Code: 9A03501

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**THERMAL ENGINEERING II**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Why ideal regenerative cycle cannot be practically possible?
(b) What are the advantages of a regenerative feed heating in steam power cycle?

2 (a) What do you understand by the term “Boiler Draught”? What are the various types of draughts used in usual practice?
(b) How much air is used/kg of coal burnt in a boiler having chimney of 35 m height to create a draught of 20 mm of water, when the temperature of flue gas in the chimney is 370ºC and the boiler house temperature is 34ºC. Does this chimney satisfy the condition of maximum discharge?

3 Explain the phenomenon of superheated expansion of steam and its effect on the discharge from a nozzle as compared to with expansion in thermal equilibrium condition. Give some idea of limits within which condition of supersaturation may exist.

4 Find the optimum ratio of blade speed to steam speed for a two-stage velocity-compounded impulse turbine. How diagram efficiency varies with blade-steam velocity ratio with the increase in number of stages?

5 Explain the working of a single-stage reaction turbine. Sketch pressure and velocity variations along the axis of the turbine. Show the expansion on h-s chart.

6 (a) Classify the steam condensers.
(b) Why is the steam condenser used in each power plant unit?

7 In a closed cycle gas turbine there is two-stage compressor and a two-stage turbine. All the components are mounted on the same shaft. The pressure and temperature at the inlet of the first-stage compressor are 1.5 bar and 20ºC. The maximum cycle temperature and pressure are limited to 750ºC and 6 bar. A perfect intercooler is used between the two-stage compressors and a reheater is used between the two turbines. Gases are heated in the reheater to 750ºC before entering into the L.P turbine. Assuming the compressor and turbine efficiencies as 0.82. Calculate (i) efficiency of cycle without regenerator (ii) efficiency of cycle with a regenerator whose effectiveness is 0.70. (iii) mass of the fluid circulated if the power developed by the plant is 350 kW. The working fluid used in the cycle is air.

8 Explain using a neat sketch, the principle of operation of turbo jet engine.

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III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**THERMAL ENGINEERING II**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 Dry saturated steam at 15 bar absolute is supplied to a steam turbine. The exhaust takes place at 1.1 bar. Determine (a) Rankine efficiency neglecting pump work (b) pump work (c) work ratio (d) steam consumption per kWhr if efficiency ratio is 0.65 (d) thermodynamic mean temperature of heat addition (e) Carnot efficiency for a given pressure limit using steam as a working substance. By introducing a jet condenser the exhaust pressure is reduced to 0.2 bar, find the percentage increase in Rankine efficiency, percentage decrease in steam consumption and percentage increase in moisture content.

2 (a) Define the chimney efficiency and find out expression for the same.
(b) Find the height of chimney necessary to produce a draught of 30 mm of water column. The atmospheric air temperature is 217ºC. Air fuel ratio is 13.5. What will be the power required if induced draught fan is used for producing the above draught? Fuel consumption is 1500 kg/hr.

3 (a) What is the function of a nozzle? Explain about various types of nozzles.
(b) Derive an expression for velocity of flow through a nozzle.

4 The rotor of an impulse turbine is 60 cm in diameter runs at 9600 rpm. The nozzles are at 20º to the plane of the wheel and the steam leaves at 600 m/s. The blade outlet angle is 30º and the friction factor is 0.8. Determine the power developed and diagram efficiency.

5 (a) Give a comparison between impulse turbine and reaction turbine.
(b) What is by-pass governing? Compare it with throttle governing.

6 The pressure under the air baffle of a surface condenser is 52 mm of hg. Temperature of the mixture leaving the cooler suction is 25ºC. Assuming available water at 15.5ºC and external water might lower the temperature further at 20ºC. Explain the effect of this on the quantity of vapour accompanying the air pump suction.

7 (a) What are the deviations in actual gas turbine cycle as compared with air standard cycle?
(b) Define isentropic efficiency of a compressor and turbine.

8 A turbo-jet engine consumes air at the rate of 60.2 kg/s when flying at a speed of 1000 km/h. Calculate: (i) Exit velocity of the jet when the enthalpy change for the nozzle is 230 kJ/kg and velocity coefficient is 0.96. (ii) Fuel flow rate is kg/s when air-fuel ratio is 70:1 (iii) thrust specific fuel consumption (iv) Thermal efficiency of the plant when the combustion efficiency is 92% and calorific value of fuel used is 42000 kJ/kg.

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Code: 9A03501

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**THERMAL ENGINEERING II**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Explain why reheat cycle is not used for low boiler pressures.
(b) What are the desirable properties of a fluid for use as working substance in a steam engine plant?

2 Explain the procedure to draw the heat balance sheet.

3 (a) Mention the types of nozzles. Where are these used?
(b) The dry saturated steam is expanded from 10 bar to 6 bar in a nozzle. If the expansion is supersaturated, determine the degree of under cooling and degree of super - saturation.

4 The nozzles of a de-Lavel turbine delivers 1.5 kg/s of steam at a speed of 800 m/s to a ring of moving blades having a speed of 200 m/s. The exit angle of the nozzle is 18º. If the blade velocity coefficient is 0.75 and the exit angle of the moving blades is 25º, calculate (i) inlet angle of moving and fixed blades (ii) diagram efficiency (iii) energy lost in blades per second (iv) power developed (v) axial thrust on the turbine rotor.

5 At a stage in a reaction turbine, the mean blade ring diameter is 1 m. The turbine runs at 3000 rpm. The blades are designed for a degree of reaction of 50% with exit angles of 30º and inlet angles of 50º. The turbine is supplied with a steam at 10000 kg/h and the stage efficiency is 85%. Determine (i) power output of the stage (ii) specific enthalpy drop in kJ/kg (iii) percentage increase in relative velocity of steam over moving blades (iv) the specific steam consumption.

6 (a) State briefly the sources and effect of air leakage into a condenser. Discuss.
(b) Why are non-condensable gases removed from the surface condensers continuously? Explain the function of Edward air pump.

7 (a) Differentiate between closed cycle and open cycle gas turbine plant.
(b) Define effectiveness of a regenerator.

8 For the combustion of 420 kg of petrol, a flying missile has a range of 240 km; an average velocity of 576 km/h and a propulsive force of 2700 N. The maximum temperature rise in the combustion chamber is 815ºC. The diameter of the discharge nozzle is 30 cm. The altitude of the flight is 610 m, where the atmospheric pressure is 0.944 bar. The calorific value of the fuel is 42000 kJ/kg. $C_p$ for exhaust gases can be taken as 1.16 kJ/kgK. Calculate (i) air-fuel ratio (ii) exhaust gas temperature and their velocity relative to missile (iii) propulsive efficiency (iv) overall efficiency of the unit.

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Code: 9A03501

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**THERMAL ENGINEERING II**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 Explain the working and analysis of the regenerative Rankine cycle with one-feed-water heater.

2 (a) What is the use of preheater in high pressure boiler?
(b) Explain the working of an economizer with a neat sketch.

3 For a nozzle, show the area on p-v diagram which represents the conversion of heat energy to kinetic energy. Prove that this area equals the heat drop during expansion. Assume isentropic flow in a nozzle. Further show the expansion for steam on T-s and h-s charts and for air on T-s chart.

