

**Khulna University of Engineering & Technology**  
**Department of Industrial Engineering and Management**

B.Sc. Engineering 2<sup>nd</sup> Year 2<sup>nd</sup> Term Examination, 2015

**EEE 2211**

Electronics

Full Marks: 210

Time: 3hrs

- N.B:** i) Answer any **THREE** questions from each section in separate scripts.  
 ii) Figures in the right margin indicate full marks.  
 iii) Assume reasonable data if missing any.

**SECTION-A**

1. (a) What is meant by doping of semiconductor? Explain how depletion layer is formed in P-n junction. 13
- (b) Define P-n junction. Draw and explain the V-I characteristics of P-n junction. 10
- (c) Discuss the operation of Zener diode as a voltage stabilizer. Draw the output wave shape of the following shown in figure 1(c), if the input is  $V_i = 50\sin\omega t$ . 12

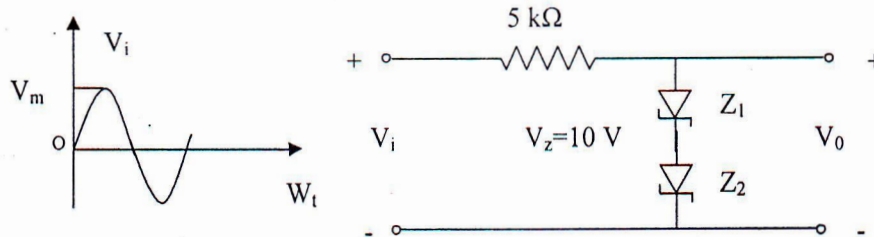


Figure 1(c)

2. (a) Explain the necessity of transistor biasing. Based on the readings provided in following figure 2(a), determine whether the network is operating properly, if not, explain the probable cause. 13

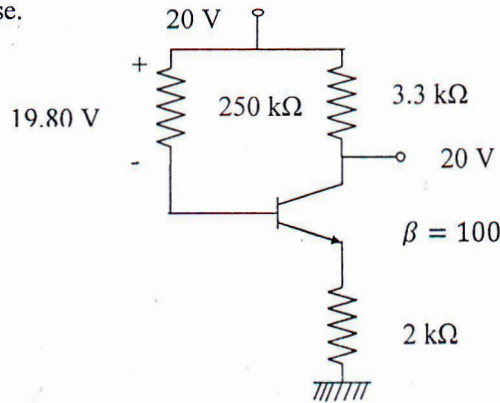


Figure 2(a)

- (b) How can a faithful amplification be achieved? Explain the operation of transistor as an amplifier. 10
- (c) Differentiate between JFET and BJT. Write down the working principle of MOSFET. 12
3. (a) Explain the V-I characteristics of an SCR. Also draw two transistor model of SCR. 13
- (b) Determine the dc bias voltage  $V_{CE}$  and current  $I_C$  for the following voltage divider biasing configuration shown in figure 3(b). Also find  $V_E$ ,  $I_E$  and draw the dc load line. 12

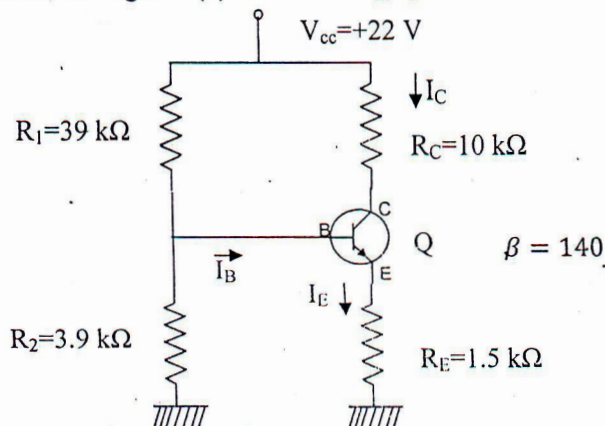


Figure 3(b)

