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T.E. (Mechanical S/W)

Examination – May 2013

Production Management

(2008 Pattern)

Total No. of Questions : 10 **[Total No. of Printed Pages :2]**

[Time: 3 Hours] **[Max. Marks: 100]**

Section I

Q1. A) What are functions and types of management? [8]

B) Explain different types organization in short. [8]

OR

Q2. A) What are different types of group dynamics? Explain two types in short. [8]

B) Explain private and public trusts in detail. [8]

Q3. A) What is industrial engineering? What are its functions and applications? [8]

B) What is production planning and control? Explain its functions. [8]

OR

Q4. A) Distinguish between process and product layout. [8]

B) Explain principles of material handling. [8]

Q5. Write a short notes on (any three). [18]

1. Taylors functional organization
2. Pillars of TPM.
3. SIMO chart
4. Time study.
5. PMTS and MOST.

Section II

Q6. A) What is importance of control chart? Explain control chart for variables.[8]

B) Explain OC Curve. Where and how it is used? [8]

OR

Q7. A) Brief about i) Quality function deployment. ii) TPM [8]

B) Explain in short i) PDCA ii) PDSA cycle [8]

Q8. A) What is Design of Experiments? Explain how it is applied. [8]

B) What is ISO, QC and CNN standards. [8]

OR

Q9. A) Explain i) 7QC Tools ii) Quality circle [8]

B) Explain i) Six Sigma. Ii) Poka yoke [8]

Q10. Write a short notes on (any three). [18]

1. Concurrent Engineering
2. House of Quality
3. FMEA and FTA
4. Hypothesis Testing
5. Quality Circle.

[Total No. of Questions: 12] **[Total No. of Printed Pages: 3]**

UNIVERSITY OF PUNE
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T. E. (Mech-SW) Examination-2013
Tribology (2008 Course)

[Time: *3* **Hours]** **[Max. Marks: 100]**

Instructions:

1 *Answers to the two sections should be written in separate answer-books.*
2 *Black figures to the right indicate full marks.*
3 *Neat diagrams must be drawn wherever necessary.*
4 *Assume suitable data, if necessary.*

SECTION–I

UNIT-I

Q.1 (A) Write short notes on following; [6]
1. Anti-friction additives 2. Anti-wear additives
3. Anti-scuff additives.

(B) A circular plate of 600 mm diameter is placed over a plane stationary surface. The two are separated by oil-film of thickness 0.3 mm. The viscosity of oil is 70cp. Determine the force required to push the plate at a speed of 3.2 m/s. [6]

(C) What is the relation between Absolute Viscosity and Kinematic Viscosity? Write S.I. Units of both? [4]

OR

Q.2 (A) State the operating conditions where grease is preferred over mineral oils as a lubricant. List different types of greases along with their applications. [4]

(B) Compare sliding and rolling contact bearing on the basis of: [8]
i) Load carrying capacity (ii) Space requirement
(iii) Suitability to shock loads (iv) Accessories required
(v)Frictional power loss (vi) Quietness of operation
(vii) Maintaince cost (viii) Overall cost

(C) Determine the viscosity of the lubricant in centi-poise, having viscosity 160 SUS & specific gravity 0.86? [4]

UNIT-II

Q.3 (A) What are the factors affecting wear. [4]

(B) Write short notes on: [12]
(i) Abrasive wear (ii) Surface fatigue wear
(iii) Stick-slip phenomenon in friction

OR

Q.4 (A) Explain adhesive wear and deduces the expression. [8]
$Q=k(W/3\ p_0)$
Where, Q=Total wear volume per unit distance of sliding, W = Total normal load.

Po=Yield pressure; and k=Probability of an asperity contact producing a wear particle.

(B) Explain the following terms. [4]
(i) Real area of contact (ii) Apparent area of contact.

(C) Explain causes of friction. [4]

UNIT-III

Q.5 (A) The following data is given for a 360 hydrodynamic bearing: [12]
Radial load= 3.2 KN, Journal diameter=50 mm, Bearing length =50mm, journal speed =1490 r.p.m , Radical clearance =50 microns, Viscosity of lubricant =25 cp, Density of lubricant =860 kg /m ^{3}, Specific heat of lubricant=1.76 KJ/kg° C, Assuming that total heat generated in the bearing is carried by total oil flow in bearing. Find
(i) The minimum oil film thickness, (ii) The coefficient of friction, (ii) The power lost in friction, (iv) Total flow rate of lubricant in 1/min, (v) the side leakage, (vi) The temperature rise.
Use following data

I/d	Є	Ho/c	S	(r/c)f	(Q/rcnsl)	Os/Q	p/pmax
1	0	1.0	∞	∞	π	0	--
	0.1	0.9	1.33	26.4	3.37	0.150	0.540
	0.2	0.8	0.631	12.8	3.59	0.280	0.529
	0.4	0.6	0.264	5.79	3.99	0.497	0.484
	0.6	0.4	0.121	3.22	4.33	0.680	0.415
	0.8	0.2	0.0446	1.70	4.62	0.842	0.313
	0.9	0.1	0.0188	1.05	4.74	0.919	0.247
	0.97	0.03	0.00474	0.514	4.82	0.973	0.152
	1.0	0	0	0	0	1.0	--

(B) With neat sketches, explain the mechanism of pressure development in hydrodynamic bearings. [6]

OR

Q.6 (A) Starting with 2D Reynold's equation show that for infinitely short journal bearing with usual notations ,the pressure is given by [12]

$$\mathbf{P} = \frac{3\mu\omega \sin \Phi}{c^2(1+ \epsilon\, Cos\ \Phi)^3}\left[\frac{l^2}{4} - Z^2\right]$$