4 In an impulse turbine, the steam issues from the nozzle with a speed of 600 m/s and blade speed is 120 m/s. The velocity is compounded by passing the steam through a ring of moving blades, through a ring of fixed blades and finally through a ring of moving blades. The nozzle angle is 18º and the blade exit angles and relative velocity coefficients are the following:

| Blades | Exit angle | Velocity coefficient |
|---|---|---|
| First row moving blades | 20º | 0.8 |
| Fixed-row blades | 25º | 0.85 |
| Second-row moving blades | 30º | 0.9 |

Find the diagram efficiency under these conditions and power output for steam flow rate of 5 kg/s. What would be the maximum possible diagram efficiency for given steam inlet velocity and nozzle angle?

5 A Parsons steam turbine delivers dry saturated steam at 2.8 bar from the fixed blades at 85 m/s. The mean blade height is 50 mm and the moving blade exit angle is 20º. The axial flow velocity of the steam is 75% of the blade velocity at the mean radius. Flow rate of steam is 3 kg/s. Effect of the blade tip thickness on the annulus area can be neglected. Find (i) the rotational speed (ii) power and efficiency (iii) the enthalpy drop of the steam in this stage.

6 (a) Draw the schematic diagram of low level counterflow jet condenser and explain its working principle.
(b) What are the advantages and limitations of surface condensers over jet condensers?

7 Discuss briefly the methods employed for improvement of thermal efficiency of open cycle gas turbine plant.

8 (a) What is meant by jet propulsion system?
(b) Derive efficiency of a diffuser. Show it on h-s plot.

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**Code: 9A03502**

B.TECH III Year I Semester (R09) Regular & Supplementary Examinations November 2012

# DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

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1. (a) Write a short note on gyroscope.
   (b) An aeroplane runs at 600 km/h. The rotor of the engine weighs 4000 N with radius of gyration of 1 metre. The speed of rotor is 3000 r.p.m. in anticlockwise direction when seen from rear side of the aeroplane. If the plane takes a loop upwards in a curve of 100 metres radius, find (1). Gyroscopic couple developed: and. (2) Effect of reaction gyroscopic couple developed on the body of aeroplane.

2. (a) What is meant by the expression 'friction circle'? Deduce an expression for the radius of friction circle in terms of the radius of the journal and the angle of friction.
   (b) An effort of 1500 N is required to just move a certain body up an inclined plane of angle 12°, force acting parallel to the plane. If the angle of inclination is increased to 15°, then the effort required is 1720 N. Find the weight of the body and the coefficient of friction.

3. (a) What is a clutch? Make a sketch of a single-plate clutch and describe it's working.
   (b) A cone clutch is to transmit 7.5 kW at 900 r.p.m. The cone has a face angle of 12°. The width of the face is half of the mean radius and the normal pressure between the contact faces is not to exceed 0.09 N/mm$^2$. Assuming uniform wear and the coefficient of friction between contact faces as 0.2. Find the main dimensions of the clutch and the axial force required to engine the clutch.

4. (a) Draw the turning moment diagram of a single cylinder double acting steam engine.
   (b) The crank of a three-cylinder single-acting engine are set equally at 120°the engine speed is 540 rpm. The turning-moment diagram for each cylinder is a triangle for the power stroke with a maximum torque of 100 .m at 60°after dead-centre of the corresponding crank. On the return stroke, the torque is sensibly zero. Determine
      (a) The power developed.
      (b) The coefficient of fluctuation of speed if the flywheel has a mass of 7.5 kg with a radius of gyration of 65 mm.
      (c) The coefficient of fluctuation of energy.
      (d) The maximum angular acceleration of the flywheel.

5. A proell governor has equal arms of length 300 mm. The upper and lower ends of the arms are pivoted on the axis of the governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the balls are 150 mm and 200 mm. The mass of each ball is 10 kg and the mass of the central load is 100 kg. Determine the range of speed of the governor.

6. (a) Two masses in different planes are necessary to rectify the dynamic unbalance comment.
   (b) A shaft with 3 metres span between two bearings carries two masses of 10 kg and 20 kg acting at the extremities of the arms 0.45 m and 0.6 m long respectively. The planes in which these masses rotate are 1.2 m and 2.4 m respectively from the left end bearing supporting the shaft. The angle between the arms is 60°. The speed of rotation of the shaft is 200 rpm if the masses are balanced by two counter masses rotating with the shaft acting at radii of 0.3 m and placed at 0.3 m from each bearing centers. Estimate the magnitude of the two balance masses and their orientation with respect to the X—axis, i.e mass of 10 kg.

***Contd. in page 2***

7. Derive the following expressions, for an uncoupled two cylinder locomotive engine:
   (a) Variation in tractive force.
   (b) Swaying couple and
   (c) Hammer blow.

8. (a) What are free damped and forced vibrations? Explain.
   (b) The following data are given for a vibratory system with viscous damping; Mass2.5 kg; spring constant=3 N/mm and the amplitude decreases to 0.25 of the initial value after five consecutive cycles. Determine the damping coefficient of the damper in the system.

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**Code: 9A03502**

2

B.TECH III Year I Semester (R09) Regular & Supplementary Examinations November 2012

# DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

*****

1. (a) Explain the application of gyroscopic principles to aircrafts.
   (b) The mass of the motor cycle along with the rider is 180 kg. The height of the centre of gravity of total mass is 60 cm above the ground when it moves straight. Each wheel has diameter equal to 70 cm and polar mass moment of inertia of each wheel is 2 $kgm^2$. The engine rotates at a speed 5 times the road wheel and engine rotating parts have polar mass moment of inertia equal to 0.2 $kgm^2$. Determine the angle of heel required if motor cycle negotiates a curve of radius 100 m at a speed of 108 km/hr.

2. (a) A truncated conical pivot of cone angle $\phi$ rotating at speed N supports a load W. The smallest and largest diameter of the pivot over the contact area are d and D respectively. Assuming uniform wear, derive the expression for the frictional torque.
   (b) A 150 mm diameter valve against which a steam pressure of 2 $MM/m^2$ is acting is closed by means of a square threaded screw 50 mm in external diameter with 6 mm pitch. If the coefficient of friction is 0.12: Find the torque required to turn the handle.

3 (a) What is a brake? What is the difference between a brake and a clutch?
   (b) A Single dry plate clutch transmits 7.5 kW at 900 r.p.m. The axial pressure is limited to 0.07 $M/mm^2$. If the coefficient of friction is 0.25, find
      (1) Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4 and 2.
      (2) Outer and inner radii of the clutch plate.

4. (a) Explain the terms' fluctuation of energy' and 'fluctuation of speed' as applied to flywheels.
   (b) A vertical double action steam engine develops 75 kW at 250 r.p.m. The maximum fluctuation of energy is 30 per cent of the work done per stroke. The maximum and minimum speeds are not to vary more than I per cent on either side of the mean speed. Find the mass of flywheel required. If the radius of gyration is 0.6 m.

5. (a) Define and explain the following terms relating to governors:
      (i) Sensitiveness and
      (ii) Isochronisms.
   (b) The arms of a porter governor are 300 mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to the sleeve at a distance of 35 mm from the axis of rotation. The load on the sleeve is 54 kg and the mass of each ball is 7 kg determine the equilibrium speed when the radius of the balls is 225 mm. What will be the range of speed for this position if the frictional resistance to the motion of the sleeve are equivalent to a force of 30 N?