3. (c) With proper circuit diagram and wave space, show that the maximum efficiency of a full wave bridge rectifier is 81.2%. 10
4. (a) Show that UJT can be used as a relaxation oscillator and also find its frequency of oscillation. 12
- (b) Define dielectric heating. Show that the power dissipated per unit volume is represented by,  $P = 0.555E^2f \epsilon_r (p.f) \times 10^{-12}$  watts/c.c in the case of dielectric heating, where the symbols have their usual meaning. 13
- (c) Draw the block diagram of a regulated power supply and explain briefly with wave shapes at different important parts. 10

**SECTION-B**

5. (a) What is meant by digital electronics? On the basis of application, explain the superiority of digital electronics over analog electronics. 05
- (b) Find the values of X: 08
- i)  $(1010.011)_2 = (X)_{10}$
- ii)  $(630.4)_8 = (X)_{10}$
- iii)  $(673.124)_8 = (X)_2$
- iv)  $(306.D)_{16} = (X)_2$
- (c) Write down the name, graphic symbol, algebraic function and truth tables of different logic gates. 12
- (d) What is meant by canonical form? Express the Boolean function,  $F = A + B'C$  in terms of minterms and maxterms. 10
6. (a) Simplify the Boolean function  $F(w, x, y, z) = \sum(1, 3, 7, 11, 15)$  that have the don't care conditions,  $d(w, x, y, z) = \sum(0, 2, 5)$ . 10
- (b) What is meant by universal gate? Implement the following Boolean function using NAND gate only.  $F = A(B + CD) + BC'$  10
- (c) Write down the truth table of adder circuit. Show that a full adder circuit can be implemented using two half adder circuits. 10
- (d) Prove "de-morgan" theorem using truth table. 05
7. (a) What is counter? Design a 3-bit binary counter using T-flip flops from its excitation table. 11
- (b) What is cathode ray tube? Explain different parts of a CRT. Also write down its advantages, disadvantages and applications. 12
- (c) What is meant by combinational and sequential circuit? 06
- (d) Define integrate circuit and prime implicant. 06
8. (a) Write short notes on: 08
- i) Thermistor ii) Thermo-couples
- (b) What is meant by transducer? What are the different types of temperature measurement devices? 07
- (c) What is meant by instrumentation? Mention different components of a typical instrumentation system. 08
- (d) What is shift register? Design a 4-bit serial transfer shift register. 12



**Khulna University of Engineering & Technology**  
**Department of Industrial Engineering and Management**

B.Sc. Engineering 2<sup>nd</sup> Year 2<sup>nd</sup> Term Examination, 2015

**IPE 2207**

(Probability and Statistical Analysis)

Full Marks: 210

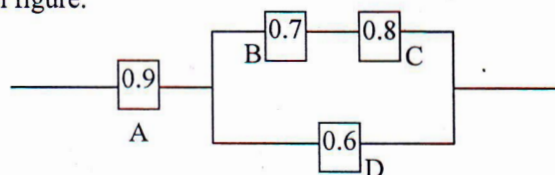
Time: 3 hrs

**N.B:** i) Answer any THREE questions from each section in separate scripts.  
 ii) Figures in the right margin indicate full marks.

**SECTION-A**

1. (a) Define the following terms: 10  
 i) Mean    ii) Median    iii) Standard deviation    v) Percentile
- (b) The probabilities that a husband and wife will be alive 20 years from now are given by 0.8 and 0.9 respectively. Find the probability that in 20 years 10  
 i) Both will be alive;  
 ii) Neither will be alive;  
 iii) At least one of them will be alive.
- (c) State the Bayes' rule. 05
- (d) At a certain university, 20% of the men and 4% of the women are over 6feet tall. Furthermore, 40% of the students are women. If a student is randomly selected and is observed to be over 6 feet tall, what is the probability that the student is a woman? 10
  
2. (a) Define random variable. 05
- (b) The proportion of people who respond to a certain mail-order solicitation is a continuous random variable X that has a density function 15  

$$f(x) = \begin{cases} \frac{2(x+2)}{5}, & 0 < x < 1 \\ 0 & \text{elsewhere} \end{cases}$$
 i) Show that  $P(0 < x < 1) = 1$ .  
 ii) Find the probability that more than  $1/4$  but fewer than  $1/2$  of the people contacted will respond to this type of solicitation.
- (c) A shipment of 7 television sets contains 2 defective sets. A hotel makes a random purchase of 3 of the sets. Find the probability distribution for the number of defective sets. 15
  