Hence show that maximum pressure is obtained at Φ_m such that

$$\text{Cos } \Phi_m = \frac{1 \pm \sqrt{1+24\,\epsilon^2}}{4\epsilon}$$

(B) Discuss different regimes of lubrication with help of 'stribeck curve'. [6]

SECTION-II

UNIT-IV

Q.7 (A) Following data is given for a hydrostatic thrust bearing:-Thrust load =500 KN, shaft speed=720rpm, shaft diameter=500mm, recess diameter=300mm, film thickness =0.5mm, viscosity of lubricant =29.3cP [14]

Calculate 1) supply pressure 2) Flow requirement in 1/min
3) Power loss in pumping 4) Power loss in friction.
5) Optimum film thickness.
Show the variation of energy losses graphically.

(B) Explain in brief the parameters of bearing design. [4]

OR

Q.8 (A) Following data is given for a hydrostatic thrust bearing:- [14]
Shaft speed=720rpm, shaft diameter=500mm, recess diameter=250mm.viscosity of lubricant=25cP, Supply pressure=5 MPa, Minimum oil film thickness=150 micron, Specific gravity of lubricant=0.86
Calculate
1) Load carrying capacity 2) Flow requirement in 1pm
3) Power loss pumping 4) Power loss in friction
5) Temperature rise in oil
Assume Cp=1.75 KJ/Kg ^{0} C. Also assume that total power loss is converted into frictional heat.

(B) With neat sketch, explain the principle of operation of hydrostatic bearing. [4]

Q.9 (A) Two parallel plates 50mm long and of infinite width are separated by an oil film of 28 μ m thick having viscosity of 0.72 Ns/m ^{2}. If load per unit width of 16000 N/m is applied to the plates, find the time required to reduce the film thickness to 2.8 μ m and the maximum pressure. [8]

(B) Discuss advantages, limitations & applications of gas lubricated bearings. [8]

OR

Q.10 (A) Discuss lubricant degradation, warning & protective devices. [8]

(B) Explain tribological aspects of lubrication in forging & extrusion operation. [8]

Q.11 (A) Compare EHL with HD lubrication [6]

(B) Following data relates to a hydrodynamic tapered pad bearing. [10]
Length of pad=900 mm, width of pad=150mm, max. oil film thickness=120 μ m, min. oil film thickness=60 μ m , viscosity of oil=0.06 Pa-s, sliding velocity=4m/s
Calculate
i) pressures at a distance of 130 mm from the leading edge.
(ii) load carrying capacity

OR

Q.12 (A) Write short note on [9]
i) Bearing materials (ii) Oil seals (iii) Gaskets

(B) With a neat sketch, explain,'Rayleigh Step Bearing'. Explain its advantages, limitations & applications [7]

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T. E.(Mechanical)Examination - 2013

HEAT TRANSFER (302042)

(2008 Pattern)

[Total No. of Questions:12] **[Total No. of Printed Pages :6]**

[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

*(1) Answer **three questions** from each section .*

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Black figures to the right indicate full marks.

(4) Neat diagrams must be drawn wherever necessary.

(5) Use of electronics pocket calculator is allowed.

(6) Use of external data books is not allowed.

(7) Assume suitable data, if necessary.

SECTION I

UNIT-I

Q1 a) Explain in brief the analogy between heat flow and electricity with its significance. [4]

b) An immersion water heater of surface area $0.1m^2$ and rating 1 kW is designed to operate fully submerged in water. Estimate the surface temperature of the heater when the water is at 40°C and $h_{water} = 300W/m^2K$. If this heater is by mistake used in air at 40°C with $h_{air} = 9W/m^2$ [4]

K, what will be the surface temperature?

c) Derive a general three dimensional heat conduction equation in Cartesian coordinate system. Reduce it as 1) Poisson equation, 2)Fourier equation, 3) Laplace equation. [10]

OR

Q2 a) A brick wall (k=1.5W/mK) 0.20 m thickness separates hot combustion gases of a furnace from outside ambient air which is at 25°C. the outer surface temperature of brick wall is found to be 100°C. if natural convection heat transfer coefficient on the outside surface of brick wall is 25 $W/m^2 K$, ε =0.85, calculate inner surface temperature of brick wall. [8]

b) Explain the significance of i. Thermal Diffusivity, ii. Thermal Conductivity, iii. Overall heat transfer coefficient [6]

c) Explain different types of Insulating materials [4]

UNIT-II

Q3 a) Define Critical radius of insulation. Explain why an insulated small diameter wire has a higher current carrying capacity than an uninsulated one. [8]

b) A plane wall of thickness 0.1 m and k=25 W/mK, having uniform volumetric heat generation of 0.3 MW/m^3 is insulated on one side and is exposed to a fluid at 92°C. the convective heat transfer coefficient between the wall and the fluid is 500 $W/m^2 K$. Determine: i) the maximum temperature in the wall, ii) temperature at the surface exposed to the fluid, iii) draw the temperature profile [8]

OR

Q4 a) An electrical conductor of 10mm diameter insulated by PVC (k=0.18 [8]

W/mK) is located in air at 30° C having convective heat transfer coefficient of 7.8 W/m^2 K. if surface temperature of base conductor is 85°C, find i. Current carrying capacity of conductor when 2mm thick insulation is provided (take resistivity of conductor = 70 $\mu\Omega$ cm), ii. Critical insulation thickness, iii. Max. current carrying capacity, iv. % increase in current carrying capacity by providing critical insulation.

