

Subject Code: BME-27

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Mechanical Engineering Department

B. Tech. / ODD (Semester V)

Mid Term Exam- (2019-20)

Subject: HEAT & MASS TRANSFER

Time: 2 Hrs

Maximum Marks: 20

Note: Answer all questions. Assume suitably if any data is missing.

1. Attempt any **Three** parts of the following. Q. 1 (a) is compulsory.

(a) Derive the general heat conduction equation in polar coordinate system for homogeneous and isotropic material. Further, deduce the Poisson's and Fourier's equation of heat conduction. [4]

(b) Consider a spherical container of inner radius 8 cm and outer radius 10 cm of thermal conductivity 45 W/m °C. The inner and outer surfaces of container are maintained at 200 °C and 25 °C respectively. Determine the temperature at a radius 9 cm and rate of heat transfer. [2]

(c) Deduce the expression for temperature distribution and rate of heat transfer for finitely long fin with adiabatic tip of uniform cross-sectional area. [2]

(d) Discuss the physical significance of efficiency and effectiveness of a fin. How do they relate each other for both infinitely long and adiabatic tip fin? [2]

2. Attempt any **Two** parts of the following. Q. 2 (a) is compulsory.

(a) An insulated steam pipe having outside diameter of 30 mm is to be covered with two layers of insulation, each having thickness of 20 mm. The thermal conductivity of one material is 5 times that of the other. Assuming that the inner and outer surface temperatures of composite insulation are fixed, how much will heat transfer be increase when better insulation material is next to the pipe than it is outer layer? Comments on result. [4]

(b) Derive the expression for the steady state overall heat transfer coefficient in a composite slab of series combination, whose inner surface is exposed to hot fluid and outside surface is exposed to a cold fluid. [2]

(c) Derive the expressions for temperature distribution and rate of heat transfer for a steady state radial conduction in a hollow spherical shell of constant thermal conductivity, without heat generation subjected to Newtonian boundary conditions. [2]

3. Attempt any **Two** parts of the following. Q. 3 (a) is compulsory.

(a) A horizontal high-pressure steam pipe of 10 cm outside diameter passes through a large room whose walls and air are at 23 °C. The pipe outside surface temperature is 165 °C and emissivity is 0.85. Determine the heat loss from the pipe per unit length using Churchill and Chu correlation. Properties at mean film temperature are as follows: $\rho = 1.165 \text{ kg/m}^3$; $\text{Pr} = 0.697$; $k = 0.0313 \text{ W/m-K}$; and $\nu = 22.80 \times 10^{-6} \text{ m}^2/\text{s}$. Do the same problem for $\text{Gr} = 5 \times 10^{10}$. Comment also. [4]

- (b) Two rods of identical shapes and size are held fixed between two supporting plates each maintained at $100\text{ }^{\circ}\text{C}$ and are exposed to an ambient air at $25\text{ }^{\circ}\text{C}$. The midpoint temperature of rod 1 made of thermal conductivity 200 W/m K is measured to be $50\text{ }^{\circ}\text{C}$, while the temperature at corresponding location in rod 2 is found to be $60\text{ }^{\circ}\text{C}$. Calculate and comment on thermal conductivity of rod 2. [2]
- (c) Explain the free convection heat transfer mechanism from an isothermal vertical flat plate. Give the physical significance of Rayleigh number. [2]

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**B. Tech., 3rd Year
(SEM V) ODD SEMESTER
MINOR TEST 2019 - 2020**

Machine Design-I

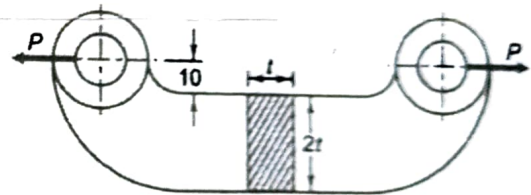
Time: 2 Hrs.