3. (a) Write down the properties of Poisson's distribution. 05
- (b) In testing a certain kind of truck tire over a rugged terrain, it is found that 25% of the trucks fail to complete the test run without a blowout. Of the next 15 trucks tested, find the probability that 15  
 i) From 3 to 8 have blowouts;  
 ii) Fewer than 5 have blowouts;  
 iii) More than 10 have blowouts.
- (c) Inventory is withdrawn from a stock of 10 items according to a poisson distribution at the rate of 2 items per day. Find the probability that 15  
 i) 6 items are withdrawn during the first 2 days;  
 ii) At most 4 items are withdrawn during the first 3 days;  
 iii) No items are left at the end of 4 days.
  
4. (a) What is meant by moment generating function (MGF) ? 05
- (b) Find the moment generating function of the binomial random variable X with parameters n and p, and then use it to verify that  $\mu = np$  and  $\sigma^2 = npq$ . 13
- (c) An electrical system consists of 4 components as illustrated in the following figure. Assume that each component work independently and the probability of working of each component is also shown in figure. 17





Find the probability that

- i) the entire system works;
- ii) The component C does not work, given that the entire system works.

**SECTION-B**

5. (a) Explain the significance of z-score in statistical analysis. 08
- (b) A company pays its employees an average wage of 1590 TK per week with a standard deviation of 150 tk. If the wages are approximately normally distributed 14
- i) What percentage of the workers receive wages between 1375 TK and 1622 TK.?
  - ii) The highest 5% of the employee weekly wages is greater than what amount?
- (c) The average life of a certain type of small motor is 10 years with a standard deviation of 2 years. The manufacturer replaces free all motors that fail while under guarantee. If he is willing to replace only 3% of the motors that fail, how long a guarantee should he offer? Assume that the lifetime of a motor follows a normal distribution. 13
6. (a) What is sampling error? State and explain the central limit theorem. 10
- (b) What is hypothesis testing? Explain the effect of level of significance in hypothesis testing. 10
- (c) A manufacturer of ketchup, uses a particular machine to dispense 16 ounces of its ketchup into containers. He knows the amount of ketchup in each container follows a normal distribution with a mean of 16 ounces and a standard deviation of 0.15 ounce. A sample of 50 containers filled last hour revealed the mean amount per container was 16.017 ounces. 15
- i) Does the evidence suggest that the mean amount dispensed is greater than 16 ounces? Use the 0.05 significance level.
  - ii) How strong your opinion is? Justify it.
7. (a) A production manager wants to compare the number of defective products produced on the day shift with the number on the afternoon shift. A sample of the production from 6 day shifts and 8 afternoon shifts revealed the following number of defects. 18
- |           |   |    |   |    |   |    |    |   |
|-----------|---|----|---|----|---|----|----|---|
| Day       | 5 | 8  | 7 | 6  | 9 | 7  |    |   |
| Afternoon | 8 | 10 | 7 | 11 | 9 | 12 | 14 | 9 |
- At the 0.05 significance level, is there a difference in the mean number of defects per shifts? Assume the population has equal standard deviation.
- (b) A national wide sample of influential republicans and democrats was asked as a part of a comprehensive survey whether they favored lowering environmental standards so that high sulfur coal could be burned in coal-fired power plants. The results were: 17
- |                 |             |           |
|-----------------|-------------|-----------|
|                 | Republicans | Democrats |
| Number sampled  | 1000        | 800       |
| Number in favor | 200         | 168       |
- At the 0.02 level of significance, can we conclude that there is a larger proportion of Democrats in favor of lowering the standards? Determine the P-value.
8. (a) Write down the characteristics of F-distribution. 03
- (b) Consider the following measurements of the heat producing capacity of the coal produced by two mines (in millions of calories per ton) 12
- |         |      |      |      |      |      |      |
|---------|------|------|------|------|------|------|
| Mine 1: | 8260 | 8130 | 8350 | 8070 | 8340 |      |
| Mine 2: | 7950 | 7890 | 7900 | 8140 | 7920 | 7840 |
- Using the 0.10 significance level, is there a difference in the variation of coal produced?
- (c) There are three hospitals in Khulna. The following data show the number of outpatient surgeries performed at each hospital last week. At the 0.05 significance level, can we conclude there is a difference in the mean number of surgeries performed by hospital or by day of the week? 20