b) A steel pipe (k=50 W/mK) of 100 mm I.D and 110 mm O.D is to be covered with two layers of insulation each having thickness of 50 mm. The thermal conductivity of first insulation material is 0.06 W/mK and that of the second is 0.12 W/mK. Estimate heat loss per meter length of pipe when temperature of inside tube surface is 523 K and that of surface is 323 K. if order of insulation is reversed, calculate change in heat loss with all other conditions kept unchanged. Comment on results. [8]

UNIT-III

Q5 a) Pin fin are provided to increase the heat transfer rate from a hot surface. Which of the following arrangement will give higher heat transfer rate: i) 6 fins of 10 cm length or ii) 12 fins of 5 cm length Take k_{fin} = 200 W/m°C, h= 20W/m^2 °C, Cross section area of fin=2 cm^2 perimeter = 4cm, fin base temp=230 ° C, Surrounding air temp=30°C. For analysis, use fin with insulated tip condition. [6]

b) Explain difference between fin efficiency and fin effectiveness [4]

c) A mercury thermometer is being used for measuring temperature of a fluid which changes within a time period less than 3 seconds. State the suitability of this arrangement by assuming bulb of thermometer a sphere of 1mm diameter having k=10W/mK, $\propto$ =5x10^{-5} m^2/s, h=10 W/m^2K. find [6]

diameter of thermocouple junction used for the same purpose in same environment. $K_{thermocouple}$ =90 W/mK, $\propto_{thermocouple}$ =25x10^{-5} m^2/s.

OR

Q6 a) State assumptions made in lumped capacitance method. Using this method derive the following relation$(T-T_a)/(T_i - T_a) = e^{-(Bi\ Fo)}$ with usual notations. [8]

b) Fins are more effective, when provided on the surface for which film heat transfer coefficient is smaller. Explain. [4]

c) Explain difference between Biot number and Nusselt number [4]

Q7 a) Explain how electrical network can be applied to solve radiation heat transfer problems. [6]

b) Two large parallel planes 'A' and 'D' are maintained at temperature of 1500K and 600K respectively. Their emissivities are 0.9 and 0.4 respectively. Two radiation shields, 'B' with emissivity=0.5 and 'C' with emissivity=0.2 are inserted in between them, such that A, B, C and D are placed one after the other. Calculate. i. Heat transfer rate without radiation shield, ii. Heat transfer rate with radiation shield, iii. Temperature attained by planes 'B' and 'C'. [10]

OR

Q8 a) Write the statements and mathematical expressions of the following laws in radiation heat transfer. i. Planck's law, ii. Wien's law, iii. Kirchhoff's law, iv. Lambert's cosine rule. [8]

b) Define Radiosity and Irradiation. [4]

c) Determine the rate of heat loss by radiation from a steel tube of outside [4]

diameter 70 mm and 3m long at a temperature of 227°C if the tube is located within a square brick conduit of 0.3 m side and at 27°C. take $\in$ steel=0.79 and $\in$ brick=0.93

UNIT-V

Q9 a) Define Prandtl number and give its significance. Give its relation with Thermal boundary layer and velocity boundary layer. Also give its value for liquid metals, heavy oils, water and air. [10]

b) A hot plate 1mx0.5m at 130°C is kept vertically in still air at 20°C. find i. Heat Transfer coefficient, ii. initial rate of cooling the plate in °C/min. Assume 0.5 m side is vertical and heat transfer takes place from both the sides of the plate. Use: $Nu=0.59\ (GrPr)^{1/4}$ At 75°C, the properties of air are: ρ =1.07 kg/m^3, v=19.1x10^{-6} m^2/s. Cp=1007 J/kg K, k=0.029 W/mK, mass of plate=20 kg, specific Heat of plate=400 J/kg K [6]

OR

Q10 a) Draw neat diagrams to show directions of natural convection fluid flow (development of thermal boundary layers) when: [8]

i. Plate is kept vertical and surrounding fluid temperature is higher than plate

ii. cylinder is kept horizontal and surrounding fluid temperature is lower than cylinder

iii. Plate is horizontal and surrounding fluid temperature is lower than the plate

iv. cylinder is vertical and surrounding fluid temperature is lower than the cylinder

b) Air at 2 bar pressure and 200°C is heated as it flows at a velocity of [8]

10 m/s through a tube with diameter of 3 cm with constant heat flux maintained at the wall with wall temperature 20°C above air temperature along all length of tube. Calculate: i. Heat transfer per unit length of tube, ii. increase in bulk temperature of air over 4 m length of tube.

Properties of air at 200°C are Pr=0.681, μ =2.57 x 10^{-5} kg/ms, k= 0.0386 W/mK, Cp=1.025 kJ/kg K. Use: Nu=0.023 $(Re)^{0.8}$ $(Pr)^{0.8}$

UNIT-VI

Q11 a) Explain phenomenon of nucleate boiling. List the factors that affect nucleate boiling. [8]

b) Write a note on Forced Convection Boiling [6]

c) Write a note on Heat Transfer Augmentation Techniques [4]

OR

Q12 a) Establish expression for LMTD for counter flow heat exchanger with usual notations. [8]

b) In a tube type parallel flow heat exchanger hot water at 80°C is cooled to 65°C by cold water entering at 20°C and leaving at 35°C. what would be the exit temperature if the flow rate of water is doubled? [10]

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T. E. Mechanical/Mech SW Examination –2013
TURBO MACHINES
(2008 Course)

[Total No. of Questions:12] **[Total No. Printed Pages:7]**
[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

