Code: 9A03501

R9

B.Tech III Year I Semester (R09) Supplementary Examinations, May 2013

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 steam power plant operates on a theoretical reheat cycle. Steam at boiler at 150 bar, 550ºC expands through the high pressure turbine. It is reheated at a constant pressure of 40 bar to 550ºC and expands through the low pressure turbine to a condenser at 0.1 bar. Draw T-s and h-s diagrams.

Find: (i) Quality of steam at turbine exhaust.

(ii) Cycle efficiency. (iii) Steam rate in kg/KWhr.

2 (a) Explain the construction and working of a simple vertical boiler with a neat sketch.

(b) A boiler evaporates 8 kg of water per kg of coal into dry saturated steam at 10 bar pressure. The feed water temperature is 46ºC. Find the equivalent evaporation from and at 100ºC. Also calculate the factor of evaporation.

3 Define nozzle efficiency. Explain the effect of friction on the performance of the nozzle with the help of h-s diagram.

4 A stage in an impulse turbine consists of converging nozzles and one ring of moving blades. The nozzle angles are 22º and the moving blades have both tip angles of 35º. If the velocity of steam at nozzle exit is 450 m/s, find the blade speed so that the steam shall pass on to the blades without shock and find the stage efficiency, neglecting frictional losses, if the blades run at the end thrust on shaft if power developed is 36.8 KW.

5 Show that for maximum diagram efficiency of a reaction turbine the blade-steam speed ratio is equal to cos α, where α is the angle of absolute velocity at inlet. State the assumption made. Hence derive an expression for maximum efficiency.

6 A prime mover uses 15000 kg of steam per hour and develops 2450 KW. The steam is supplied at 30 bar and 350ºC. The exhaust from the prime mover is condensed at 725 mm of Hg when barometer records 755 mm of Hg. The condensate temperature from the condenser is 31ºC and the rise of temperature of circulating water is from 8ºC to 18ºC.

Determine: (i) The quality of steam entering the condenser.

(ii) The quantity of circulating cooling water and the ratio of cooling.

7 (a) What are the applications of the gas turbine plants?

(b) Define isothermal efficiency of a compressor and prove that the isothermal work input to a compressor is always minimum.

8 Define the principle of jet engine. List the different types of jet engines.

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Code: 9A03502 **R9**

B.Tech III Year I Semester (R09) Supplementary Examinations, May 2013

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 car is of total mass 3000 kg. It has wheel base equal to 2.5 m and track width equal to 1.5 m. The effective diameter of each wheel is 80 cm, and moment of inertia of each wheel is 1.0 kg.m^2. The rear axle ratio is 4. The mass moment of inertia of engine rotating parts is 3 kg.m^2 and spin axis of engine parts is perpendicular to the spin axis of wheels. Determine the reaction at each wheel if car takes right turn of 100 m radius at 108 km/hr speed. Also determine critical speed. The height of C.G. is 0.5 m from ground and it is placed on the vertical line through geometric center of wheels.

2 A conical pivot supports a load of 25 kN, the cone angle being 120 degrees, and the intensity of normal pressure is not to exceed 0.25 MPa. The external radius is twice the internal diameter. Find the outer and inner radii of bearing surface. If the shaft rotates at 180 r.p.m and the coefficient of friction is 0.15, find the power loss in friction, assuming uniform pressure.

3 A cone clutch of semi cone angle 15^0 is used to transmit a power of 30 KW at 800 r.p.m. The mean frictional surface radius is 150 mm. The normal intensity of pressure at the mean radius is not to exceed 0.15 N/mm^2. The coefficient of friction is 0.2. Assuming uniform wear, Determine :

(a) Width of the contact surface and

(b) Axial load (or force) needed to engage the clutch.

4 Write short notes on:

(a) Turning moment diagram.

(b) Piston-effort.

(c) Coefficient of fluctuation of speed.

5 With a neat sketch, explain the working of Hartnell governor.

Contd. in Page 2

6 (a) What you understand by static and dynamic balancing?

(b) The four masses m_1, m_2, m_3, and m_4 having their radii of rotation as 200 mm, 150 mm, 250 mm and 300 mm are 200 kg, 300 kg, 240 kg and 260 kg in magnitude respectively. The angles between the successive masses are 45º, 75º, and 135º respectively. Find the position and magnitude of the balance mass required, if it radius of rotation is 200 mm.