	Number of surgeries performed		
	Hospital 1	Hospital 2	Hospital 3
Monday	14	18	24
Tuesday	20	24	14
Wednesday	16	22	14
Thursday	18	20	22
Friday	20	28	24



**Khulna University of Engineering & Technology**  
**Department of Industrial Engineering and Management**

B.Sc. Engineering 2<sup>nd</sup> Year 2<sup>nd</sup> Term Examination, 2015

**IPE 2229**

Industrial Psychology and Law

Full Marks: 210

Time: 3hrs

- N.B:** i) Answer any *THREE* questions from each section in separate scripts.  
ii) Figures in the right margin indicate full marks.  
iii) Assume reasonable data if missing any.

SECTION-A

1. (a) Define Psychology and Industrial Psychology. Describe the necessity of I-O Psychology. 12  
(b) What is socialization? Discuss the biological context and cultural context of socialization. 12  
(c) Describe the stages of Piaget cognitive development theory. 11
2. (a) What is motive? Define it in different perspective. 11  
(b) "Reinforcement affects behavior"-Justify the statement. 12  
(c) What is work-family conflict? Mention the sources of work-family with resolutions. 12
3. (a) What is group? Why are groups formed? Discuss. 11  
(b) Discuss group versus individual performance on additive task. 12  
(c) Explain process loss and team commitment concept of group. 12
4. (a) What is "Burnout"? How does leadership differ from management? 09  
(b) What is job descriptive index? Discuss the effect of job satisfaction on absence and turnover. 12  
(c) Describe the principles of propaganda. 14

SECTION-B

5. (a) Define factory? Write down the powers of inspector according to factory Act 1965. 12  
(b) What types of precautions are necessary in case of fire in any factory? Write down the laws of fencing machineries. 13  
(c) What are the provisions for hoists and lifts as described in factory Act 1965? 10
6. (a) What are the provisions for weekly holiday and festival holiday? 10  
(b) Mention the laws for canteens and first aid appliances in any factory. 12  
(c) Define the term director general. What are the restrictions on manufacture, sale of articles injurious to environment according to Bangladesh conservation Act 1995? 13
7. (a) Define trade union. What are the requirements for registration of a trade union? 12  
(b) What are the factors that should be taken into considerations while declaring any area as ecologically critical area as described in Bangladesh conservation Act 1997? 13  
(c) What are the requirements for issuing environmental clearance certificate of orange B and Red category? 10
8. (a) What are the penalties for illegal strike or lock-out and dual membership of trade unions? 11  
(b) Discuss unfair labor practices on the part of workmen, according to industrial relation ordinance 1969. 12  
(c) Write down the procedure and powers of labor court, according to industrial relation ordinance 1969. 12



**Khulna University of Engineering & Technology**  
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B.Sc. Engineering 2<sup>nd</sup> Year 2<sup>nd</sup> Term Examination, 2015

ME 2215

Thermal Engineering and Heat Transfer

Full Marks: 210

Time: 3 hrs

- N.B:** i) Answer any **THREE** questions from each section in separate scripts.  
ii) Figures in the right margin indicate full marks.  
iii) Assume reasonable data if missing any.