1) *Attempt q. No. 1 or q. no2, Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I and Q No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10. Q. No. 11 or Q No. 12 from section II.*
2) *Answer **any three** questions from each I and three questions from section II*
3) *Answers to the **two sections** should be written in **separate answer-books**.*
4) *Neat diagrams must be drawn wherever necessary.*
5) *Black figures to the right indicate full marks.*
6) *Use of electronic pocket calculator is allowed.*

SECTION – I

Q.1 a) Show that, in case of jet striking the flat plate mounted on wheel, efficiency shall be maximum when the tangential velocity of wheel is half that of the jet. [8]

b) A jet of water having a velocity of 30 m/s, strikes a series of radial curved vanes mounted on a wheel which is rotating at 300 r.p.m. The jet makes an angle of 30^0 with the tangent to the wheel at inlet and leaves the wheel with a velocity of 5m/s at an angle of 130^0 to the tangent to the wheel at outlet. Water is flowing from outward in a radial direction. The outer and inner radii of the wheel are 0.5m and 0.25m respectively. [8]

Determine :

i) Vane angles at inlet and outlet
ii) Work done per unit weight of water
iii) Efficiency of wheel

OR

Q.2 a) Obtain an expression for the work done per second by water on the runner of Pelton wheel and also find the relation between jet speed and bucket speed for maximum efficiency. [8]

b) A Pelton wheel is working under a gross lead of 400m. The water is supplied through penstock of diameter 1 m and length 4 km from reservoir to the Pelton wheel. The coefficient of friction for the penstock is given as 0.008. The jet of water of diameter 150 mm strikes the buckets of the wheel and gets deflected through an angle of 165^{o}. The relative velocity of water at outlet is reduced by 15% due to friction between inside surface of the bucket and water. If the velocity of the buckets is 0.45 times the jet velocity at inlet and mechanical efficiency as 85% [8]

Determine :

i) Power given to the runner
ii) Shaft power
iii) Hydraulic efficiency and overall efficiency

Q.3 a) The following data is given for a Francis Turbine Net heat H = 70m ; Speed N = 600 r.p.m.; Shaft power = 367.875 kW ; η_0 =85% η_h = 95% ; flow ratio = 0.25; breadth ratio = 0.1 ; outer diameter of the runner = 2 x inner diameter of the runner. The thickness of vanes occupy 10% of circumferential area of the runner. Velocity of flow is constant at inlet and outlet and discharge is radial at outlet. [10]

Determine :

i) Guide blade angle
ii) Runner vane angles at inlet and outlet
iii) Diameters of runner at inlet and outlet
iv) Width of wheel at inlet

b) What is specific speed of a turbine? State its significance and derive an [8]

expression for the same.

OR

Q.4 a) A Propeller reaction turbine of runner diameter 4.5 m is running at 40 r.p.m [10]

The guide blade angle at inlet is 145° and runner blade angle at outlet is 25° to the direction of vane. The axial flow area of water through runner is $25m^{2.}$

If the runner blade angle at inlet is radial, determine:

i) Hydraulic efficiency of the turbine
ii) Discharge through turbine
iii) Power developed by the turbine
iv) Specific speed of the turbine

b) A conical type draft tube, attached to Francis turbine has an inlet diameter [8] of 3 m and its area at outlet is 20 m^2. The velocity of water in inlet, which is set 5 m above tail race level, is 5 m/s. Assuming the loss in draft tube equal to 5% of velocity head at outlet, find:

i) The pressure head at top
ii) Total head at top taking tail race level as datum
iii) Power of water at runner outlet
iv) Power of water at turbine outlet
v) Power lost in draft tube.

Q.5 a) An impulse turbine has 3 similar stages of the same mean diameter an [10] geometry; each stage develops 500 kW. The peripheral speed of the rotor blades at the mean diameter is 100 m/s; the whirl components of the absolute velocities at entry and exit of the rotor are c_{y2} = 200 m/s and c_{y3} = 0 respectively. The nozzle angles at exit are equal to $\alpha_2 = 65^o$.

The steam at the exit of the first stage has P_2 = 8.0 bar, $t_2 = 200^oC$. Determine for the first stage

i) mean diameter of the stage for a speed of 3000 r.p.m
ii) mass flow rate of steam
iii) isentropic enthalpy drop for an efficiency of 69%

iv) rotor blade angles
v) the blade height of the nozzle and rotor blade at exit.

b) How are steam turbines classified? Give a list of types of steam turbines used in various applications. [6]

OR

Q.6 a) A 50% reaction stage of a gas turbine has the following data : [10]

Entry pressure and temperature $P_1 = 10$ bar, $T_1 = 1500$ K

Speed = 1200 r.p.m., mass flow rate of the gas = 70 kg/S,

Stage pressure ratio and efficiency $\rho_r = 2.0$, efficiency $\eta_{st} = 87\%$

Fixed and moving blade exit angles = 60^o

Assume optimum blade to gas speed ratio. Take $\gamma = 1.4$, $C_p = 1.005$ KJ/Kg K for the gas

Determine:

i) Flow coefficient
ii) Mean diameter of the stage
iii) Power developed
iv) Pressure ratio across fixed and rotor blade rings
v) Hub tip ratio of the rotor
vi) Degrees of reaction at hub in tip

b) Explain briefly four method which can be employed for improving thermal efficiency of steam turbine power plant. [6]

SECTION – II

Q.7 a) The stagnation pressure ratio across a gas turbine stage is 2.0 and the initial and final stagnation temperatures of the gas are 600^oC and 500^oC respectively. The absolute velocity of the gas both at entry and exit is 120 m/S. Determine [10]

i) Total to total efficiency
ii) Total to static efficiency
iii) Work done per kg of gas
iv) Mass flow rate of gas to develop 10 MW

b) What are the advantages of closed circuit gas turbine power plant over open [6]

circuit gas turbine power plant? Give three practical examples where closed circuit gas turbine plants are used.