Max. Marks: 20

- Note:** (i) Attempt all questions. Marks are indicated against each question.
(ii) Use of design data book is permitted.
(iii) Assume missing **data suitably**, if any.

Q.1 Attempt any Three parts of the following. Q. 1(a) is compulsory.

- (a) Discuss the various factors which should be considered in material selection. It is required to select a material by weighted point method. There are three candidate materials viz. FG 150, FG 260 and FG 400, which have passed through screening test. For a particular application, the designer has given 4-points weightage for ultimate tensile strength (MPa), 3-points weightage for fatigue limit (Wohler)-Un-notched (MPa) and 2-points weightage for shear strength (MPa). 4
- (b) Define machine design and write the step by step design procedure for the design of machine element. 2
- (c) An offset link subjected to a force P of 25kN is shown in adjacent figure. It is made of grey cast iron FG300 and factor of safety is 3. Determine the dimensions of the cross-section of the link. 2
- (d) A bar is subjected to a combination of steady load of 60kN and a load fluctuating between 10kN (compressive) to 90kN (Tensile). The endurance limit of the bar is 150 MPa. The bar is made of cold drawn steel 30C8 with a square cross section of side a . If the factor of safety is 2, determine the value of a (in mm), according to the Goodman's criterion. 2



Q.2 Attempt any Two parts of the following. Q. 2(a) is compulsory.

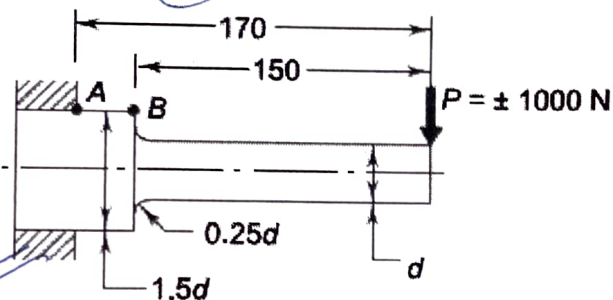
- (a) State and derive the expression of distortion energy theory of failure. Also prove that the yield strength in shear is 0.577 times the yield strength in tension. 4
- (b) Determine and draw the type of fit D7-d8 used in an assembly of the components. Also determine the tolerance for shaft and hole. 2
- (c) Write percentage of alloying elements of following materials designated as: 2
(i) 40C8 (ii) 40Ni8Cr8V2 (iii) 25C12S14 (iv) X20Cr18Ni2.

Q.3 Attempt any Two parts of the following. Q. 3(a) is compulsory.

- (a) The stresses developed at a point in a machine component are as follows: $\sigma_x = -80$ MPa, $\sigma_y = 60$ MPa and $\tau_{xy} = 100$ MPa. Draw:

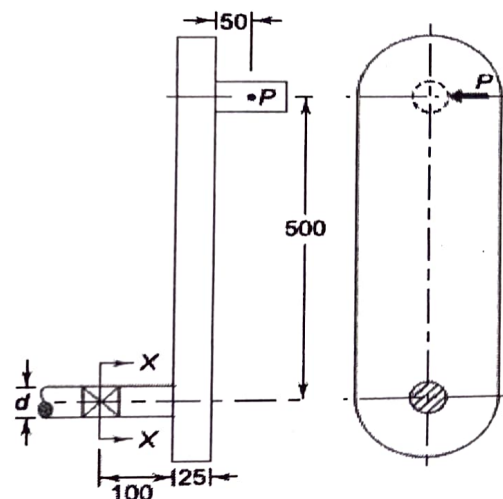
- Initial stress element.
- Complete Mohr's circle.
- Principal stress element and Maximum shear stress element.
- Stress element at an angle of 30° CW.

- (b) A cantilever beam made of cold drawn steel 20C8 is subjected to a completely reversed load of 1000 N. The notch sensitivity factor at the fillet can be taken as 0.85 and expected reliability 90%. Determine the diameter 'd' of the beam for a life of 10000 cycles. Take the factor of safety 2.