6. (a) Define and explain the term 'balancing of rotating masses' what will be the harm if the rotating parts of a high speed engine are not properly balanced?
   (b) A shaft carries five masses A,B,C,D and E which revolve at the same radius in planes which are equidistant from one another. The magnitude of the masses in planes A, C and D are 50 kg, 40 kg and 80 kg respectively. The angle between A and C is 90° and that between C and D is 135°. Determine the magnitude of the masses in planes B and E and their positions to put the shaft in complete rotating balance.

***Contd. in page 2***

7. (a) Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass.
   (b) The axes of a three-cylinder air compressor are at 120° to one another and their connecting rods are coupled to a single crank. The length of each connecting rod is 240 mm and the stroke is 160 mm. The reciprocating parts have a mass of 2.4 kg per cylinder. Determine the primary and secondary force if the engine runs at 2000 rpm.

8. (a) Discuss the effect of inertia of a shaft on the free torsional vibrations.
   (b) Calculate the whirling speed of a shaft 20 mm diameter and 0.6 m long carrying mass of 1 kg at its mid-point. The density of the shaft material is 40 $Mg/m^3$ , and ;young's modulus is 200 $GN/m^2$ .Assume the shaft to be freely supported.

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**Code: 9A03502**

3

B.TECH III Year I Semester (R09) Regular & Supplementary Examinations November 2012

# DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

*****

1. (a) Explain the special characteristics exhibited by the gyroscope when it is operating.
   (b) The rotor of a turbine installed in a boat with its axis along the longitudinal axis of the boat makes 1500 r.p.m. clockwise when viewed from the stern? The rotor has a mass of 750 kg and a radius of gyration of 300 mm. If at an instant the boat pitches in the longitudinal vertical plane so that the bow rises from the horizontal plane with an angular velocity of 1 rad/s, determine the torque acting on the boat and the direction in which it tends to turn the boat at the instant?

2. (a) State the laws of static and dynamic friction.
   (b) A conical pivot bearing supports a vertical shaft of 200 mm diameter. It is subjected to a load of 30 kN. The angle of the cone is 120° and the coefficient of friction is 0.025. Find the power lost in friction when the speed is 140 r.p.m. assuming.
      (i) Uniform pressure and
      (ii) Uniform wear.

3. (a) Describe the working of a band and block brake with the help of a neat sketch. Deduce the relation for ratio of tight and slack side tensions.
   (b) A conical friction clutch is used to transmit 90 kW at 1500 r.p.m. The semi cone angle is 20° and the coefficient of friction is 0.2. If the mean diameter of the bearing surface is 375 mm and the intensity of normal pressure is not to exceed 0.25 n/mm$^2$ , find the dimensions of the conical bearing surface and the axial load required.

4. (a) Define the terms 'coefficient of fluctuation of energy' and 'coefficient of fluctuation of speed' in the case of flywheels.
   (b) The turning moment diagram for a multi cylinder engine has been drawn to a scale of 1 mm =4500 N-m vertically and 1 mm=2.4° horzontally. The intercepted areas between output torque curve and mean resistance line take in order from one end are 342,23,245,303,115,232,227,164 mm$^2$, when the engine is running at 150 r.p.m. If the mass of the flywheel is 1000 kg and the total fluctuation of speed does not exceed 3% of the mean speed, find the minimum value of the radius of gyration.

5. (a) Define and explain the following terms relating to governors:
      (i) Stability and (ii) Hunting.
   (b) In a porter governor, the mass of the central load is 18 kg and the mass of each ball is 2 kg. The top arms are 250 mm while the bottom arms are each 300 mm long. The friction of the sleeve is 14 N. If the top arms make 45° with the axis of rotation in the equilibrium position. Find the range of speed of the governor in that position.

6. (a) What is meant by static and dynamic unbalance in machinery? How can the balancing be done?
   (b) Four masses A,B,C and D are attached to a shaft and revolve in the same plane. The masses are 12 kg ,10 kg, 18 kg and 15 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm the angular position of the masses B,C and D are 60° and 135° and 270° from the mass A. Find the magnitude and position of the balancing mass at a radius of 100 mm.

***Contd. in page 2***

7. The cylinder axes of a V-engine are at right angle to each other. The weight of each piston is 2 kg and of each connecting rod 2.8 kg the weight of the rotating parts like crank webs and the crank pin is 1.8 kg. The connecting rod is 400 mm long and its centre of mass is 100 mm from the crank pin centre. The stroke of the piston is 160 mm. Show that the engine can be balance d for the revolving and the primary force by a revolving counter mass. Also, find the magnitude and the position if its centre of mass from the crankshaft centre is 100 mm. What is the value of the resultant secondary force if the speed is 840 rpm?

8. (a) Deduce an expression for the natural frequency of free transverse vibrations for a beam fixed at both ends and carrying a uniformly distributed mass of 'm' kg per unit length.
   (b) Explain the term logarithmic decrement, as applied to damped vibrations.

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**Code: 9A03502**

4

B.TECH III Year I Semester (R09) Regular & Supplementary Examinations November 2012

# DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

*****

1. (a) Explain the special characteristics exhibited by the gyroscope when it is operating?
   (b) A four wheel trolley car of total mass 2000 kg running on rails of 1 m gauge, rounds a curve of 25 m radius at 40 km/h. The track is banked at 10°. The wheels have an external diameter of 0.6 m and each pair of an axle has a mass of 200 kg. The radius of gyration for each pair is 250 mm. The height of C.G. of the car above the wheel base is 0.95 m, allowing for centrifugal force and gyroscopic couple action; determine the pressure on each rail.

2. (a) What is meant by the expression friction circle? Deduce an expression for the radius of friction circle in terms of radius of the journal and angle of friction.
   (b) A conical pivot bearing supports a vertical shaft of 200 mm diameter. It is subjected to a load 30 kN. The angle of the cone is 120° and the coefficient of friction is 0.025. Find the power lost in friction when the speed is 140 r.p.m. assuming?
      (i) Uniform pressure and (ii) Uniform wear.

3. (a) Explain function of absorption type dynamometer.
   (b) A car moving on a level road at a speed km/h has a wheel base 2.8 meters, distance of C.G. from ground level 600 mm, and the distance of C.G. from rear wheels 1.2 meters. Find the distance travelled by the car before coming to rest when brakes are applied.
      (i) To the rear wheels.
      (ii) To the front wheels and
      (iii) To all the four wheels. The coefficient of friction between the tyres and the road may be taken as 0.6.

4. (a) What is meant by piston effort and crank effort?
   (b) The turning moment diagram for a four stroke gas engine may be assumed for simplicity to be represented by four triangles , the areas of which from the line of zero pressure are as follows: Expansion stoke=3550 $mm^2$: exhaust stroke=500 $mm^2$: suction stroke=350 $mm^2$: and compression stroke=1400 $mm^2$. Each $mm^2$ represent 3 N-m. Assuming the resting moment to be uniform. Find the mass of the rim of a flywheel required to keep the mean speed 200 r.p.m with $\pm 2\%$ . The mean radius of the rim may be taken as 0.75 m. Also determine the crank positions for the maximum and minimum speeds.