OR

Q.8 a) A small gas turbine plant has a output of 1 MW at a maximum to minimum temperature ratio of 5 and pressure ratio of 25. The overall turbine and compressor efficiencies are 85% and 82% respectively. The compressor draws air at 300 K; the properties of gas may be assumed to be the same as that of air. Determine : [10]

i) The mass flow through the turbine
ii) Thermal efficiency of the plant
iii) Efficiencies of reversible Joule cycle and Carnot cycle between the same temperatures.

b) What are the various methods employed for improving the efficiency and output of a constant pressure gas turbine power plant? [6]

Q.9 a) What do you man by manometric head, manometric efficiency, mechanical efficiency and overall efficiency of a centrifugal pump? [8]

b) A centrifugal pump having outer diameter equal to two times inner diameter. and running at 1200 r.p.m. works against a total head of 75 m. The velocity of flow through the impeller is constant and equal to 3 m/s. The vanes are set back at width at an angle of 30^o at outlet. If the outer diameter of the impeller is 600 mm and width at outlet is 50 mm, determine : [10]

i) Vane angle at inlet
ii) Work done per second by impller
iii) Manometric efficiency

OR

Q10 a) What is priming of centrifugal pump and why it is necessary? [4]

b) Draw and discuss the operating characteristics of a centrifugal pump. [6]

c) The outer diameter of an impeller of a centrifugal pump is 400 mm and [8]

outlet width is 50 mm. the pump is running at 800 r.p.m. and is working against a total head of 15 m. The vane angle at outlet is 40^o and manometric efficiency is 75% Determine :

i) Velocity of the flow at outlet
ii) Velocity of water leaving the vane
iii) Angle made by the absolute velocity at outlet with the direction of motion.
iv) Discharge

Q.11 a) An axial compressor stage has following data [10]

Temperature and pressure at entry ------ 300K, 1 bar

Degree of reaction---------- 50%

Mean blade ring diameter---------- 36 cm

Rotational speed---------- 18000r.p.m.

Blade height at entry---------- 6 cm

Air angles at rotor and stator exit--------- 25^o

Axial velocity---------- 180 m/s

Work done factor---------- 0.88

Stage efficiency---------- 85%

Mechanical efficiency---------- 96.7%

Determine:

i) Air angles at the rotor and stator entry
ii) The mass flow rate of air
iii) The power required to drive the compressor
iv) The loading coefficient
v) The pressure ratio developed the stage
vi) The Mach number at the rotor entry

b) How do stalling and surging take place in centrifugal compressor stages? [6]

How does it affect the performance of compressor? Suggest methods to minimize.

OR

Q.12 a) Derive the following relation for efficiencies and degree of reaction of axial compressor [8]

$$\eta_{st} = R\,\eta_R + (1-R)\,\eta_D$$

Calculate the value of the stage efficiency of 50% reaction compressor stage with the following efficiencies of the blade rows.

$$\eta_R = 0.849 \text{ and } \eta_D = 0.849$$

b) Draw velocity triangles at entry and exit for following axial compressor stages. [8]

i) $R = 1/2$

ii) $R = 1$

iii) $R > 1$

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T. E. (MECH S/W) Examination May 2013

BEHAVIOURAL SCENCE

(2008 Pattern)

[Total No. of Questions:9] **[Total No. of Printed pages :2]**

[Time : 3 Hours] **[Max. Marks : 100]**

(1) *Answers any 3 questions from each section 2.*

(2) *Answers to the two Sections should be written in separate answer-books*

SECTION-I

Q.1 a) Explain in brief features of public, private and cooperative sector. [8]

b) What is purpose of industrial enterprise ? Discuss external factors influencing and governing enterprise. [8]

OR

Q.2 a) What is motivation? What are different theories of motivation? Explain any two in details. [8]

b) What is role of trade unions? Elaborate it. [8]

Q.3 a)Explain various functional areas of management. [8]

b)What are learning theories? Explain in details. [8]

OR

Q.4 a) What are various functions of sales and marketing in industrial organisation? [8]

b)What is organistaion structure? Explain any two organisations based on its structure. [8]

Q.5 What short notes on(any three). [18]

a)Incentive scheme.

b)Activity based costing.

c)Strategic planning

d)Affiliation and Maslaw.
e)Cognitive learning theory

SECTION-II

Q.6 a) Explain the Homan's model of leadership. state the various leadership under this Model [8]

b) What do you mean by 'organisational culture' state the characteristics [8]

Q.7 a)Define conflict. state and explain the various causes of conflict How conflict can be minimized [8]

b)Communication makes an organisation alive'' Discuss emphasising the importance of communication in an organisation [8]

Q.8 a)How will you set a pattern of interview for the post of production supervisor? state the important considerations. [8]

b)What is managerial grid? Differentiate between Team manager and Task manager with the help of managerial grid. [8]

Q.9 Write a short note on (any three) [18]

a)Written communication & its limitation
b)Free – rein leadership style
c)Downword communication
d)Transactional Analysis.

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T. E. (MECH S/W) Examination –May 2013

WELDING TECHANOLOGY

(2008 Pattern)

[Time : 3 Hours] **[Max. Marks : 100]**

Total No. of Questions : 10 **[Total No. of Printed Pages :2]**

Instructions :

*(1) Answer **any three** questions from each section.*

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Neat diagrams must be drawn wherever necessary.