7 A V-twin engine has the cylinder axes at right angle and connecting rods operates a common crank. The reciprocating mass per cylinder is 10 kg. The crank is 7.5 cm long and each connecting rod is 35 cm long. Show that the engine may be balanced for primary effects by means of a revolving balance mass. If the speed of the crank is 500 r.p.m, what is the maximum value of the resultant secondary force and in which direction does it act?

8 A horizontal spring mass system with coulomb damping has a mass of 5 kg attached to a spring of stiffness 980 N/m. if the coefficient of friction is 0.025, calculate:

(a) The frequency of free oscillations.

(b) The number of cycles corresponding to 50% reduction in amplitude if the initial amplitude is 5 cm and

(c) The time taken to achieve this 50% reduction.

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Code: 9A03503

R9

B.Tech III Year I Semester (R09) Supplementary Examinations, May 2013

MACHINE TOOLS

(Mechanical Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 Explain at least four types of chip breakers and their working with neat sketches.

2 With a block diagram, explain the method of taper turning by tail stock set-over method.

3 (a) What is a shaper? Explain its working principle.
(b) With a block diagram, explain the principal parts of a shaper.

4 With a neat block diagram, discuss the advantages of a radial drilling machine.

5 With a neat block diagram, explain the features and working of a horizontal milling machine.

6 (a) What do you understand by grain or grit with respect to grinding wheels?
(b) Explain various grades of grinding wheels.

7 Explain in details how hand lapping is carried out for external cylindrical work.

8 What are screw clamps? Explain the features of a screw clamp with neat sketch.

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Code: 9A03504

R9

B.Tech III Year I Semester (R09) Supplementary Examinations, May 2013

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 meant by toughness and how is it measured?

(b) Explain the terms: (i) Strength. (ii) Elasticity. (iii) Resilience.

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) Distinguish between endurance strength and ultimate strength.

(b) Determine the size of a piston rod subjected to a total load having cyclic fluctuation from 150 kN (compression) to 25 kN (tension). The endurance limit is 360 MPa and yield strength is 400 MPa. Take factor of safety = 1.5; surface finish factor = 0.88 and stress concentration factor = 2.25.

4 A locomotive boiler of 1.8 m internal diameter is required to generate steam at 1.4 MPa gauge. Calculate the thickness of the shell plate and design the triple riveted longitudinal double butt strap joint with unequal straps. The allowable stresses are 77 MN/m^2 in tensile, 60 MN/m^2 in shear and 135 MN/m^2 in compression. The efficiency of triple-riveted longitudinal butt joint is 84%.

5 The external load applied to a bolted joint fluctuates between zero and 6.24 kN. The bolt is tightened with an initial load of 5.8 kN. The root area of the bolt is 105 x 10^{-6} m^2. The ratio of the deflection per N of load for the bolt to that for the members is 3.

(i) Determine the maximum and minimum bolt loads.

(ii) Determine the average stress and the variable stress, assuming a stress concentration factor of 2.8 which includes surface and size effects.

(iii) Plot the Soderberg working-stress diagram and determine if the bolt is safely loaded for a factor of safety of 1.8. The material has a yield point of 276 MPa, and an endurance limit in reversed axial loading of 138 MPa.

6 Two rods having 30 mm x 30 mm square cross-section are connected using a gib and cotter. Calculate the leading dimensions of the joint so as to have the strength of the joint same as the strength of the rods in tension. For all the parts of the joint take the allowable stresses as follows:

Tensile strength = 120 N/mm^2, Shear strength = 70 N/mm^2 and Compression strength = 240 N/mm^2.

7 (a) Explain the difference between shaft, axle and spindle.

(b) A shaft transmits 75 KW power at 300 r.p.m. The distance between the two bearings is 3000 mm. It is subjected to torsion only. Calculate the diameter of the shaft, (i) for steady loading and (ii) for suddenly applied load with minor shocks. Take the allowable shear stress for the shaft material as 35 N/mm^2.

8 A flange coupling connects two 50 mm diameter lengths of commercial shafting. The coupling flanges are bolted together with four bolts of the same material as the shaft. The bolts are set in clearance holes. The diameter of the bolt circle is 240 mm and the flange thickness is 22 mm.