5. (a) What are the effects of friction and of adding a central weight to the sleeve of a watt governor?
   (b) A loaded governor of the porter type has equal arms and links each 250 mm long. The mass of each ball is 2 kg and the central mass is 12 kg. When the ball radius is 150 mm, the valve is fully open and when the radius is 185 mm, the valve is closed? Find the maximum speed and the range of speed. If the maximum speed is to be increased 20% by an addition of mass to the central load. Find what additional mass is required?

6. (a) Discuss how a single revolving mass is balanced by two masses revolving in different planes.
   (b) Four masses A,B.C and D revolve at equal radii and are equally spaced along a shaft. The mass B is 7 kg and the radii of C and D make angles of 90° and 240° respectively with the radius of B. Find the magnitude of the masses A. C and D and the angular position of A so that the system may be completely balanced.

***Contd. in page 2***

7. The following data refer to a two cylinder uncoupled locomotive:

| | | |
|---|---|---|
| Rotating mass per cylinder | = | 280 kg |
| Reciprocating mass per cylinder | = | 300 kg |
| Distance between wheels | = | 1400 mm |
| Distance between cylinder centres | = | 600 mm |
| Diameter of treads of driving wheels | = | 1800 mm |
| Crank radius | = | 300 mm |
| Radius of centre of balance mass | = | 620 mm |
| Locomotive speed | = | 90° |
| Dead load on each wheel | = | 3.5 tonne. |

Determine

(i) The balancing mass required in the planes of driving wheels if whole of the revolving and two-third of the reciprocating mass are to be balanced.
(ii) The swaying couple.
(iii) The variation in the attractive force.
(iv) The maximum and minimum pressure on the rails.
(v) The maximum speed of locomotive without lifting the wheels from the rails.

8. (a) Define, in short, free vibrations, forced vibrations and damped vibrations.
(b) A shaft 1.5 m long, supported in flexible bearings at the ends carries two wheels each of 50 kg mass. One wheel is situated at the centre of the shaft and the other at a distance of 375 mm from the centre towards left. The shaft is hollow of external diameter 75 mm and internal diameter 40 mm. The density of the shaft material is 7700 kg/ $m^3$ and modulus of elasticity is 200 $GN/m^2$. Find the lowest whirling speed of the shaft, taking into account the mass of the shaft.

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Code: 9A03503

1

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**MACHINE TOOLS**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 Differentiate orthogonal cutting and oblique cutting with neat sketches.

2 Explain various work holding and tool holding device used on turret and capstan lathes.

3 (a) How is the size of the shaper determined?
(b) How are shapers classified?

4 Explain various operations performed on a drilling machine in detail.

5 Classify and explain briefly, various types of column and knee type milling machines.

6 (a) What do you understand by a silicate bond?
(b) What are the advantages and disadvantages of this bond?

7 (a) Compare and contrast broaching and honing.
(b) List the application of broaching.

8 Discuss the importance considerations in jig and fixture design.

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Code: 9A03503

2

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**MACHINE TOOLS**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 With a neat sketch, explain the basic elements of any machining operation.

2 List various tools and attachments used on turret and capstan lathe. Explain some of them.

3 (a) Explain the importance of slotting machine in a machine shop.
(b) Explain the operations performed on a slotting machine.

4 (a) What do you mean by drilling, milling and boring?
(b) How do they differ from each other?

5 Classify and explain various types of milling machine.

6 Explain various types of bond materials used in a grinding wheel.

7 With an example, explain how machining time can be calculated for a broaching machine.

8 Explain the main principles of design of jigs and fixtures.

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Code: 9A03503

3

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**MACHINE TOOLS**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 Discuss about various types of chips produced during machining of various metals with neat figures.

2 (a) Describe the different methods of feeding the tool in thread cutting.
(b) What is under cut? Why is it provided?

3 Classify and explain the basic operations that are done on a shaper.

4 (a) How is drill size determined?
(b) What is the importance specification of a twist drill?

5 (a) How is production milling machine different from fixed bed type milling machine?
(b) Explain various types of production milling machine?

6 How are grinding machines classified? Explain various types.

7 (a) Compare and contrast broaching and grinding.
(b) List the application of broaching.

8 Discuss the important conditions that must be satisfied by a successfully designed jig.

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Code: 9A03503

4

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**MACHINE TOOLS**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 Explain various methods and means of chip breaking.

2 Explain with a neat sketch, the working of an engine lathe.

3 Explain various quick return mechanisms used for shaper machine.

4 What is a twist drill? With a neat sketch explain the principal parts of a twist drill.

5 (a) What is hand milling machine? Explain its uses.
(b) What are the planer type milling machines? Explain their features.

6 What is drilling? Explain the working principle involved in it. Describe the basic components of a grinding machine.

7 Briefly the constructional features of lapping and broaching machines.

8 Discuss in detail the advantages of using jigs and fixtures in mass production.

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Code: 9A03504

1

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**DESIGN OF MACHINE ELEMENTS I**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) What is the need of standardization? Explain different types of standardization and advantages of each.

(b) Explain the basic procedure for mechanical engineering design.

2 A rod of 20 mm diameter and 400 mm long is subjected to: a weight of 1.2 kN falls through a height of 2 mm, before striking a collar, provided at the lower end of the rod. Take E = 2.1 x $10^5$ N/$mm^2$. (i) Determine the stress induced. (ii) Compare this impact stress with the one produced from the same load that acts as a static load. (iii) How much the rod length is changed so that the impact stress induced is 120 MPa? (iv) How much the height of fall is changed so that the impact stress induced is 120 MPa?

3 (a) Explain the various types of varying stress.

(b) Determine the maximum stress produced in a rectangular plate 50 mm wide, 8 mm thick with a central hole of 10 mm. It is loaded in an axial tension of 1 kN as shown in figure-3.2.

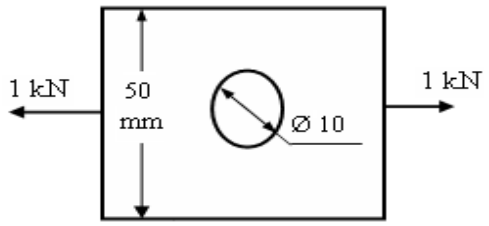


Figure-3.2

4 (a) A single riveted lap joint, joining two mild steel plates of 10 mm thick each, is required to resist each a load of 200 kN. Determine the diameter, pitch, and number of rivets required for the joint. The allowable stresses for both plate and rivet material is 60 MPa in tensile, 90 MPa in compression and 45 MPa in shear.

(b) Explain caulking and fullering with respect to the riveted joint.

5 (a) What hole must be drilled in the head of the bolt M 36, to make uniform strength?

(b) A bolt is used to fasten two members together. The members and the bolt are of the same material and have the same cross section area. Determine what external load $W_2$ will cause separation of the members to occur if the initial tightening load $W_1$ is 20 kN.

Contd. in Page 2

6 Design the chain (Knuckle) link to withstand a load of 40 kN. Use the following allowable stresses.
For links: tensile strength = 60 N/mm$^2$ Shear Strength = 35 N/mm$^2$ and Compression Strength = 65 N/mm$^2$.
For Pin: Shear Strength = 30 N/mm$^2$ and Bearing Strength = 65 N/mm$^2$.

7 (a) What is torsional rigidity of a shaft? How is a shaft designed for torsional rigidity?
(b) Determine the inside and outside diameters of a hollow shaft which will replace a solid shaft made of the same material and be equally as strong as solid one and also have only half the weight of solid one.