**SECTION-A**

1. (a) Define thermodynamic system. Explain the non-equilibrium and quasi-static process. 12  
(b) What is closed system? State and explain Corollary-1 of first law of thermodynamics. 13  
(c) State Zeroth law of thermodynamics. Show that work and heat are path function. 10
2. (a) Define IC engine. Explain the valve timing diagram of four stroke cycle diesel engine. 11  
(b) Write down the functions of following: 09  
    i) Piston ii) Connecting iii) Carburettor  
(c) An ideal diesel cycle operates on 1 kg of standard air with initial pressure of 1 bar and a temperature of 35° C. the pressure at the end of compression is 33 bar and the cut-off 6% of the stroke. Determine i) The compression ratio ii) The percentage clearance iii) The heat supplied iv) The heat rejected. 15  
Take  $\gamma = 1.4$  and  $C_p = 1 \text{ kJ/kgK}$ .
3. (a) What is steam boiler? Differentiate between boiler mountings and boiler accessories. 10  
(b) Briefly describe with a neat diagram, the construction and working of a Babcock and Wilcox water tube boiler. 15  
(c) What is a gas turbine? List the methods of improving the efficiency and specific output of a simple gas turbine. 10
4. (a) Define C.O.P and Tonne of refrigeration. What are the factors affect comfort air conditioning? 08  
(b) 1.5 kw per tonne of refrigeration is required to maintain the temperature of -40° C in the refrigerator. If the refrigeration cycle works on Carnot cycle, determine the following: 15  
    i) C.O.P of the cycle ii) Temperature of the sink iii) Heat rejected to the sink per tonne of refrigeration, and iv) Heat supplied and E.R.P, if the cycle is used as a heat pump.  
(c) Draw a line diagram of air conditioning system required in winter season. Explain the working of different components in the circuit. 12

**SECTION-B**

5. (a) What is the basic difference between heat transfer and thermodynamics? State Fourier's law of heat conduction. 08  
(b) Derive the three dimensional heat conduction equation in rectangular coordinate for constant thermal conductivity. 12  
(c) Consider an aluminum hollow sphere of inside radius  $r_1 = 2 \text{ cm}$ , outside radius  $r_2 = 6 \text{ cm}$ , and thermal conductivity  $k = 200 \text{ W/(m}\cdot\text{°C)}$ . The inside radius surface is kept at a uniform temperature  $T_i = 100^\circ \text{ C}$  and the outside surface dissipates heat by convection with a heat transfer coefficient  $h_\infty = 80 \text{ W/(m}^2\cdot\text{°C)}$  into the ambient air at temperature  $T_\infty = 20^\circ \text{ C}$ . Determine the outside surface temperature of the sphere and the rate of heat transfer from the sphere. 15
6. (a) Define fin efficiency. Prove that heat loss becomes maximum at the critical thickness of insulation. 10  
(b) Derive the expression of the steady-state temperature in the slab where the temperature of the slab is only dependent on time and the slab is subjected to mixed boundary condition. 12



6. (c) Using the lumped system analysis, determine the time required for a solid steel ball of Diameter  $D = 5$  cm [ $\rho = 7833$  kg/m<sup>3</sup>,  $C_p = 0.465$  kJ/(kg.°C) and  $k = 54$  w/(m.°C)] to cool from 600 to 200° C if it is exposed to an air stream at 50° C having a heat transfer coefficient  $h = 100$  w/(m<sup>2</sup>.°C). 13
7. (a) What is meant by LMTD? Derive an expression of LMTD for parallel flow heat exchanger. 12  
 (b) Define thermal boundary layer. Derive the expression of Reynolds-Colburn analogy. 11  
 (c) The exact expression for the local drag coefficient  $C_x$  for laminar flow over a flat plate is given by  $c_x = \frac{0.664}{Re_x^{1/2}}$ , air at atmospheric pressure and  $T_\infty = 350$  K flows with a velocity of 30 m/s over a flat plate  $L = 0.2$  m long. Determine the drag force acting per 1-m width of the plate. 12
8. (a) Define view factor. Derive the reciprocity relationship between two elemental surfaces  $dy_1$  and  $dy_2$ . 10  
 (b) Explain the concept of black body in relation to radiation. 05  
 (c) Write short note on: 08  
 i) Radiating surface ii) Gray body iii) Solar radiation iv) Transmissivity  
 (d) Consider two large parallel plates, one at  $T_1$  K with emissivity  $\epsilon_1 = 0.8$  and the other at  $T_2$  K with emissivity  $\epsilon_2 = 0.4$ . An aluminum radiation shield with an emissivity  $\epsilon_3 = 0.05$  is placed between the plates. Sketch the radiation network for the system with and without the radiation shield. Calculate the percentage reduction in heat exchanger rate resulting from the radiating shield. 12

