part - IV) (Revised) (Semester - VII) Examination, April - 2018 INDUSTRIAL PRODUCT DESIGN (Elective - II) Sub. Code: 67834

Day and Date : Saturday, 28 - 04 - 2018 Total Marks: 100 Time : 02.30 p.m. to 5.30 p.m. Instructions : 1) All questions are compulsory. 2) Figures to the Right indicate full marks. 3) Draw neat sketches wherever necessary. Explain the challenges of product development. Q1) a) [8] Explain the concept of Market research and market survey. b) [8] OR Explain quality aspect of product design. b) [8] Q2) a) Explain the Steps in concept development process. [8] Explain the process of product planning. b) [8] OR b) Explain the process of concept selection. [8] Explain the types of product architecture with examples. Q3) a) [8] b) Explain the use of computerized data management process. [10] OR Explain the functional elements of wrist watch with a neat diagram. [10] b) P.T.O.

Seat

No.

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Q4) a)	Explain the types of prototyping in product design.	[8]	
b)	What are the principles in Design for Manufacturing and Ass (DFMA), OR	embly [8]	
b)	Explain the concept of value engineering.	[8]	
Q5) a)	Explain the application of anthropometric data in ergonomic desig	m. [8]	
b)	Explain the following with respect to controls :	[10]	
	i) Design of foot control levers.	11	
	ii) Design of machine displays.		
	OR		
b)	Explain the Man-Machine relationship system.	[10]	
Q6) a)	Explain an approach to industrial design.		
b)	Explain the safety precautions to be followed in cement industry. OR	[8]	
b)	Explain the features of ISO 14000 environmental management system	m. [8]	
	++++		

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501-80530

JH-80530

B.E. (Mechanical) (Part - I) (Semester - VII) Examination, May -2015 TOTAL QUALITY MANAGEMENT (New Course)

Sub. Code: 47986

Day and Date : Tuesday, 26 - 05 - 2015 Time : 10.00 a.m. to 01.00 p.m.

Seat No.

Total Marks: 100

Instructions: 1) Answer any three questions from each section.

2) Figures to the right indicate full marks.

3) Make suitable assumptions wherever necessary and state them clearly.

4) Use of statistical tables and scientific calculator is permitted.

SECTION-1

01) a)	Briefly explain internal failure costs providing examples appropriate to a		
~	manufacturing environment.		
b)	How does technical quality differ from functional quality.	[8]	

Q2) a) Ten samples were examined in order to launch a quality control program. The numbers of nonconformities observed per sample are shown below. [10]

Draw the control chart. Is the process under control?

Sample number	No.of Errors	Sample number	No.of Errors
S1	1	\$6	3
S2	4	S7	5
S3	4	S8	10
S4	1	S9	7
S5	6	S10	3

P.T.O.

[4]

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- b) Discuss the procedure for rating of vendors for manufacturing organization. [6]
- Q3) a) What is process capability? Explain two widely used process capability indices.
 [9]
- b) With suitable examples explain three sigma quality if applied to process.[7]
- (04) a) Explain the concept of loss function in Taguchi's quality engineering.[6]
 - b) What is the raliability of the system below where the reliabilities of the components A, B, C and D are 0. 975, 0. 985, 0.988 and 0.993 respectively?



c) Describe any two types of reliability tests.

SECTION - II

Q5)	a)	Explain the benefits derived from TQM with examples.	8]
	b)	Juran Says. "quality is not free" While Crosby says, "quality is free Express your opinion on this issue.	e" 8]
Q6)	a)	Explain Kano's model of customer satisfaction.	8]
	b)	Describe in detail process of building of quality culture in an organizatio	n. 8]

- Q7) a) State the benefits of implementing ISO 9001: 2008 quality management systems requirements.
 [8]
 - b) What are the essential requirements for improving service quality across service industry? [8]

Q8) Write short notes on any three:

- a) Organizations structure of QC.
- b) Pillars of Poka-yoke.
- c) QFD's house of quality.
- d) Benefits of FMEA.
- e) Organization structure for TQM.

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[18]

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