(i) Determine the minimum bolt diameter required to transmit the same torque that the shaft can transmit.

(ii) What power may be transmitted at 200 rev/min under steady load conditions?

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Code: 9A03505

R9

B.Tech III Year I Semester (R09) Supplementary Examinations, May 2013

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) Distinguish between conduction, convection and radiation modes of heat transfer.

(b) A solar pane, 1 m × 1.25 m receives solar radiation 1500 W, Calculate surface temperature of the pane if the ambient temperature is 25^0C and the convective heat transfer coefficient of the air film over the surface of pane is 12.5 W/m^2.K.

2 (a) Define thermally conductivity and how it can be measured. What is the difference between thermal conductivity and thermal conductance?

(b) A 0.8 m high and 1.5 m wide double pane window consists of two 4 mm thick layers of glass (78 W/m.K) separated by a 10 mm wide stagnant air space (0.026 W/mK). Determine the rate of heat transfer through this window and the temperature of the inner surface, when the room is maintained at 20^0C. Take the convection heat transfer coefficients on the side and the outside surfaces of the window as 10 and 40 W/m^2 K respectively.

3 (a) What is lumped mass model? Derive the equation for the temperature of a lumped body for the specified transient condition.

(b) A thick bronze plate (α = 0.86 x 10^{-5} m^2/s and K = 26 W/m.K) is initially at a uniform temperature of 250^0C. Suddenly the surface is exposed to a coolant at 25^0C. Assuming h = 150 W/m^2.K, determine the temperature at 5 cm from the surface after 10 min of exposure.

4 (a) Using dimensional analysis, obtain the general form of equation for natural convection heat transfer.

(b) A rectangular plate is 120 cm long in the direction of flow and 200 cm wide. The plate is maintained at 80^0C when placed in nitrogen that has a velocity of 2.5 m/s and a temperature of 0^0C. Determine: (i) the average friction coefficient, (ii) the viscous drag exerted on the plate, (iii) the average heat transfer coefficient and (iv) the total heat transfer rate from the plate.

5 (a) What is Reynold's analogy? Describe the relation between fluid friction and heat transfer.

(b) Water at 60^0C enters a tube of 2.54 cm diameter at a mean velocity of 2 cm/s. Calculate the exit water temperature if the tube is 3.0 m long and wall temperature is constant at 80^0C.

6 (a) Draw the boiling curve for the water and explain the salient features.

(b) Saturated steam, at 120^0C condenses on a 2 cm OD vertical tube which is 20 cm long. The tube wall is maintained at a temperature of 119^0C. Calculate the average heat transfer coefficient and the thickness of the condensate film at the base of the tube. Assume Nusselt solution is valid.

7 In an industry, 0.6 kg/sec of oil, (Cp = 2.5 kJ/kg K) is to be cooled in a counter flow heat exchanger from 110^0C to 35^0C by the use of water entering at 20^0C. The overall heat transfer coefficient is expected to be 1500 W/m^2K. Presume that the exit temperature of water is not to exceed 80^0C. Using NTU method, calculate:
(i) Water flow rate. (ii) Surface area required. (iii) Effectiveness of exchanger.

8 (a) Define view factor and discuss its importance.

(b) If the intensity of radiation emitted by a surface covered with lamp back (α = 0.96) in the normal direction is 1.85 × 10^3 W/$m^{2.}$ Sr. Calculate the temperature of the surface if it follows Lambert's cosine Law.

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Code: 9AHS401 **R9**

B.Tech III Year I Semester (R09) Supplementary Examinations, May 2013

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 What is managerial economics? What type of issues comes under the preview of managerial economics?

2 What is elasticity of demand? Explain how point elasticity and arc elasticity are improved methods of measuring elasticity of demand.

3 What is a limiting factor? Explain how BEP can be used for choosing a product mix when there is a limiting factor. Illustrate.

4 Define perfect competition market. Explain the important features of perfect competition?

5 Explain the features of sole trader form of organization. Discuss the merits and demerits of sole trade's form of organization.

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 Explain the following concepts and illustrate their treatment with imaginary data:
(a) Depreciation.
(b) Prepaid expenses.
(c) Reserve for bad and doubtful debts.
(d) Income received in advance.

8 What is meant by ratio analysis? Explain briefly various techniques of ratio analysis?

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