**Khulna University of Engineering & Technology**  
**Department of Industrial Engineering and Management**  
 B.Sc. Engineering 2<sup>nd</sup> Year 2<sup>nd</sup> Term Examination, 2012  
**ME 2213**  
 Mechanics of Solids

Full Marks: 210

Time: 3 hrs

**N.B:** i) Answer any **THREE** questions from each section in separate scripts.  
 ii) Figures in the right margin indicate full marks.  
 iii) Assume reasonable data if missing any.

**SECTION-A**

1. (a) An aluminium rod is rigidly attached between a steel rod and a bronze rod as shown in figure 1(a). Find the maximum value of  $P$  that will not exceed a stress in steel of 140 Mpa in aluminium of 70 Mpa or in bronze of 100 Mpa. 12

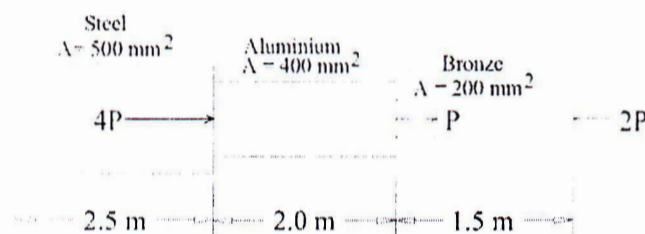


Figure 1(a)

- (b) A rigid bar of negligible weight is supported as shown in figure 1(b). If  $W=70\text{KN}$ , compute the temperature change that will cause the stress in the steel rod to be 55Mpa. Assume  $\alpha = 11.7 \mu\text{m}/(\text{m}.\text{°C})$  for steel and  $\alpha = 18.9 \mu\text{m}/(\text{m}.\text{°C})$  for bronze. 10

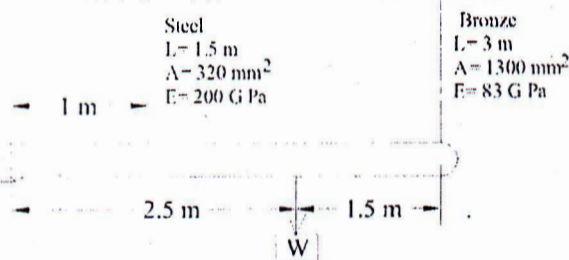


Figure 1(b)

- (c) The rigid bars AB and CD are supported by pins at A and C and the two rods. Determine the maximum force  $P$  that can be applied as shown in figure 1(c) if its vertical movement is limited to 10 mm. Neglect the weights of all members. 13

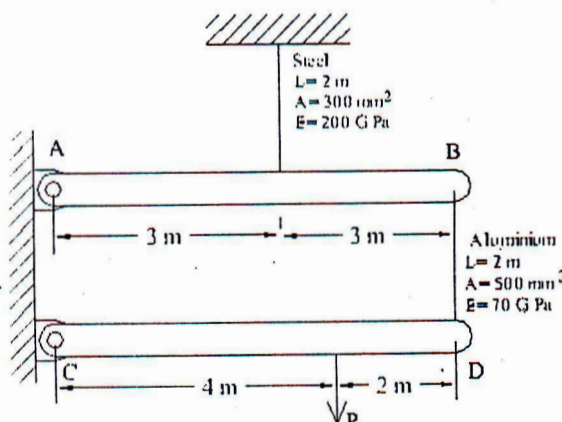


Figure 1(c)



2. (a) Derive torsion formula with assumption and hence deduce the relation between maximum shear stress and applied torque. 10

(b) The steel shaft rotates at 4Hz with 35 KW takes off at A, 20 KW applied at B and 55 KW removed at C as shown in figure 2(b). Using  $G=83\text{Gpa}$ , find maximum shearing stress and angle of rotation of gear A related to gear C. 12