- (c) The dimensions of an overhang crank are given in the adjacent figure. The force P acting at the crankpin is 2 kN. The crank is made of steel 30C8 and the factor of safety is 2. Determine the diameter d at the section - XX using:

- Maximum principal stress theory of failure.
- Maximum shear stress theory of failure.



Max. Marks: 20

Q.1 Attempt any three parts of the following.Q.1 (a) is compulsory

- Fig. 1

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Fig. 2

- ✓ (d) Explain sensitiveness, hunting, stability and isochronism in connection with governors [2]

Q.2 Attempt any two parts of the following. Q.2 (a) is compulsory

- a) The turning moment diagram of a four stroke engine is assumed to be represented by four triangles, the area of which from the line of zero pressure are suction stroke = 440 mm^2 , Compression stroke = 1600 mm^2 , Expansion stroke = 7200 mm^2 , Exhaust = 660 mm^2 . If $1 \text{ mm}^2 = 3 \text{ Nm}$ and the resisting torque is uniform, find the mass of the rim of the flywheel to keep the speed between 218 rpm and 222 rpm when the mean radius of the rim is 1.25m. [4]
- b) For a certain engine having an average speed of 1200 rpm a flywheel approximated as a solid disc is required for keeping the fluctuation of speed within 2% about the average speed. The fluctuation of kinetic energy per cycle is found to be 2 kJ. What is the least possible mass of the flywheel if its diameter is not to exceed 1m? [2]
- c) The minimum and maximum speed of a flywheel are 242 rpm and 238 rpm respectively. The mass of the flywheel is 2600 kg and radius of gyration is 1.8m. Find the (i) mean speed of flywheel (ii) maximum fluctuation of energy (iii) coefficient of fluctuation of speed. [2]

Q.3 Attempt any two parts of the following. Q.3 (a) is compulsory

- a) Each ball of a porter governor has a mass of 6 kg and the mass of the sleeve is 40 kg. The upper arms are 300 mm long and are pivoted in the axis of rotation whereas the lower arms are 250 mm long and are attached to the sleeve at a distance of 40 mm from the axis. Determine the equilibrium speed of the governor for a radius of rotation of 150 mm for 1% change in speed. Also find the effort and power for the same speed change. 455.77 328.79 [4]
- b) The mass of the each ball of a Hartnell type governor is 1.4 kg. The length of ball arm of the bell crank lever is 100 mm whereas the length of the arm towards sleeve is 50 mm. The distance of the fulcrum of bell crank lever from the axis of rotation is 80 mm. The extreme radii of rotation of the balls are 75 mm and 112.5 mm. The maximum equilibrium speed is 6 % greater than the minimum equilibrium speed which is 300 rpm. Determine the equilibrium speed when radius of rotation of the ball is 90 mm. [2]
- c) What do you mean by mean by spin, precession and gyroscopic planes? What is effect of gyroscopic couple on the stability of four wheeler while negotiating a curve? [2]