(4) Assume suitable data, if necessary.

Q1) a) What is gas welding? Explain gas welding equipment and its working. [08]

b) Explain different types of welding flames. [08]

OR

Q2) a) Define welding techniques. Explain its types in detail. [08]

b) What are advantages, disadvantages and applications of gas welding? [08]

Q3) a) Explain principle of arc welding process. What are its variables and parameters? [08]

b) What is carbon arc welding? Explain in detail state its applications. [08]

OR

Q4) a) What is GTAW welding? Explain process in detail. What are its applications? [08]

b) What are electrode coating ingredients and their functions? [08]

Q5) Write short notes on (any three) [18]

a) Welding filler metal rods & fluxes

b) Light, medium and heavily coated electrodes.

c) Manufacture of electrodes

d) Projection welding

e) Percussion welding

SECTION II

Q6) a) What is diffusion welding? Explain in detail. State its applications. [08]

b) Explain ultrasonic welding process. Where it is used? [08]

OR

Q7) a) What do you mean by inertia welding? How it is performed. Where it is applied? [08]

b) Explain in short thermit and laser beam welding processes with its application. [08]

Q8) a) What is principle of operation of brazing? Explain brazing joint design. [08]

b) Explain process of silver brazing and Vaccum brazing. [08]

OR

Q9) a) Compare process of soldering and welding. [08]

b) Define adhesive bonding. Explain selection and types of adhesives, applications of adhesive bonding. [08]

Q10) Write short notes on any three. [18]

a) Spatter, under cutting and over lapping

b) Discontinuities in welds, causes and remedies

c) Solid state welding process

d) Explosive welding

e) Factor affecting welding cost.

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T. E.(Mechanical Sandwich)Examination - 2013
THEORY OF MACHINE & MACHINE DESIGN II(302064)
(2008 Pattern)

[Total No. of Questions:12] **[Total No. of Printed Pages :9]**
[Time : 4 Hours] **[Max. Marks : 100]**

Instructions :

*(1) Answer **Q1 or Q2, Q3 or Q4, Q5 or Q6** from section I and **Q7 or Q8, Q9 or Q10, Q11 or Q12** from section II.*
*(2) Answers to the **two sections** should be written in **separate answer-books**.*
(3) Black figures to the right indicate full marks.
(4) Neat diagrams must be drawn wherever necessary.
(5) Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator is allowed.
(6) Assume suitable data, if necessary.

SECTION-I

UNIT-I

Q1 a) A Cam operates a roller in-line reciprocating follower, while rotating at 300 rpm, Minimum radius of cam 25mm, lift of follower 30 mm, Diameter of roller 15mm, Rise of follower takes place during 120° of cam rotation by simple harmonic motion, outer dwell of next 30° rotations of cam and return stroke is for next 150° of cam rotation by Uniform acceleration and retardation motion. Draw the Cam Profile, find magnitude of maximum acceleration during Rise and return stroke. [14]

b) Determine the *Chebychev*spacing for function ranges from *1 to 3*, [4]

where three precision points are required to be considered. Use graphical method.

OR

Q2 a) Explain the term Structural Error [2]

b) Draw Profile of a Cam to give the following motion to an Oscillating roller follower, as detailed below: [16]

i) Follower to moveoutward through an angular displacement of 17° during 90° of cam rotation,

ii) Follower to dwell for 60° of cam rotation,

iii) Follower to return to its initial position during 90° of cam rotation, and

iv) Follower to dwell during remaining 120° of cam rotation.

The pivot of the oscillating follower is 115mm from the axis of rotation of the cam. The distance between the pivot centre and the roller centre is 100mm, the roller is 38mm diameter and the minimum radius of the cam is 50mm. The outward stroke of the follower is completed with S.H.M., while the return stroke of uniform acceleration and retardation, retardation being double the acceleration.

UNIT-II

Q3 a) Two mating Spur Gear with module 6.5mm have 19 and 47 teeth of 20° Pressure angle and 6.5mm addendum. Determine the number of pairs [10]

of teeth in contact and the angle turned by the larger wheel for one pair of teeth in contact.

Determine also the ratio of the sliding velocity to the rolling velocity when the engagement terminates.

b) Two helical gears transmit 30 KW with velocity ratio 4, the normal pressure angle of 20° and helix angle 25°, normal module is 12mm and standard addendum is equal to one module. The pinion has 20 teeth and rotates at 400 rpm. Determine forces on tooth with neat sketch. [6]

OR

Q4 a) State and prove Law of Gearing [4]

b) An Epicyclic gear train, the compound wheels A and B as well as internal gear C and D rotate independently about axis O. the wheel E and F rotate on pin fixed to the arm G. E gears with A and C, and F gears with B and D. All wheels have same module and number of teeth's are T_C=28, T_D=26, T_F=T_E=18. [12]

i) Sketch the arrangement, ii) If the arm G makes 100 r.p.m. clockwise and A is fixed, find the speed of Gear B.