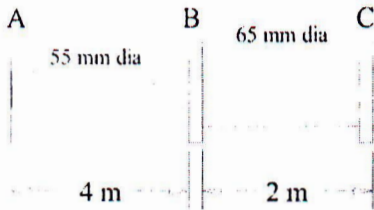


Figure 2(b)

(c) A rigid bar is supported by two identical springs of 20 turns and  $\frac{3}{4}$  in diameter wire having a mean diameter of 6 in as shown in figure 2(c). Determine the maximum load W that may supported if the shearing stress in the springs is limited to 20 ksi. 13

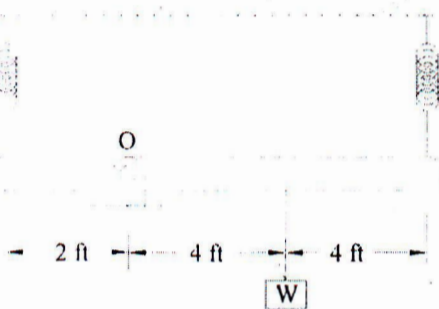


Figure 2(c)

3. (a) Draw moment and load diagrams corresponding to the given shear diagram shown in figure 3(a). Specify values at all change of load positions and at all points of zero shear. 17

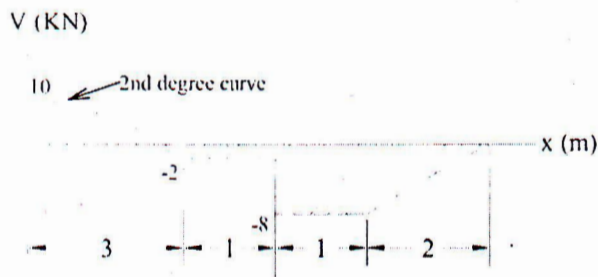


Figure 3(a)

(b) A T section shown in figure 3(b) is the cross section of a beam formed by joining two rectangular pieces of wood together. The beam is subjected to a maximum shearing force of 60 KN. Show that the NA is 34mm from the top and that  $I_{NA} = 10.57 \times 10^6 \text{mm}^4$ . Using these values, determine the shearing stress (i) at the neutral axis and (ii) at the junction between the two pieces of wood. 18

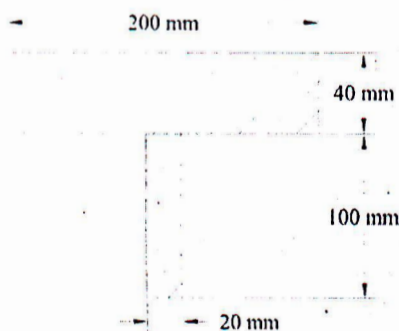
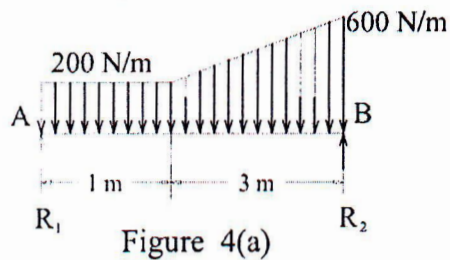
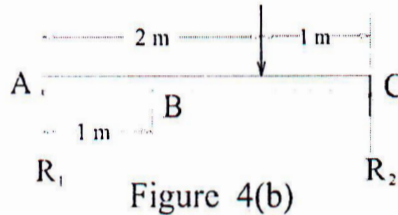


Figure 3(b)

4. (a) The beam loaded as shown in figure 4(a). Compute the moment of area of the moment diagram between the reactions about both the left and right reaction. 17

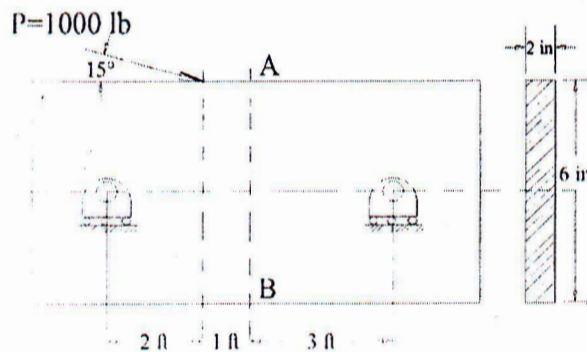


- (b) The simple beam supports a concentrated load of 300 N at 2m from the left support as shown in figure 4(b). (i) Compute the value of  $EI\delta$  at B, which is 1m from the left support. (ii) Locate the position of maximum deflection and compute the maximum  $EI\delta$ . 18