8 A vertical turbine shaft employs a solid flanges coupling and transmits 3 MW of power at 120 rpm. The shaft lengths are hollow having $d_i/d_o$ ratio of 0.45. Design and sketch the coupling taking the following allowable stresses: For shaft, keys and bolts: 80 N/mm$^2$ in shear and 140 N/mm$^2$ in tensile, and for cast iron flange: 15 N/mm$^2$ in shear.

*****

Code: 9A03504

2

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**DESIGN OF MACHINE ELEMENTS I**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 (a) What are alloy steels? State the effect of the following alloying elements in steel: (i) Chromium, (ii) nickel, (iii) manganese, and (iv) sulphur.

(b) Explain the different methods of case hardening.

2 A short cast iron column of hollow circular section with 250 mm outside diameter and 150 mm inside diameter carries a vertical load of 400 kN acting at a point 100 mm from the axis of the column. Find (i) the normal and bending stresses induced in the column. (ii) If the resultant stress, throughout the cross-section is to be compressive what should be the maximum value of the distance between the axis and the load.

3 A pulley is keyed to the shaft midway between two antifriction bearings. The bending moment at the pulley varies from -150 N-m to + 450 N-m and the twisting moment in the shaft varies from 50 N-m to 200 N-m. The shaft is to be made from cold drawn steel having ultimate strength of 540 $N/mm^2$, yield strength of 400 $N/mm^2$ in reversed bending. Calculate the required diameter of the shaft at the key slot. Take the theoretical stress concentration factor = 2.3; notch sensitivity factor = 0.9; size factor = 0.88; surface finish factor = 0.85 and factor of safety = 1.8.

4 (a) Differentiate between (i) lap riveted joint and butt riveted joint (ii) chain riveting and zig zag riveting.

(b) What forms of riveted joints are used in boiler construction – sketch and explain?

5 The external load applied to a bolt fluctuates between zero and 8000 N. The ratio of the unit deflection per unit load for the bolt to that for the members are 3. The endurance limit of the bolt material in reversed axial loading is 210 $N/mm^2$ and the yield point is 350 $N/mm^2$. The root area of the thread is 115 sq mm. Assume a stress concentration factor of 2.5 and a factor of safety 1.8 based on the yield strength of the material. The stress concentration factor takes into account the effect of surface and size.

Determine the minimum initial tightening load that must be applied to prevent separation. Plot the Soderberg working stress diagram for the material and determine if the bolt is safely loaded based on an initial load as determined earlier.

6 Sketch and explain the design procedure for a Knuckle joint.

Contd. in Page 2

7 In a centrifugal pump-motor assembly, the mass moment of inertia of the motor (moment of inertia of impeller of pump may be neglected) is 1.2 N-m-sec$^2$. A steel shaft of 25 mm diameter and 300 mm length connects the pump and motor. At constant speed of 100 rpm, 4 kW are transmitted through the shaft with no measurable vibration. A steel rod enters the impeller eye along with the liquid and result the motor is tripped due to overload and the motor also stops instantly. What is the resulting maximum shear stress in the shaft? Take the modulus of rigidity for shaft as $0.8 \times 10^5$ N/mm$^2$.

8 A rigid coupling is used to connect a 45 KW, 1440 rpm electric motor to a centrifugal pump. The starting torque of the motor is 225% of the rated torque. There are 8 bolts and their pitch circle diameter is 150 mm. The bolts are made of steel 45C8 ($S_{yt}$ = 380 N/mm$^2$) and factor of safety is 2.5 Determine the diameter of the bolts. Assume that the bolts are finger-tight in reamed and ground holes.

*****

Code: 9A03504

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**DESIGN OF MACHINE ELEMENTS I**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 (a) Explain in brief the following properties of materials:
(i) Mechanical, (ii) Metallurgical, and (iii) Magnetic.
(b) Suggest suitable materials with reasons, for the following components:
(i) Screw jack, (ii) Leaf spring, and (iii) Ball bearing balls

2 A cantilever of span 750 mm carries a uniformly distributed load of 6 kN/m. Assume yield strength of 350 MPa and factor of safety as 3. Find the economical cross section for cantilever, among: (i) Circular section of diameter'd'. (ii) Rectangular cross section with depth twice the width, and (iii) I-section of depth 5 t and flange 4 t, where t is the thickness. Specify the dimensions and cross-sectional area of the economic section.

3 A steel cantilever beam, having ultimate strength of 540 MPa and yield strength of 400 MPa, of circular cross-section, whose length being 200 mm, is subjected to a transverse load at its free end that varies from 50 N (up) to 150 N (down) and at the free end an axial load varies from 100 N (compression) to 400 N (tension). Determine the required diameter for infinite life using a factor of safety of 2. Take stress concentration factor for bending and axial loads are 1.4 and 1.6 respectively. Take size factor as 0.8 and surface factor as 0.9.

4 (a) Design a double riveted chain type butt joint for plates having 10 mm thickness. Find the efficiency of the joint. Assume the allowable stress is 95 $N/mm^2$ in tension, 80 $N/mm^2$ in shear and 155 $N/mm^2$ in compression.
(b) What is the difference between structure and pressure vessel riveted joints?

5 The external load applied to a bolted joint fluctuates between zero and 8000 N. The bolt id tightened with an initial load of 6500 N. The root area of the bolt is 115 $mm^2$. The ratio of deflection per unit load for the bolt to that for members are 3. Determine the maximum and minimum bolt loads. Determine whether the bolt is safely loaded for a factor of safety 1.8 and a stress concentration factor of 3. The material has a yield point of 280 $N/mm^2$ and endurance strength in reversed axial loading of 140 $N/mm^2$. Stress concentration factor includes the size and surface finish effects.

6 Sketch and explain the design procedure for a Cotter joint with Gib.

Contd. in Page 2

7 (a) Derive an expression for the 'equivalent bending moment', when a shaft is subjected to both bending moment and twisting moment.

(b) A solid aluminium shaft of 1 m length and of 50 mm diameter is to be replaced by a hollow steel shaft of the same length and the same outside diameter, such that both the shafts cab has the same angle of twist per unit twisting moment over the total length. What must be the inner diameter of the hollow steel shaft? Take modulus of rigidity of steel equal to three times that of aluminum.

8 A mutiflex flexible coupling is used to transmit 15 KW power at 720 rpm. It consists of two flanges keyed to the driving and driven shafts are connected together by means of a number of coils. The coils are placed in the slots on the periphery of the flanges at a distance of 30 mm from the axes of the shafts. The coils have a rectangular cross section 4 x 2 mm and are made of steel FeE 220 ($S_{yt}$ = 220 N/mm$^2$). The factor of safety is 2.5. Calculate the number of required coils.

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Code: 9A03504

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**DESIGN OF MACHINE ELEMENTS I**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

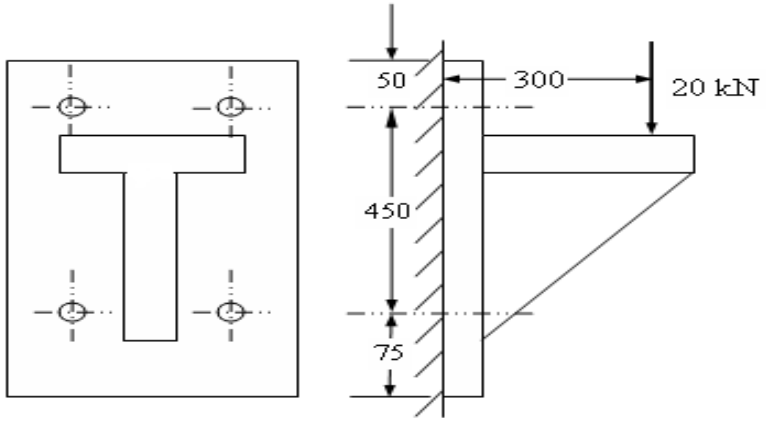
1 (a) What are the bearing metals and list out their important properties?
(b) Why is some materials heat treated? Explain briefly the method and reasons for tempering.