UNIT-III

Q5 a) A motor cycle with rider has mass of 250kg. The centre of gravity of the motor cycle and the rider is 60cm above the ground when running straight in vertical position. Each wheel diameter is 60cm with mass [10]

moment of inertia of 1kg m^2. The engine rotates 6 times faster than the wheel in the same direction and the rotating part of the engine have a mass moment of inertia of 0.175 kg-m^2. Determine the angle of inclination of the motor cycle if it is speeding at 80km/hr and takes turn of radius 50m.

b) A torsion dynamometer is fitted on turbine shaft to measure the angle of twist. The shafts twist 1.6° for the length of 8 meters at 600 r.p.m. the diameter of shaft is 250mm. Find the power transmitted by the turbine. Take G=80GPa. [6]

OR

Q6 a) Derive an expression for gyroscopic couple [8]

b) In a belt transmission dynamometer, the driving pulley rotates at 300 rpm. The distant between the centre of the driving pulley and the dead mass is 800mm. The diameter of each of the driving as well as the intermediate pulley is equal to 360mm. Find the value of the dead mass required to maintain the lever in a horizontal position when the power transmitted is 3KW. Also find its value when the belt just begins to slip on the driving pulley, co-efficient of friction being 0.25 and the maximum tension in the belt 1200N. [8]

SECTION-II

Q7 a) A spur gear with 20° full depth involute system consists of 21 teeth pinion meshing with a 40 teeth gear. The pinion and gear are made of steel [10]

with 600 MPa and 400 MPa ultimate tensile strengths respectively. The pinion shaft is connected to a 5kW 720 r.p.m. electrical motor. The starting torque of motor is approximately 1.25 the rated torque and the factor of safety is 2. Assume load concentration factor as 1.6.

Assume

Lewis form factor Y=0.484-(2.87/Z) where Z-number of teeth

b= 10 x module

Load-stress factor K=$0.16\left({}^{BHN}/_{100}\right)^2 N/mm^2$

Standard module in mm →1,1.25,2,3,4,5,6,8,10,12,16.

a) Evaluate the module based on beam strength using velocity factor Cv=6/(6+V). assume V=5 m/s initially.

b) Select the standard module and calculate gear dimensions

c) Specify surface hardness of gears

b) A pair of straight teeth bevel gears are mounted on shafts which are intersecting at right angles. The pinion shaft is connected to electrical motor developing 5.75 kW power at 500 r.p.m. The number of teeth on gear and pinion are 35 and 25 respectively. The tooth forms correspond to 20° pressure angle full depth involute. The pinion and gear are made of steel having ultimate tensile stress 600 N/mm^2 and heat treated to Surface hardness of 350 BHN. The module and face width of tooth are 5mm and 25 [8]

mm respectively. Use following data

Lewis form factor Y=0.484-(2.85/Z') where Z'- virtual no. of teeth

Velocity factor C_v = 6/(6+V) where V-pitch line velocity in m/s

Service factor C_s=2

Load-stress factor, k=0.16$\left(\frac{BHN}{100}\right)^2 N/mm^2$

Determine factor of safety for bending and pitting failure of gears.

OR

Q8 a) A single stage helical gear reducer is to receive power from a 1440 rpm, 25 kW induction motor. The gear tooth profile is involute full depth with 20° normal pressure angle and helix angle of 23°. The number of teeth on pinion is 20 and gear ratio is 3. Both the gears are made from C40 steel with an allowable bending stress of 95 MPa and hardness of 250 BHN. Design the gear pairs with 20% overload capacity from standpoint of bending and wear strength. Assume the factor of safety as 1.25 and face width as 14 times of **transverse** module. Assume Buckingham's equation for estimating the dynamic load. The deformation factor may be taken as 114/Nmm. [12]

Assume

Lewis form factor Y=0.484-(2.85/Z') where Z'-virtual no. of teeth

Velocity factor C_v=5.6/(5.6+√V) where V-pitch line velocity in m/s (assume 5m/s initially)

$F_d=\frac{21.v\left(bc\ \cos^2\Psi+Ft\right)\cos\ \Psi}{21.v+\sqrt{bc\cos^2\Psi+Ft}}$ where $F_t=C_s \times pt$

Load-stress factor $K=0.16\left(BHN/_{100}\right)^2\ N/mm^2$

Standard module in mm→1,1.25,2,3,4,5,6,8,10,12,16.

b) Explain in detail thermal considerations in worm gear drives [6]

Q9 a) A single row deep groove ball bearing is subjected to following [10]

Workcycle

Sr. No.	Fraction of cycle	Radial Load (N)	Thrust load (N)	Speed (r.p.m.)	Service Factor
1	1/10	2000	1200	400	3.0
2	1/10	1500	1000	500	1.5
3	1/5	1000	1500	600	2.0
4	3/5	1200	2000	800	1.0

If the desired rating life is 15000 hours. Select the bearing from following Data.

Bearing No.	6015	6215	6351	6415
Dynamic Load Capacity(kN)	31	52	90	120

Assume Radial and axial load factors to be 1.0 and 1.5 respectively and inner race rotates.

b) A single plate clutch, consisting of two pairs of contacting surfaces, is [6] required to transmit 40 kW power at 1560 rpm. The coefficient of friction between the contacting surfaces is 0.3 and intensity of pressure is limited to 0.4 N/mm^2. The outer diameter is limited to 300 mm. if the service factor

is 1.25. Determine:

a) The inner diameter of friction disk;

b) The axial force required to engage the clutch

Use Uniform wear theory.

OR

Q10 a) Write short notes on(any two) [8]

i) Objectives and Methods of preloading in Bearings

ii) Design Considerations in Friction Clutches

iii) Designation of Bearings

b) A centrifugal clutch is to be designed to transmit 15 kW at 900 rpm. [8]

The shoes are four in number. The speed at which the engagement begins is $3/4^{th}$ of running speed. the inside radius of the drum is 150 mm while the radius of the drum is 150 mm while the radius of center of gravity of shoe in engaged position is 120mm. the coefficient of friction of shoe material is 0.25. determine

i) mass of each shoe

ii) size of the each shoe (assuming arc of contact of each subtend an angle ϕ=60° and intensity of pressure exerted on each shoe=0.1 N/mm^2)

Q11 a) Explain following diagrams in design of components subjected to fluctuating stresses [8]

i) Soderberg diagram ii) Modified goodman diagram

b) A transmission shaft of cold drawn steel 27 Mn2(S_{ut}=500N/mm^2) and [8] S_{yt}=300 N/mm^2) is subjected to fluctuating torque which varies from -100 N-mm to +400 Nmm. The factor of safety is 2 and the expected reliability is 90%. Neglecting the effect of stress concentration, determine the diameter of the shaft. Assume distortion energy of theory of failure.