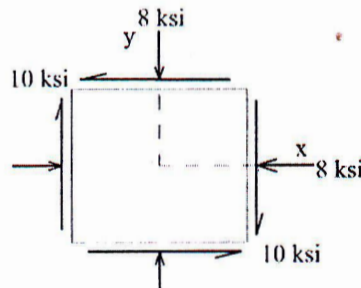


**SECTION-B**

5. (a) For the 2 in by 6 in wooden beam as shown in figure 5(a), determine the normal stresses at A and B. Are these points of maximum normal stress? If not, where are they located and what are their values? 17



- (b) For the state of stress shown in figure 5(b), determine normal and shearing stresses on the planes whose normals are at  $40^\circ$  and  $130^\circ$  with the x axis. Show these stresses on a sketch of the element. 18



6. (a) A shaft 100 mm in diameter that rotates at 30 Hz is subjected to bending loads that produce a maximum bending moment of  $2500\pi$  N.m. Determine the torque that can also act simultaneously on the shaft without exceeding a shearing stress  $\tau = 80$  Mpa or a normal stress  $\sigma = 100$  Mpa. What is the maximum power that can be transmitted by the shaft? 17



- (b) A steel column 20 cm by 30 cm in section has an effective length of 10m. Compute the maximum load that can be carried at an eccentricity of 50 cm from the weaker axis. Assume  $\sigma_j = 290$  Mpa and  $E = 200$  Gpa. The column also carries an axial load of 10 KN. 18
7. (a) What are the limitations of Euler formula? Two C310  $\times$  45 channels are latticed together so they have equal moments of inertia about the principle axes. Determine the minimum length of a column having this section, assuming pinned ends,  $E = 200$  Gpa and a proportional limit of 240 Mpa. What safe load will the column carry for a length of 10 m with a factor of safety of 2.5? 18
- (b) A W14  $\times$  90 section is to be used as a column with a length of 30 ft. The column supports an axial load of 65 kips and an eccentric load of 90 kips acting on the Y axis. Determine the maximum eccentricity of the 90 kip load using the maximum stress approach and the AISC specifications with  $\sigma_{yp} = 50$  ksi and  $E = 29 \times 10^6$  psi. 17
8. (a) A gusset plate is riveted to a larger plate by four 22 mm rivets arranged and loaded as shown in figure 8(a). Determine the maximum shear stress and minimum shear stress developed in the rivets. 17

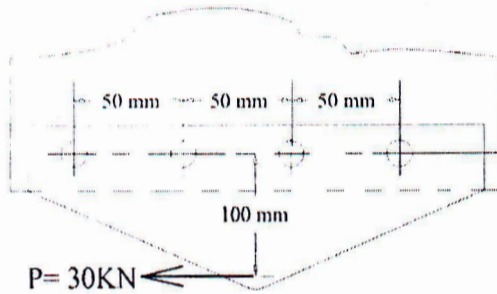


Figure 8(a)

- (b) For the riveted connection as shown in figure 8(b), determine the allowable load P if the shearing stress in the 25 mm rivets is limited to 140 Mpa. 18

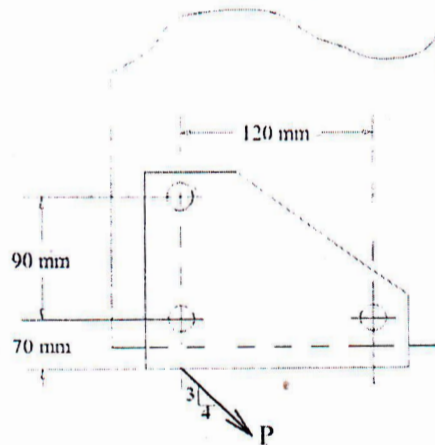


Figure 8(b)