2 (a) If a bore is made in a solid shaft in order to reduce its weight by 50%, what will be the percentage reduction in its torsional strength.
(b) Compare the torque carrying capacity of a thin walled circular tube of men diameter D and thickness t if (i) tube id closed, and (ii) tube is cut longitudinally. Also compare the torsional rigidity if the same torque is applied to both these tubes.

3 (a) Briefly write notes on 'Notch Sensitivity'.
(b) A stepped shaft of diameters D and d is subjected to a variable axial load P which cyclically varies between 0 and 10 kN. The shaft is made of C 20 steel, mirror polished, having ultimate strength as 500 MPa and yield strength as 260 MPa. Determine the diameters D and d with D/d = 1.5; factor of safety = 2; notch sensitivity factor = 0.8 and r/d = 0.2 where r is the shoulder radius.

4 (a) Explain the procedure for the design of a circumferential lap riveted joint for a boiler.
(b) Explain advantages and disadvantages of riveted joints.

5 (a) What do you understand by 'bolts of uniform strength'? How these are obtained?
(b) Calculate the size of the bolt required for the four hole bracket as shown in figure-5.8. Use coarse threads and the allowable stress of 30 N/mm$^2$.




All dimensions are in mm

Figure-5.8

Contd. in Page 2

6 Two lengths of pipes, outside diameter 50 mm, are connected by means of a sleeve and two taper pins to form a joint. The joint carries 10 KN tensile load. Design the joint and give a neat dimensioned sketch. Select suitable materials and the design stresses for all the parts.

7 An overhung shaft carries a 1 m diameter pulley, whose centre is 250 mm from the centre of the nearest bearing. The weight of the pulley is 600 N and the angle of lap of the belt may be assumed as $180^0$. The pulley is driven be a motor, placed below it at an angle of $45^0$. If the permissible tension in the belt is 2500 N and the coefficient of friction is 0.3; determine the size of the shaft. Assume the permissible shear stress in the shaft material as 50 MPa. Take shock and fatigue factors for torsion and bending as 2 and 1.5 respectively. Check the design for lateral stiffness and torsional stiffness.

8 Design a flexible coupling of pin-bush type construction or connecting a reduction gear shaft to a stone crusher shaft. The unit is driven by 30 KW, 720 rpm motor through 1:5 reductions. Choose suitable materials and their design stresses for the parts of the coupling

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Code: 9A03505

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**HEAT TRANSFER**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 (a) State and explain the Fourier's law of heat conduction.

(b) A steel pipe (K = 45.0 W/m.K) having a 0.05 m O.D is covered with a 0.042 m thick layer of magnesia (K = 0.07 W/m.K) which in turn covered with a 0.024 m layer of fiber glass insulation (K = 0.048 W/m.K). The pipe wall outside temperature is 370 K and the outside surface temperature of the fiberglass is 305 K. What is the interfacial temperature between the magnesia and fiberglass? Also calculate the steady state heat transfer.

2 (a) Define 'Temperature Field' and 'Temperature Radiant' and explain them with the examples.

(b) A long hollow cylinder has its inner and outer surfaces maintained at temperatures $T_b$ and $T_a$ respectively. The inner and outer radii are b and a respectively. Calculate the temperature profile in the solid section of the cylinder and determine the flux at both surfaces. Assume steady state condition.

3 A hot cylinder ingot 50 mm diameter and 200 mm long is taken out from the furnace at $800^0$C and dipped in water till its temperature fall to $500^0$C. Then it is directly exposed to air till its temperature falls to $100^0$C. Find the total time required for the ingot reach the temperature from 800 to $100^0$C. Take the following: K = 60 W/m$^0$C, C = 200J/kg $^0$C, p=800 kg/m3 heat transfer coefficient in water = 200 W/kgm $2^0$C heat transfer coefficient in air = 20 W/kg m2 $^0$C, Temperature of air = $30^0$C.

4 (a) Water at the rate of 3 kg/s is heated from $5^0$C to $15^0$C by passing it through a 50 mm ID copper tube. The tube wall temperature is maintained at $90^0$ C. What is the length of the tube required?

(b) State and Explain Buckingham's π – theorem.

5 (a) A horizontal plate 1 m X 0.8 m is kept in a water tank with the top surface at 60oC providing heat to warm stagnant water at $20^o$C. Determine the value of convection coefficient.

(b) Briefly explain the concept of heat transfer by free convection.

6 (a) Explain briefly the condensation mechanism on the vertical plate.

(b) An electric wire of 1.25 mm diameter and 250 mm long is laid horizontally and submerged in water at atmospheric pressure. The wire has an applied voltage of 18 V and carries a current of 45 A. Then calculate (i) heat flux (ii) the excess temperature.

7 A heat exchanger heats 25,000 kg/hr of water entering at $80^o$C while cooling 20,000 kg/hr of water from $100^o$C to $80^o$C. Determine the heat transfer area necessary for (i) Parallel flow arrangement. (ii) Counter flow arrangement. Given overall heat transfer coefficient, U= 1,500 W/m$^2$ K.

8 Write short notes on: (i) Radiation from gases and clouds of particles. ii) Design of tubular furnaces. (iii) Radiation exchange between large parallel gray planes.

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Code: 9A03505

2

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**HEAT TRANSFER**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Explain the different modes of heat transfer along with their governing laws.

(b) A certain building wall consists of 0.15 m of concrete [K=0.15 W/mK], 0.15 m of fiber glass insulation and 10 mm of gypsum board [K=0.15 W/m K]. The inside and outside convection coefficients are 10 and 40 $W/m^2K$ respectively. The outside air temperature is -6 $^0C$ and the inside temperature is 22 $^0C$. Calculate the overall heat transfer coefficient for the wall the R value, and the heat loss per area.

2 (a) The heat flow rate through a 3 cm thick wood board for a temperature difference of 30 $^0C$ between the two surfaces is 120 $W/m^2$. Calculate the thermal conductivity of wood board.

(b) Derive the temperature distribution in the 1-D steady state hallow sphere.

3 A steel tube of length 20 cm with internal and external diameters of 10 and 20 cm is quenched from $500^0C$ to $30^0C$ in a large reservoir of water at $10^0C$. Below $100^0C$ the heat transfer coefficient is 1.5 $kW/m^2K$. Above $100^0C$ it is less owing to a film of vapour being produced at the surface and an effective mean value between $500^0C$ and $100^0C$ is 0.5 $kW/m^2K$. The density of steel is 7800 $kg/m^3$ and the specific heat is 0.47 kJ/kg K. Determine the quenching time by neglecting the internal resistance.