Use following data

Surface finish factor=0.8

Size factor=0.85

Reliability factor(for 90% reliability)=0.897

OR

Q12 a) What is stress concentration? What are various causes of stress [8] concentration? Describe the various methods to reduce the effect of stress concentration.

b) The work cycle of a mechanical component subjected to completely [8] reversed bending stresses consists of following three elements

i) $\pm$ 350 N/mm^2 for 85% of time ii) $\pm$ 500 N/mm^2 for 12% of time

iii) $\pm$ 500 N/mm^2 for 3% of time

the material for the component is 50C4(S_{ut}=660N/mm2) and the corrected endurance strength of the component is 280 N/mm2. Determine the life of the component.

[Total No. of Questions:12] **[Total No. of Printed Pages:3]**

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T. E. (*Mechanical-S/w*) Examination - 2013

(Mechatronics)(2008 Course)

[Time: *3* Hours] **[Max. Marks: 100]**

Instructions:

*1 Answers **any three** questions from each section.*

2 Assume suitable data, if necessary.

SECTION -I

Q.1	A	Explain the signal conditioning elements used in mechatronics system and state its functions	5
	B	Derive the expression of gauge factor in strain gauge	5
	C	The platinum resistance temperature detector has a temperature coefficient of resistance as 0.004 **Ω**/**Ω**/° C. The resistance at 40° C is 130**Ω**. Find the resistance at 300°C.	6

OR

Q.2	A	Distinguish between the following: i) Threshold and resolution ii) Precision and Accuracy	8
	B	An electrical resistance of a strain gauge of 120**Ω** and gauge factor of 2 is bonded to steel having an elastic limit stress of 400 MN/m^2 and modulus of elasticity of 200 GN/m^2. Calculate the change of resistance, i) due to change of stress equal to $\frac{1}{10}$ of the elastic range. ii) due to an increase of temperature of 20° C if the gauge material is advance alloy. Given: a) temperature coefficient of expansion of steel=12×10^{-6}/°C b) temperature coefficient of expansion of advance alloy=10×10^{-6}/°C c) temperature coefficient of resistance of advance alloy=20×10^{-6}/°C	8
Q. 3	A	Explain the principle of operation of absolute optical encoder.	5

	B	Explain how displacement is sensed by LVDT with neat sketch show how it can be made phase sensitive.	6
	C	State the advantages and limitations of potentiometric transducer.	5
		OR	
Q. 4	A	Determine the resolution of: i) optical incremental encoder having 60 number of slots on the disc. ii) optical absolute encoder having 10 tracks.	6
	B	Explain the capacitive transducer for measurement of displacement.	5
	C	State the typical specifications of LVDT. Also state its advantages and limitations.	5
Q. 5	A	Explain Analogue to digital converter.	6
	B	Derive a first order differential equation of the temperature indicated by the thermometer T will vary with time when the thermometer is inserted in a hot liquid having a temperature T_L.	6
	C	Write a short note on transfer function	6
		OR	
Q. 6	A	Explain the building blocks of electrical system	6
	B	Explain Digital to Analogue converter	6
	C	Write a short note on SCADA	6
		SECTION II	
Q. 7	A	Differentiate between open loop control system and closed loop control system	5
	B	Define the following terms: i) Process equation ii) Process load	5
	C	A controller outputs a 4 to 20mA signal to control motor speed from 140 to 600 rpm linearly, calculate i) Current corresponding to 310rpm ii) The value of current expressed as the percentage of control output.	6
		OR	
Q. 8	A	Explain Feed forward control system with suitable example	5
	B	Explain the following terms: i) Control lag ii) Dead time	5
	C	A controlling variable is a motor speed that varies from 800 to 1750 r.p.m. If the speed is controlled by a 25 to	6

50V DC signal, calculate:

a. the speed produced by an input of 38 V and
b. the speed calculated as a percent of span.

Q. 9	A	Explain two step mode of controller with suitable example	5
	B	Derive the expression for transfer function for proportional plus derivative control system	5
	C	An integral controller is used for speed control with a set point of 12rpm within a range of 10 to 15 rpm. The controller output is 22% initially. The constant K_I= -0.15% controller output per second per percentage error. If the speed jumps to 13.5 rpm, calculate the controller output after 2s for a constant e_p	6

OR

Q. 10	A	Explain P+I+D control action with suitable example.	8
	B	A liquid level control system linearly converts a displacement of 2 to 3 m into a 4 to 20 mA control signal. A relay serves as the two position controller to open or close an inlet valve. The relay closes at 12mA and opens at 10mA. Find a) the relation between the displacement level and current. b) the neutral zone or displacement gap in meters.	8
Q. 11	A	Explain various criteria to be considered for selecting the PLC	4
	B	Write a short note on: i) Timers ii) Counters	6
	C	Explain bottle filling plant with a neat sketch and draw its ladder diagram.	8

OR

Q. 12	A	Compare PLC with relay control.	4
	B	State the typical specifications of PLC.	6
	C.	Explain elevator application with a neat sketch and draw its ladder diagram.	8