1. Attempt any Three parts of the following. Q.1(a) is compulsory.
- What is understood by Manufacturing system? Compare conventional methods of manufacturing to Advanced methods of manufacturing in brief. Point out the importance of Green manufacturing. (4)
 - Discuss the selection of a manufacturing process for the production of a component on the basis of technical viability, desired quality and economical aspects. (3)
 - Why clearance provided between die and punch? A metal disc of 20 mm diameter is to be punched from a sheet of 2 mm thickness. The punch and die clearance is 3%. Then what is required punch diameter? (3)
 - Why lubrication is needed in metal forming processes? Explain any four defects in metal forming processes with the help of neat sketches. (3)
2. Attempt any Three parts of the following. Q.2(a) is compulsory.
- Derive an expression for Forging force of strip in open die forging and also write the assumptions required for its derivation. (4)
 - What is the significance of recrystallization temperature in metal working? Distinguish Hot working and Cold working process. (3)
 - A strip of lead with initial dimensions 28 mm x 28 mm x 160 mm is forged between two flat dies to a final size of 8 mm x 98 mm x 160 mm. if coefficient of friction is 0.25, determine the maximum forging force. The average yield stress of lead in tension is 7 N/mm². (3)
 - A strip with a cross-section of 180 mm x 8 mm is being rolled with 15% reduction of area, using 400 mm diameter steel rolls. Before and after rolling, the shear yield stress of the material is 0.35 kN/mm² and 0.4 kN/mm² respectively. Calculate:
(i). The angle subtended by the deformation zone at the roll centre, and
(ii). The location of the neutral point Θ_n .
Assume the coefficient of friction to be 0.1. (3)
3. Attempt any Three parts of the following. Q.3 (a) is compulsory.
- What do you understand by Compound Die? Explain the washer making process by compound die with the help of neat sketch. (4)
 - A cylindrical cup without flange is to be drawn from a 1.8 mm thick sheet. The cup shall have 20 mm diameter and 60 mm height. Reduction ratio in the first and subsequent draws may not exceed 30% and 10% respectively. Determine the blank size and the number of draws necessary. (3)
 - What does mean by High Energy Rate Forming process? Why it is known so? Explain explosive forming with the help of neat sketch. (3)
 - What do you understand by bend allowance? What is the bend allowance when 2 mm thick sheet is bending with 60° bend angle and bend radius is 100 mm. (3)

BCS- 15

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B. TECH(EE/ME)
ODD Semester
Minor Test 2019-2020

BCS- 15 DATABASE MANAGEMENT SYSTEMS

Max. Marks: 20

Time: 02 Hrs

Note: Answer all questions.

1. Attempt any Three parts of the following. Q.1 (a) is compulsory.

- (a) Discuss the three generations of DBMSs.

- (a) Discuss the three generations of DBMSs.
(b) Describe the five components of the DBMS environment and discuss how they relate to each other.

- Describe the five components of the DBMS and how they relate to each other.
- Define the five basic Relational algebra operations with an example of each.
- Define the five basic SQL DML statements and explain their use.

- (d) Briefly describe the four basic SQL DML statements and explain their use. Also describe the main SQL DDL statements:

2. Attempt any Two parts of the following. Q.2 (a) is compulsory.

- (a) Discuss the main types of data model with an example of each. What are integrity constraints and how does multiplicity model

- (a) Discuss the main types of data model with an example of each.
(b) What are integrity constraints and how does multiplicity model these constraints?

- (a) Discuss the main constraints and how do they affect the process of Specialization?
 - (b) What are integrity constraints and how do they affect the process of Specialization?
 - (c) Describe and contrast the process of Specialization with the process of Generalization.
- Q 3 (a) is compulsory.

3. Attempt any Two parts of the following. Q.3 (a) is compulsory.

- (a) Consider the following Employee_Details table
- | Employee Name | Salary |
|---------------|--------|
| ... | ... |

Employee Name	Salary
Elle	3300
Emily	8000
John	7000
Kelly	2300

Write SQL queries for the following:

- i. Get the names of all employees.
- ii. Find the names of all employees that start with 'E'.

- iii. Select first 3 characters of names of all employees.
- iv. Get position of 'o' in employee name 'John'.
- v. Get length of name of all employees.
- vi. Get name of employee Kelly after replacing 'K' with 'J'
- vii. Find the names of all employees whose salary is equal to or greater than 5000.
- viii. Get the names of all employees in upper case.
- (b) Explain the function of each of the Clauses in the SELECT statement. What restrictions are imposed on these clauses? 2
- (c) Discuss the differences between the five Join operations: Theta join, Equijoin, Natural join, Outer join, and Semijoin. Give examples to illustrate your answer. 2
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