4 (a) Engine oil at $40^0C$ flows with a velocity of 1 m/s over a 2 m long plate whose surface is maintained at uniform temperature of $80^0C$. Determine the local and average heat transfer coefficients.

(b) How does the surface roughness affect the pressure drop and the heat transfer in the tube?

5 (a) The outer surface of a vertical is tube which is of length 1.25 m and outer diameter 50 mm is exposed to saturated steam at atmospheric pressure. The surface is maintained at $80^0C$ by the flow of cooling water through it. Determine the rate of the heat transfer to the coolant and the rate at which the steam is condensed at the tube surface. If the tube is held in horizontal position, will there be any change in the mass of condensate.

(b) Discuss various theoretical and empirical equations available to predict natural convection heat transfer coefficient.

6 (a) Discuss the phenomena of film condensation on horizontal plate and describe the mechanism.

(b) Water at atmospheric pressure is to be boiled in polished copper pan. The diameter of the pan is 350 mm and is kept at $115^0C$. Calculate: (i) power of the burner, (ii) rate of evaporation in kg/h and (iii) critical heat flux.

Contd. in Page 2

7 Water is to be cooled from 20$^{o}$C to 7$^{o}$C using brine at an inlet temperature of -1$^{o}$C with a temperature rise of 4$^{o}$C. The brine and water flows are on the tube and shell sides respectively. Determine the total heat transfer area required for a cross flow arrangement assuming an average overall heat transfer coefficient of 850 W/(m$^{2}$.$^{o}$C) and design heat load of 5900 W.

8 (a) Describe the phenomenon of radiation from real surfaces.

(b) Two very large parallel planes with emissivities 0.3 and 0.8 exchanger radiative energy. Determine the percentage reduction in radiative energy transfer when a polished aluminum radiation shield (€ = 0.04) is placed between them.

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Code: 9A03505

3

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**HEAT TRANSFER**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 (a) Derive an expression for the temperature profile in a thick walled cylinder during heat transfer by conduction under steady state.

(b) A furnace operates at $400^0$ C and has 30 cm thick wall. The outer side temperature of the furnace wall is $55^0$ C. The thermal conductivity of material 50 W/mK. Calculate: i) The rate of heat loss per unit area from the furnace wall.

2 (a) Brick work of a furnace is built of layers of fire clay and red brick and the space between them is filled with common brick. Fire clay layer is 120 mm thick, common brick is 50 mm thick and the red brick layer is 250 mm thick. The thermal conductivity values for the materials are 93, 130 and 70 W/k K respectively. Find the thickness of the red brick layer if the common brick layer is to be absent and the heat transfer remains the same. Take the fir clay thickness also remains the same.

(b) Draw a neat sketch showing thermal resistances series and parallel. Write the expressions for both.

3 A long 20 cm diameter cylindrical shaft made of stainless steel 304 comes out of an oven at a uniform temperature of 600°C. The shaft is then allowed to cool in an environment chamber at 200°C with an average heat transfer coefficient of 80 $W/m^2.°C$. Determine the temperature at the center of the shaft 45 min after the start of the cooling process. Also, determine the heat transfer per unit length of the shaft during this time period. (k = 14.9 W/m-K, Cp = 477 J/kgK, $\rho$ = 7900 $kg/m^3$).

4 (a) Engine oil at $25^0$C flows over a 30 cm long 20 cm wide plate at 1.5 m/s which is heated to a uniform temperature of $55^0$C. Determine the heat transfer rate from the plate to the oil.

(b) Derive an expression for forced convective heat transfer through a conduit using dimensional analysis

5 (a) A horizontal fluorescent tube which is 3.8 cm in diameter and 120 cm long stands in still air at 1 atm. and $20^o$C. If the surface temperature of the tube is $40^o$C and radiation is neglected, what percentage of power is being dissipated by convection. Take properties of air as v = 16.19 X 10-6 m2/sec., K air = 0.02652 W/m K, Pr = 0.706, p = 1.02 kg/m3 , Cp = 1.004 kJ/kg K

(b) Explain with neat sketch development of velocity boundary layer on hot and cold vertical plate subjected to natural convection.

Contd. in Page 2

6 (a) Derive the Nusselt theory of laminar flow film condensation on a vertical plate.
(b) A nickel wire of 1 mm diameter and 400 mm long, carrying current is submerged in a water bath which is open to atmosphere pressure. Calculate the voltage at the burnout point if at this point the wire carries a current of 190 A.

7 An organic liquid $C_p$ = 0.5 cal/(g.$^oC$) flowing at 1200 kg/hr in the inner tube (ID = 2.5 cm; OD = 3.0 cm) of a heat exchanger of 8 meter length is cooled from $90^0C$ to $50^0C$ with water flowing counter currently on the jacket side. Assume U = 450 cal/(hr.$m^2$.$^oC$). Calculate the length of a transfer unit based on the hot organic fluid and also the number of transfer units.

8 (a) What is a gray body? How does its emissivity value will vary for the real surface?
(b) An enclosure measures 1.5 X 1.7 m with a height of 2 m. The walls and ceiling are maintained at $250^0C$ and the floor at $130^0C$. The walls and ceiling have an emissivity of 0.82 and the floor 0.7. Determine the net radiation to the floor.

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Code: 9A03505

4

III B. Tech I Semester (R09) Regular & Supplementary Examinations, November 2012

**HEAT TRANSFER**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 (a) Explain the different mode of heat transfer with their governing laws.

(b) A plane brick wall, 25 cm thick, is faced with 5 cm thick concrete layer. If the temperature of the exposed brick face is $70^oC$ and that of the concrete is $25^oC$, find out the heat lost per hour through a wall of 15 m x10 m. Also, determine the interface temperature. Thermal conductivity of the brick and concrete are 0.7 W/m.K and 0.95 W/m.K respectively.

2 (a) One side of a plane wall is maintained at 100 $^0C$, while the other side is exposed to a convection environment having T=10 $^0C$ and h= 11 W /$m^2$ K The wall has k = 1.6 W/m K and is 40 cm thick. Calculate the heat transfer rate through the wall.

(b) Derive the temperature profile in 1-D steady state hallow cylinder and also for the heat transfer rate.

3 Stainless steel ball of diameter 3 cm is uniformly heated to a temperature of 800°C. It is to be hardened by first cooling in an oil bath to a temperature of 100°C and the heat transfer coefficient and the oil bath temperature are 700 W/$m^{2-}$K and 40°C respectively. What is the time required for this process? If 100 balls are to be quenched per minute, determine the heat removal rate from the oil bath per minute so that its temperature remains constant at 40°C. Properties of stainless steel are: $k$ = 61 W/m-K, $\rho$ = 7865 kg/$m^3$, $c_p$ = 0.46 kJ/kg-K.

4 (a) What is the significance of Grashof's number and Rayleigh number?

(b) Water is heated while flowing through 1.5 cm x 3.5 cm rectangular cross section tube a velocity of 1.2 m/s. The entering temperature of water is $40^0C$ and the tube wall is maintained at $85^0C$. Determine the length of tube required to raise the temperature to $70^0C$.

5 (a) Water at $20^0C$ is to be heated by passing it through the tube. Surface of tube is maintained at $90^0C$. The diameter of tube is 4 cm while its length is 9 m. Find the mass flow rate so that exit temperature of water will be $60^0$ C. The properties of water are ρ = 995 kg/$m^3$ Cp = 4.175 kJ/ kg K, K = 0.64 W/mK, V = 0.62 x $10^{-6}$ $m^2$/s, β = 4.25 x $10^{-3}$ $K^{-1}$.

(b) Explain Hydrodynamic and thermal boundary layer with reference to flow over flow heated plate.

Contd. in Page 2

6 (a) Explain the conditions under which dropwise condensation can take place. Why is the rate of heat transfer in dropwise condensation many times larger than in filmwise condensation?

(b) During the boiling of saturated water at $100^0$C with an electric heating element the heat flux of 500 W/m$^2$ is achieved with a temperature different of $9.3^0$C. What is the value of the coefficient $C_{sf}$ and the heat transfer rate?

7 Cold water leading to a shower enters a thin walled double pipe counter flow heat exchanger at 0.25 kg/s at 15°C and is heated to 45°C by hot water that enters at 100°C and 3 kg/s. If the overall heat transfer coefficient is 950 W/m$^2$-K, determine the heat transfer rate and the area of the heat exchanger by $\varepsilon - NTU$ method. Assume specific heat of water to be 4180 J/kg-K.

8 (a) What is the shape factor with respect to itself if the surface is concave, convex or flat?

(b) A room measuring 3 m X 4 m X 2 m high has the ceiling covered with heating panels. Under steady state conditions, the ceiling is at a temperature of $50^0$C and the walls and floor at a temperature of $20^0$C. Assuming all the surfaces have an absorptive of unity, calculate the net radiant heat transfer from the ceiling.

*****

Code: 9AHS401

**1**

B.Tech III Year I Semester (R09) Regular and Supplementary Examinations, November 2012

**MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS**

(Common to CE, BT, ME, EEE, ECC and MCT)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 What is demand? Explain the various factors that influence the demand for a computer.

2 What elasticity of demand is important? Explain the factors governing elasticity of demand.

3 What is break even analysis? How do you determine breakeven point? Illustrate.

4 What is market? Distinguish between perfect and imperfect markets.

5 Explain the features of sole trader form of organization. Discuss the merits & demerits of sole trades form of organization?

6 (a) What is the importance of Capital Budgeting?

(b) How do the discounting models differ from non-discounting models?

7 Journalize the following transactions and prepare Ledger accounts in the books of Mr. A.V. Narayana.

| | |
|---|---|
| 2006, June, 1 | Commenced business with cash worth Rs.80,000 |
| 5 | Discount allowed worth Rs.5,000 |
| 8 | Cash received from Swamy worth Rs.25,000 |
| 12 | Rama Rao purchased goods worth Rs.6,000 |
| 15 | Audit Fees worth Rs.2,000 |
| 18 | Received interest from Narayana worth Rs.18,000 |
| 24 | Bought goods from Prasad &Co. worth Rs.12,000 |
| 30 | Printing & Stationary expenses worth Rs.4,000 |

8 Who are the users of financial statements of a business unit and explain how differently they interpret the financial data?

*****

Code: 9AHS401

**2**

B.Tech III Year I Semester (R09) Regular and Supplementary Examinations, November 2012

**MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS**

(Common to CE, BT, ME, EEE, ECC and MCT)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 Define demand. Explain various factors determine demand for a commodity.

2 Explain with examples:
(a) Price elasticity of demand.
(b) Cross elasticity of demand.

3 Explain how do you determine breakeven point in volume and value. Explain graphically.

4 Define market. Distinguish between perfect and imperfect markets.

5 (a) Discuss the factors affection the choice of from of business organization.
(b) Define partnership & explain its features and advantages.

6 (a) Define Capital Budgeting? Explain its importance.
(b) How is useful of Payback Period method? Explain its features and limitations.

7 Explain the following in briefly:
(a) Double entry system.
(b) Book – keeping.
(c) Capital.
(d) Income.

8 The following is the balance sheet of Sri Anurag Enterprises as on 31st Dec 20007.

| Liabilities | Rs | Assets | Rs. |
|---|---|---|---|
| Share capital | 2,00,000 | Buildings | 2,00,000 |
| Reserve fund | 50,000 | Machinery | 1,50,000 |
| Profit balance | 30,500 | Stock on hand | 1,00,000 |
| Bank loan | 1,50,000 | Sundry debtors | 60,000 |
| Sundry creditors | 70,000 | Cash on hand | 20,500 |
| Provision for Tax | 30,000 | | |
| | 5,30,000 | | 5,30,000 |

You are required to comment on Liquidity and Solvency position of the concern.

******

Code: 9AHS401

**3**

B.Tech III Year I Semester (R09) Regular and Supplementary Examinations, November 2012

**MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS**

(Common to CE, BT, ME, EEE, ECC and MCT)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 State and Explain the Law of demand .what are its exceptions?

2 Define elasticity of demand. Explain its types and significance.

3 What are Laws of Returns? Illustrate with reference to agriculture.

4 What are the main features of Monopoly? How does it differ from perfect competition?

5 (a) What are the characteristics of a Business Unit?
(b) Explain the features of sole traders' form of business organization.

6 (a) What are the factors determining the Working Capital requirements?
(b) Explain the importance and nature of Capital Budgeting.

7 (a) Define trading account. Explain its objectives and importance.
(b) Depreciation.
(c) Bad debts.

8 With the following information compute:
(a) Current Ratio.
(b) Quick Ratio.
(c) Stock Turnover Ratio.
(d) Gross Profit Ratio.

| | Rs. | | Rs. |
|---|---|---|---|
| Opening Stock | 1,00,000 | Cash on hand | 3,00,000 |
| Closing Stock | 2,00,000 | Debtors | 4,00,000 |
| Purchases | 5,45,000 | Sundry Creditors | 3,00,000 |
| Wages | 15,000 | Bills Payable | 2,50,000 |
| Administrative Expenses | 4,000 | Bank Credit | 2,50,000 |
| Selling and Distribution Expenses | 2,40,000 | | |
| Sales | 10,00,000 | | |

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**4**

B.Tech III Year I Semester (R09) Regular and Supplementary Examinations, November 2012

**MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS**

(Common to CE, BT, ME, EEE, ECC and MCT)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 Define the law of demand. What are its exceptions? Explain.

2 What the methods of forecasting demand?

3 Write short notes on any two of the following:
(a) Internal economies.
(b) External economies.
(c) Production function.

4 Define market. Explain any four methods of pricing, based on strategy.

5 (a) Define partnership and explain its silent features and limitations**.**
(b) What are the qualities of a good partner?

6 (a) What are the limitations of Accounting Rate of Returns?
(b) How is Profitability Index of a project calculated? What are its advantages?

7 (a) How are Accounts finalized at the end of an Accounting period with the help of a Trial balance? Illustrate.
(b) Define financial statements, and explain its objectives and importance.

8 (a) How is Quick ratio different from current ratio? How are they helpful in evaluation?
(b) The Accounting data of a business unit is as follows.

| ***Liabilities*** | Rs. | ***Assets*** | Rs. |
|---|---|---|---|
| Share capital | 11,00,000 | Plant and machinery | 15,00,000 |
| Mortgage loans | 11,50,000 | Amounts receivable | 12,00,000 |
| Contingent liabilities | 6,50,000 | Stock on hand | 2,00,000 |
| | 29,00,000 | | 29,00,000 |

Calculate:
(a) Current Ratio.
(b) Quick Ratio.

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